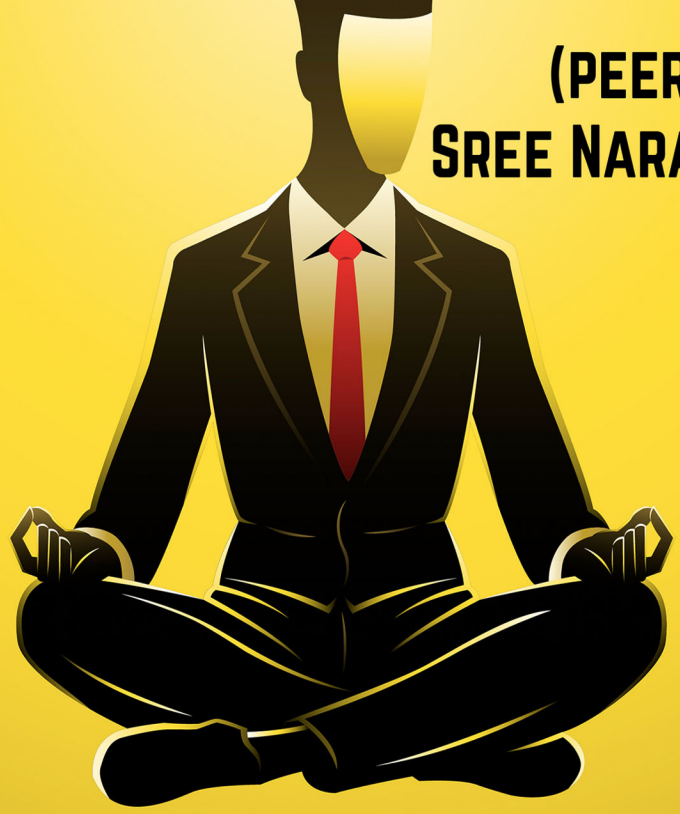
Volume XX No.1 2021-2022

Holistic Thought

Multidisciplinary Annual Research Journal (Peer Reviewed) of Sree Narayana College Kollam



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Aim and Scope

Holistic Thought, a multi-disciplinary annual journal, publishers problem oriented, empirically-grounded analytical research papers, theoretical and philosophical essays, policy discussions in the field of both natural and social sciences, in as technical language as possible. Original articles will be published either as papers or reviews after review process. The journal also publishers essay in the field humanities and the languages. Holistic Thought fosters cross-disciplinary approach in research, seeks eminent scholars, serious researchers as well as innovative young writers as its contributors.

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Editor's Message

Dear Readers,

Holistic Thought is a non-profitable peer reviewed multidisciplinary research journal published yearly by Sree Narayana College, Kollam and is devoted to all aspects of findings and research associated with multidisciplinary concept which covers areas of science, language, literature, art, history and culture. It gives us immense pleasure to publish the Volume 20 Issue 1 of Multidisciplinary Journal of Holistic Thought. In this current publication, papers are published within the areas of Science, Social Science, Literature, Computer Science and Arts. We believe that the cross-listing finding in the Holistic Thought sets the tone for a truly multidisciplinary education. The current issue exposes our readers to new and diverse disciplines, concepts, thoughts or perspectives, but also helps them discover what interests them, and how to link their specialized areas of study to other variables.

The COVID-19 pandemic has affected the whole world and influences the various sector for longer period of time. The COVID-19 is having a significant impact on all sectors of societies at the international level, and people are facing a very tough time as it has blocked all the economic, social, educational and business sectors. It is a very difficult time for the educational as well as research institutes to commence sessions. We believe that the multidisciplinary approach will help us to come out of this hard situation very soon. Once again, congrats to all the contributors of the journal in this hard time and we believe that your contributions will maintain the educational activities in another manner. We would also delighted to welcome both theoretical and empirical contributions from the academic community in the next volume of Holistic Thought on science, arts, social science, literature and any other relevant disciplines, based upon original ideas and research..

Dr. R. Sunilkumar
(Chief Editor)

Dr. P. Nikhil Chandra
(Associate Editor)

Contents

01

A review on bioplastics from natural resources: Processing methods, applications, and biodegradation

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Abstract

The current review focuses on the recent developments of bioplastics obtained from natural resources. Natural polymers have received enormous attention attributable to their ability to address the environmental threats resulting from petroleum-based polymers. This review describes the different classifications of natural polymers, their blends, properties, and applications. The review also focuses on different processing methods, and finally discusses the future trends in plastic production using natural polymers.

Keywords: Natural polymers, nanocomposites, processing, applications, biodegradation of natural polymers

1. Introduction

Plastics are becoming indispensable in our day-to-day life, primarily due to their extensive applications in different fields. Plastic materials are lightweight, flexible, moisture-resistant, durable, and relatively inexpensive. Due to the enormous demand for these materials, there is an exponential growth in the plastic production over the years and reached approximately 400 million tonnes per year as shown in Figure 1[1,2].

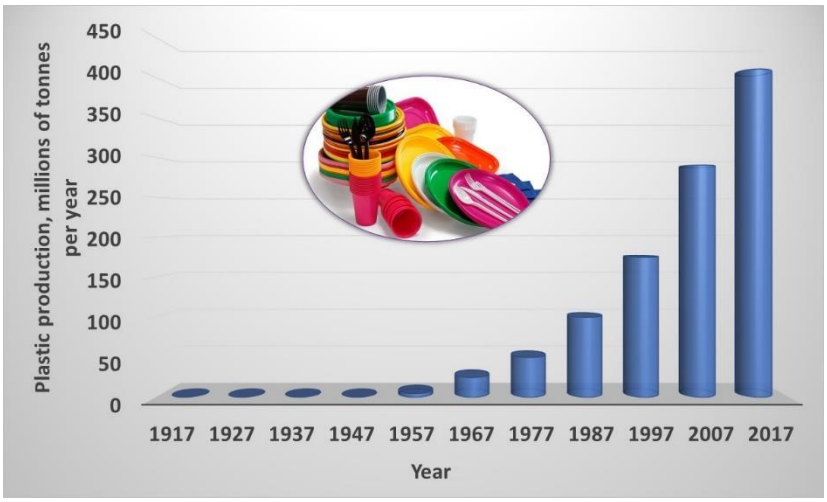

Figure 1. Global plastic production, mega tonnes, 1917 to 2017 [1,2].

The extensive production and consumption of plastic materials is a growing concern, as their waste management infrastructure often has not reached an appropriate processing rate to deal with their increasing levels of plastic waste. Shockingly, if the current trend of plastic production and waste management continues, the amount of plastic waste in the natural environment may reach approximately 12,000 million metric tons by 2050 [2]. In recent years the link between plastic waste, human health, and environment have been universally accepted, and there is a growing interest in tackling the environmental risks created by the fossil-based polymers. Micro plastics are another significant issue in plastic waste on ecosystems and human health due to their size [3,4]. Fossil-based plastic tends to degrade into micro-plastics over a period, and end up in our eco-system on both lands and in seas, by the action of UV light, acidity levels in land-fill, waves and winds.

Since fossil-based plastic materials may take 500-1000 years to degrade [5], they remain as waste in the environment. Most plastics can act as an organic pollutants that may lead to food contamination and other serious health hazards. As a result, nondegradable plastic materials cause severe adverse impacts on the environment. The fragments and toxins released during photo-decomposition of such plastic debris can pollute the soil and water. It should be noted that only 14% of the total plastic packaging material is collected for recycling, whereas the remaining 86% is discarded into the natural environment. Apart from the pollution created by the nondegradability of such systems, the large scarcity of petroleum

resources due to their extensive usage is also another serious concern. Most plastic waste, which leaches into the environment, finally ends up in the ocean carried via various water sources. A report launched at the 2016 World Economic Forum's annual meeting in Davos, highlighted that 95% of the value of plastic packaging material (worth $80-120 billion annually) is lost to the economy due to improper management and infrastructure for collection of plastic waste. On the current track, it is expected that the total weight of plastic waste could be higher than the total weight of fish in the ocean by 2050 [6]. According to another study conducted by Eriksen et al. in 2014, around 5.25 trillion plastic particles weighing 268,940 tons are floating at sea. The results obtained from their study are summarized in Table 1.

As already mentioned, global plastic production has increased twentyfold since 1960. It is expected that it may double again over the next 20 years. In Europe, about 1.5 million people are employed in the plastic industry and generated a turnover of EUR 340 billion in 2015 [7]. Even though plastics production in Europe has been stable in recent years, the possibility of reuse and recycling of plastics is very low. In Europe, every year around 25.8 million tonnes of plastic waste are generated. Of that 25.8 million tonnes, less than 30% is collected for recycling [7].

Recently Europe has adopted a strategy to address the challenges created by plastics. It involves the design and development of plastic materials by considering the importance of reuse and recycling. This approach should greatly help to reduce the adverse effect of plastic materials on the environment. However, greater efforts and cooperation is required from the plastics producers to recyclers, retailers, and consumers for the successful implementation of the strategy. In 2017, the European Commission has decided to work towards the goal of making all plastic packaging recyclable by 2030 [7].

In recent years, the global socio-economic landscape has altered dramatically, making natural polymers worth consideration for many applications. The concern over the long-term availability of oil and environmental considerations forced us to consider alternative, especially renewable, sources of materials.

Table 1. Model results for the total particle count and weight of plastic floating in the world's oceans [8].

	Size (mm)	North Pacific	North Atlantic	South Pacific	South Atlantic	Indian Ocean	Mediterranean Sea	Total
Count	0.33–1.00	68.8	32.4	17.6	10.6	45.5	8.5	183.0
	1.01–4.75	116.0	53.2	26.9	16.7	74.9	14.6	302.0
	4.76–200	13.2	7.3	4.4	2.4	9.2	1.6	38.1
	□200	0.3	0.2	0.1	0.05	0.2	0.04	0.9
	Total	199.0	93.0	49.1	29.7	130.0	24.7	525.0
Weight	0.33-1.00	21.0	10.4	6.5	3.7	14.6	14.1	70.4
	1.01–4.75	100.0	42.1	16.9	11.7	60.1	53.8	285.0
	4.76–200	109.0	45.2	17.8	12.4	64.6	57.6	306.0
	□200	734.0	467.0	169.0	100.0	452.0	106.0	2028.0
	Total	964.0	564.7	210.2	127.8	591.3	231.5	2689.4

** Total count ($n\times10^{10}$ pieces), weight ($g\times10^{8}$ g; or $g\times10^{2}$ tons) of plastic in the ocean* [9].

Natural polymers, thanks to their environmentally friendly properties such as biodegradability, low toxicity, low disposal costs, and renewability, are now gaining massive attention as one of the best solutions as an effective alternative to petroleum-based polymers. Natural polymers are mainly derived from plants and animals. Cellulose, hemicellulose, starch, pectin, etc. are obtained from plants, whereas chitin, alginates, psyllium, etc. are derived from animal origins [10]. Figure 2 presents the classification of natural polymers from various sources.

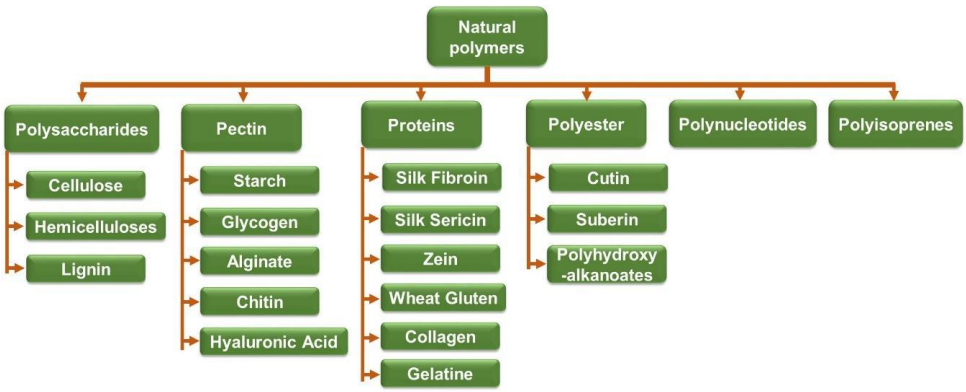

Figure 2. Classification of Natural polymers [11].

Natural polymers have found applications in several commercial sectors such as pharmaceuticals, chemical engineering, agriculture, biomedical, coatings, and food [10]. As observed in Figure 3, there is a significant increase in the number of total publications based on bioplastics in recent years, which highlights both the universal relevance of the topic and the increased funding in this field.

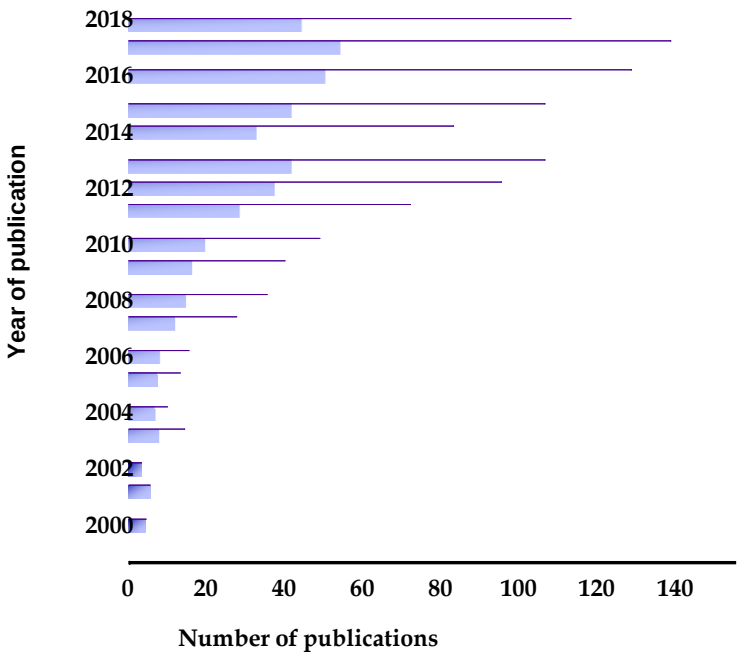

Figure 3. Total publications on bioplastics by year. (Source: Web of science)

Natural polymers have a history of more than century-much longer than fossil-based plastics. They are biodegradable and renewable, and thus environmentally friendly. At the end of their useful product life, they can be easily disposed of without harming the environment. The challenge with natural polymers being employed for large-scale replacement plastic production is primarily due to the strong interaction of functional groups [12]. This prospective provides an overview of the various natural polymers, material properties, processing challenges, applications, and future trends.

2. Types of natural polymers including properties

2.1 Cellulose

Cellulose, the principal constituent of the plant cell wall, is considered as one of the most abundant molecules derived from biomass. It was discovered in 1838 by a French chemist Anselme Payen. Cellulose is mainly extracted from kenaf, jute, cotton, wood, etc. It is highly crystalline, with a high molecular weight polymer. The general formula for cellulose is $(C_6H_{10}O_5)_n$, consisting of a linear homopolymer of glucose residues with β (1→4) linked D-glucose units. Inter and intramolecular hydrogen bonding make cellulose rigid and water-insoluble. Even though the structure is similar to starch, cellulose exhibits different properties [13,14].

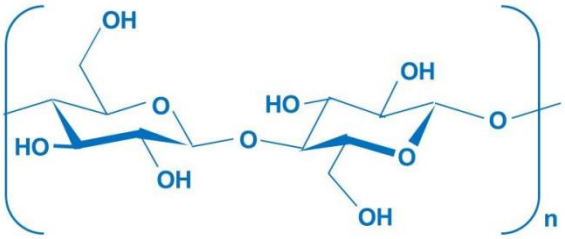

Figure 4. Repeating unit of cellulose.

2.2 Chitins

Chitin is a linear polysaccharide consisting of 2-acetamido-2-deoxy-β-D-glucopyranose units, with β (1→4) linkage [15,16]. It is present in the exoskeleton and internal structure of invertebrates. The structure is similar to cellulose, but with an acetamide group ($-NHCOCH_3$) at the C−2 position instead of the hydroxyl group (Figure 5). Chitin is the supporting material of molluscs, crustaceans, insects, etc. Chitin exists in their different crystal structures: □, β, and γ. □-chitin, which has a more compact structure, is generally obtained from the shell of crabs and shrimps. β-Chitin is obtained from the pen of loligo and squid. γ-chitin is a mixture of both □ and β-chitin [17,18]. It is biodegradable and biocompatible. Chitin exhibits poor solubility in common organic solvents, and diluted aqueous solvents, which limits its practical, commercial applications.

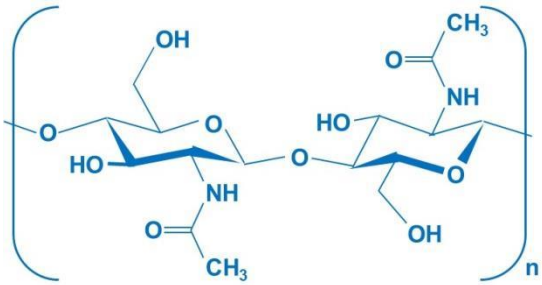

Figure 5. Structure of chitin

2.3 Starch

Starch is a polysaccharide, which contains glucose units joined together by glycosidic bonds. The natural abundance of starch is similar to that of cellulose and chitin. It mainly acts as the energy store in plants and is found in the roots, leaves, stems, etc. in granular forms with different shapes (spheres, polygon, ellipsoids, etc.). Rice, corn, wheat, sorghum, potato, etc. are some of the primary sources of starch. Generally, starch is composed of two molecules: amylose, which is the linear fraction, and its branched counterpart, amylopectin [19]. In amylose, glucose units are linked together by □-1-4 glycosidic bonds, whereas amylopectin has additional □-1-6 links [20,21]. The composition of amylose and amylopectin may vary depending on the type of starch. However, in general, the composition of amylose in starch is □20-30% and amylopectin is □70-80% [20,21]. The structure of amylose and amylopectin are shown in Figure 6. Some of the main industrial applications of starch involve adhesives, paper, and clothing. Starch is used for making packaging films, overwraps, flushable sanitary products, mulch films, etc.

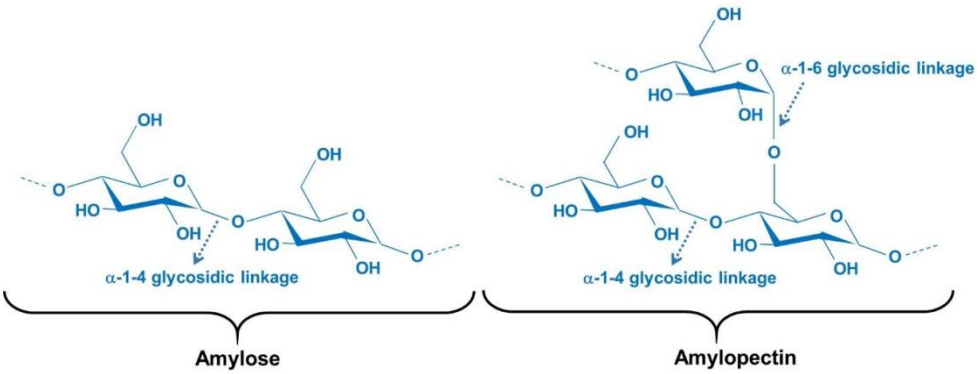

Figure 6. Structures of amylose and amylopectin (two components of starch)

2.4 Lignin

Lignin is also considered as one of the most abundant biopolymers. It is regarded as the primary source of aromatic structures on earth. It is one of the main components in the cell wall along with cellulose and hemicellulose. Lignin adds strength and structure to the cell walls of woody plants.[22] The structure of lignin is based on three different cinnamyl alcohol precursors (monolignols): p-coumaryl alcohol, coniferyl alcohol, and sinapyl alcohol (Figure. 7) [23,24]. The radical polymerization of monolignols results in the formation of a complex three-dimensional molecular structure with a great variety of bonds [25,26]. The majority will be the □-O-4 ether linkages (50%). Apart from that other linkages such as □-O-4, 4-O-5 also exist together with C–C bonds [27,28]. The reactivity and the degree of branching in the lignin are determined by the proportions of the three monomers [22].

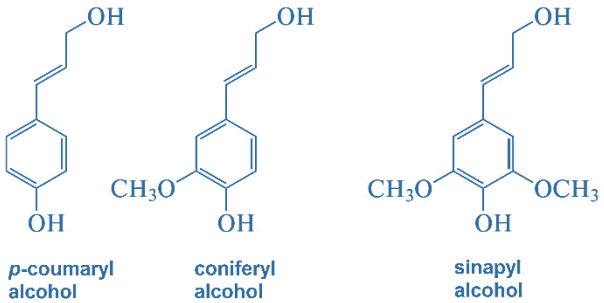

Figure 7. The three different alcohol precursors (monolignols) of lignin.

3. Modification of natural polymers

Natural polymers have received much more attention in recent years due to their environmental benefits. However, the performance of products made from the natural polymer is not similar to products produced from fossil-based counterparts due to the inherent properties of natural polymers. Some of the approaches to upgrade the properties and improve the processability of natural polymers are given below:

i) Blending of polymers ii) Chemical modification

iii) Grafting of functional groups iv) The addition of nanoadditives

Out of these methods, polymer blending and the creation of polymer nanocomposites by adding nanoadditives are the most preferred methods on an industrial scale mainly due to their adoptability on an industrial scale without invasive modification of current processing technologies.

3.1 Blends of natural polymers

3.1.1 Blends of Cellulose

Nishio et al. prepared cellulose/poly(viny1 alcohol) (PVA) blend films from mixed solutions in N, N-dimethylacetamide (DMAc)-lithium chloride (LiC1) by solution-coagulation method and analyzed using different characterization techniques. They noted that there is a significant decrease in the crystallinity of PVA with the addition of cellulose and no crystallization was observed when the cellulose content is above 70 wt. % [29]. The authors employed the same method to prepare the blends of cellulose with nylon 6 and poly(□-caprolactone) (PCL) [30]. Similar to the result obtained in their previous study, the crystallinity of both nylon and PCL has been found to decrease with the increase in the cellulose content. However, the crystalline nature was retained even at a composition containing 90 wt. % cellulose. The level of miscibility of both the blends was found to be relatively low, but there was no indication of phase separation at any level above micrometer size. Miyamoto et al. prepared cellulose-starch blend films using the solution- coagulation method and investigated their structure and properties [31]. The blended films showed porous structures, and the average pore size was found to increase with increasing starch content. Such porous blend films displayed high water and oil absorbency. It was observed that the oil absorbency of the blend film with 50 % starch was ten times higher than that of cellulose film.

3.1.2 Blends of Starch

Even though the compatibility of starch with synthetic polymers is weak, some efforts have been made to prepare starch/polymer blends, especially to improve the degradability of commonly used synthetic polymers. Modified starch was also used to enhance the miscibility and adhesion of starch in the blends [32]. Olivato et al. prepared starch/ poly(butylene adipate-co-terephthalate) blends with tartaric acid as an additive and investigated the mechanical, optical and structural properties. The result indicated that the addition of tartaric acid had improved the properties of the materials, which makes it suitable for food packaging applications [33]. It has been reported that the blending of commercial polyester Bionolle with starch has improved the rate of degradation of the Bionolle [34].

Tudorachi et al. investigated the biodegradation behavior of polyvinyl alcohol (PVA)/starch mixtures in the presence of some bacteria and fungi

due to the better compatibility of PVA with starch. They observed that the microorganisms had consumed the starch along with the amorphous part of PVA [35].

Polyethylene is a commonly used thermoplastic polymer due to its wide range of applications. However, it is resistant to microbial breakdown [36]. It was reported that the addition of biodegradable compounds like starch could improve the degradation of polyethylene [37]. The degradation rate of starch/polyethylene blend was found to vary with the amount of starch as well as the environmental conditions [38]. To study the degradation of these starch/polyethylene blends in a natural environment, Johnson et al. investigated the chemical, photo, and biological degradation of 11 types of commercially produced degradable starch/polyethylene compost bags [39]. The oxygen tension on the surface of the film was found to have a substantial effect in controlling the degradation. The pro-oxidant additive (transition metal), has also played a significant role in controlling the degradation in the compost environment [39].

3.1.3 Blends of Chitin

Chitin is often blended with other polymers mainly to overcome its poor solubility and reactivity. Lee et al. reported that the blends of β-chitin and poly(vinyl alcohol) (PVA) showed improved mechanical properties [18]. Ramaprasad et al. used chitin–polyaniline blend for the construction of developing humidity sensors. They observed that the blends showed a significant improvement in the conductivity along with good thermal and environmental stability even after three years [40]. Mi et al developed chitin/poly(d,l-lactide-co-glycolide) and chitin/polylactide-based microspheres for protein delivery. They observed that the formulations of the blends might help in the controlled release of bovine serum albumin (BSA) [41]. Park et al. fabricated biodegradable nanostructured scaffolds based on poly (glycolic acid) (PGA)/chitin blend for tissue engineering applications [42]. Based on the results, they concluded that the blend with 25% PGA and 75% chitin with bovine serum albumin coating could be used for making scaffolds for tissue engineering applications [42].

3.1.4 Blends of Lignin

Lignin is an aromatic biopolymer that represents the second most abundant natural polymer other than cellulose. The abundance and aromatic structure would make it an ideal polymer for blending with various natural polymers

to improve their properties. Lignin has been evaluated with different natural polymers to improve their performance and properties for various applications [43,44]. It has been reported that the grafting of starch films with lignin can improve the water resistance, which is one of the main drawbacks of starch-based packaging films [45]. Kaewtatip et al. studied the mechanical properties and the resistance to water absorption of thermoplastic starch (TPS) in the presence of kraft lignin (KL) and esterified lignin (EL). Both the blends showed improved mechanical properties compared to that of pure TPS. [43] Huang et al. prepared the blends of soy protein, which got the attention mainly due to its low-cost and biodegradability, with alkaline lignin and investigated their properties with the help of different characterization techniques. The results indicated that the presence of alkaline lignin could enhance the thermal stability, tensile strength, Young's modulus and water resistivity of soy protein plastics, which helps in expanding their applications [46]. Mousavioun et al. investigated the thermal stability and miscibility of poly (hydroxybutyrate) and soda lignin blends. An improvement in the overall thermal stability was observed for the PHB/lignin blends compared to PHB over a wider temperature range [47]. Wu et al. studied the mechanical properties of bio-based composite films derived from cellulose, starch, and lignin. The mechanical properties of the composite films were found to improve significantly due to the combined effect of different components. Also, the thermal stability and gas permeability were found to be better for the composite films [48].

4. Natural Polymer Nanocomposites:

The increasing use of natural polymers can lead to entirely novel materials with enhanced performance compared with traditional plastics. In recent years, innovations in the development of plastic products from natural polymers increasing due to awareness of problems associated with fossil plastics and breakthroughs in processing technologies. Thus, the use of natural polymers will help to reduce the use of fossil-based raw materials, which in turn reduces the volume of plastic waste. This will also help in the protection of the climate through the reduction in carbon dioxide released. Apart from biodegradability, natural polymers show some excellent properties, which are comparable with that of commodity plastics [10]. However, some of the properties like high gas permeability, low melt viscosity, higher processing temperatures, etc. restrict the use of natural

polymers in different applications. The physical and chemical properties of natural polymers and their synthetic counterparts can be quite different. The processing and development of products based on natural polymers are not always easy and cost-effective. Therefore, in the applications, the main focus is to capitalize on inherent bio-degradability and other unique properties of natural polymers and not to compete with the properties of conventional plastics. Even though the modification of biodegradable polymers is a challenging task, the nano-reinforcement of pristine polymers to prepare nanocomposite has already proven to be an effective way to concurrently improve these properties [49,50]. Therefore, from the preparation to the processing of natural polymer-based nanocomposites, that is, 'green nanocomposites' is leading the future drive to deliver more environmentally friendly materials for future generations.

5. Polymer nanocomposite technology

Natural polymers in their native form are unsuitable to be used in the same way as fossil plastics, requiring chemical, and thermal modification, blending with other polymers or reinforced with nano fillers to gain the technological usefulness of these polymers. In recent years, the use of nano additives such as nanoclays, 2-dimensional nanomaterials and other class fillers as additives to enhance the polymer performance has been well established. Various nano-reinforcements currently under investigation include nano clay (layered silicates), graphene, boron nitride, cellulose nanofibers, and carbon nanotubes. Polymer nanocomposites are of keen interest due to their significant enhancement of a large number of physical properties, including barrier, mechanical, flammability resistance, thermal and environmental stability, solvent uptake, and rate of biodegradability, relative to unmodified polymer resins [51,52]. It was observed that the improvement in different properties was obtained at a lower filler content (<5 wt %). This improvement in the properties of polymer nanocomposites is attributed to the strong interfacial interactions between the polymer matrix and the filler at the lower filler loading. Nanofillers generally consist of layer thicknesses in the order of 1 nm, and very high aspect ratios (e.g., 10–1000). A few weight percent of nano additive properly dispersed throughout the matrix can create a much higher surface area for polymer-filler interactions than the conventional composites.

Very few studies have explored natural polymer nanocomposites. Starch attracted widespread attention among natural polymers due to its low cost

and abundance for packaging applications [53-61]. The studies reported that the addition of various types of nano additives resulted in significant improvement in tensile strength, modulus, elongation and barrier properties. Very recently, Jabier et al. reported the preparation of starch and chitosan nanocomposites reinforced with montmorillonite and bamboo nanofibers [53,62,63]. The results showed an increase in both tensile strength (by 50%), and elongation break (by 66%) compared to starch and chitosan, due to strong hydrogen bonding between the fillers and polymers.

Cellulose acetate (CA), which is obtained by the esterification of cellulose, has attracted attention due to its biodegradable nature, optical clarity, chemical resistance, and high toughness. Park et al. first reported the preparation of biodegradable plasticized CA/clay hybrid nanocomposites [64]. Melt processing via extrusion-injection moulding is adopted in fabricating the nanocomposites from CA powder, eco-friendly triethyl citrate (TEC) plasticizer and organoclay. The results showed that the addition of TEC plasticizer at 20 wt% exhibited the best intercalation and exfoliation of clays as well as the best physical and mechanical properties of the resulting nanocomposites. The tensile strength, modulus and heat deflection temperature were improved, and the water vapor permeability was reduced by a factor of two, but the impact strength was decreased. In their later work (Park et al., 2004a) [65], they investigated the effect of compatibilizer maleic anhydride grafted cellulose acetate butyrate (CAB-g-MA) on the nanostructure of the biodegradable CA/organoclay nanocomposites. They reported that nanocomposite systems with 5wt% compatibilizer contents displayed a better-exfoliated structure than the counterpart without compatibilizer hybrid. Chitosan, a non-toxic natural polysaccharide, is compatible with living tissue and finds applications in packaging, wound healing, production of artificial skin, food preservation, cosmetics, and wastewater treatment [66]. Chitosan-based nanocomposites prepared using various nano additives were reported by Rhim et al. [67]. The tensile strength of the composites was increased by 7-16%, and moisture resistance increased by 25-30% depending upon the type of nanoparticles evaluated. Especially chitosan-based composites with nano silver particles showed enhanced antimicrobial activity. Darder et al. reported chitosan-layered biopolymer clay nanocomposites for sensor applications and are useful for anionic detection in aqueous media [68].

Despite the huge possibilities to deploy natural polymer-based nanocomposite materials in various applications, the low level of production, property limitations and high production costs restrict their use in a wide range of applications. Therefore, new improved processing technologies and economies of scale are all indispensable to produce a more favorable, global adoption of natural polymer solutions.

6. Processing of natural polymers

Polymer processing involves the conversion of raw polymeric materials into finished products with desired shapes and properties. Different processing methods have been developed depending on the chemistry and properties of the polymer and the end-use of the final product. Some of the main polymer processing techniques are briefly described below.

6.1 Extrusion Moulding

Extrusion is mainly used for moulding thermoplastic materials. Some of the natural polymers like starch, gelatin, etc. can be processed via melt processing [10,69]. The typical melt extrusion involves the pumping of raw materials through a barrel with a rotating screw, where it will be subjected to heat and pressure to achieve a product with uniformity [70,71]. Unwanted particles are removed with the help of a breaker plate and screen, and retained between the barrel and die. The final product is obtained after both sizing and cooling. Everyday products such as pipes, straws, films for packaging, etc. are produced via extrusion moulding. In the pharmaceutical industry, especially in the drug delivery systems, melt extrusion is preferred over the other methods [72-75].

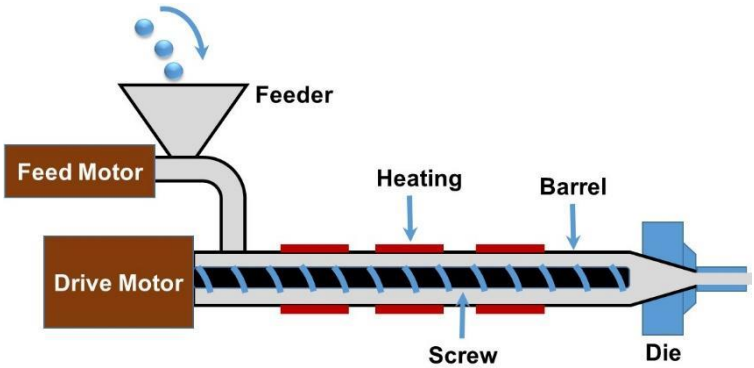

Figure 8. Schematic representation of an extruder.

Some of the natural polymers were also processed using the extrusion. Andreuccetti et al. used an extrusion process to prepare gelatin-based

films and investigated the mechanical properties [69]. Starch, lipids, cellulose, etc. are some other examples of natural polymers, which were processed using extrusion [76-78].

6.2 Injection Moulding

Injection moulding is one of the main processing techniques used for the mass production of plastic parts. Some of the advantages of the process include the quick cycle of production, material and color flexibility, design flexibility, etc. In the injection moulding, the polymer material is fed into the machine in the form of pellets through a hopper. The pellets were heated within a heated barrel, and the polymer melt was injected into a suitable mould, which is cooled under pressure. Around 33% of all the processed polymeric materials are made using injection moulding [10,79,80]. Even though the machine is similar to the extruder, there is a difference in the screw operation. In injection moulding, along with the rotation, the screw moves forward and backward as per the steps of the molding cycle. Injection moulding is widely used for making automotive parts, bottle caps, parts for electronic applications, etc. It has also found applications in the biomedical area and the development of drug products [80,81]. Gomes et al. developed a new method based on the conventional injection moulding process to prepare biodegradable porous scaffolds from corn-starch- based polymers [81]. By following this method, they were able to prepare scaffolds with a porous core, which showed promising mechanical properties. In another report, native starch was processed in the presence of water using the injection molding [82]. Starch and gelatin capsules were also developed using the injection moulding process [83].

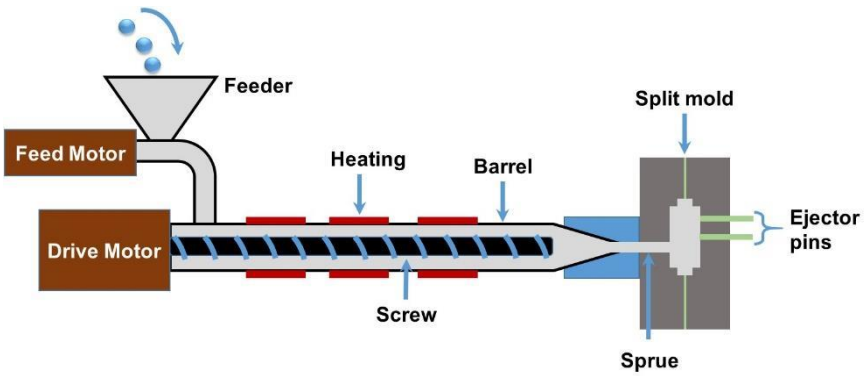

Figure 9. Schematic representation of an injection moulding.

6.3 Solvent Casting

Solvent casting is considered the oldest technology for making plastic films. This technique can be effectively used for making films with uniform thickness, superior optical purity, and mechanical properties. The process involves the dissolution or dispersion of the polymer in a suitable solvent, which is coated onto a substrate and the solvent is removed later by drying [10,84]. Santos et al. attempted to understand the effect of cellulose whiskers on the physical properties of glycerol-plasticized tilapia gelatin films, which are prepared using solvent casting technique from solutions with different concentrations [85].

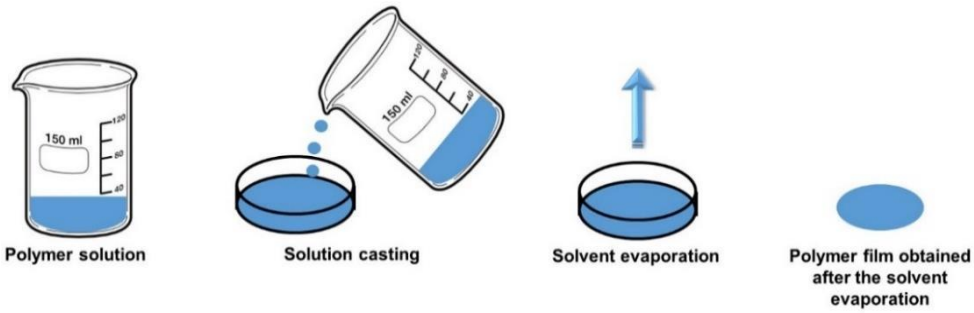

Figure 10. Different stages of solvent casting.

6.4 Electrospinning

In the electrospinning process, fine fibers from polymer solution are produced by using the electrostatic forces. The electrospinning setup consists of a high voltage power supply, a spinneret (e.g., a pipette tip) and a collecting plate. As shown in Figure 11, there are mainly two standard electrospinning setups: vertical and horizontal. Before the electrospinning process, the polymer is dissolved in a suitable solvent and then introduced into the capillary tube. Due to the surface tension of the polymer solution, it will be held at the end of the capillary, which is subjected to an electric field. Once the electric field reaches a critical value, it overcomes the surface tension, and the solution is electrically charged. The charged jet of solution is ejected from the capillary tip and fibres are formed on the collector plate after the evaporation of the solvent [86-88].

Different factors such as voltage, polymer fluid properties, flow rate, the distance between the capillary tip and the collector plate, and dimensions of the needle tip can tune the properties of the electrospun [89]. In some

reports, the electrospinning process has been used to prepare fibers of natural polymers such as chitosan and silk fibroin [90,91].

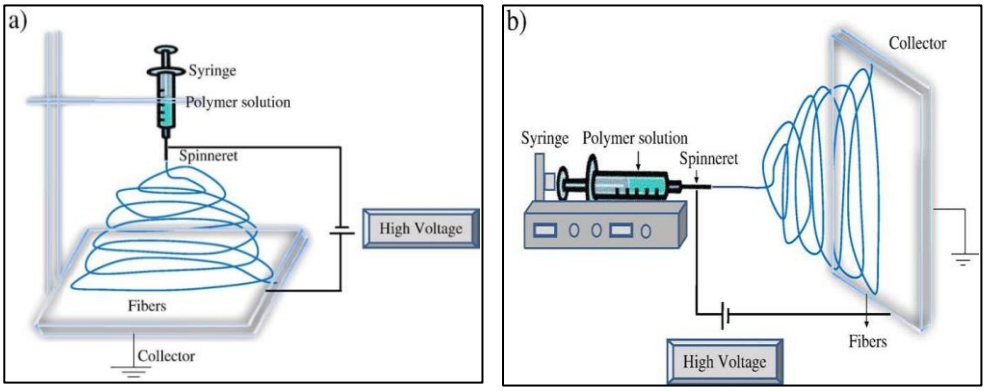

Figure 11. Schematic diagram of set up of electrospinning apparatus (a) typical vertical set up and (b) horizontal set up of electrospinning apparatus. [Reprinted with permission from ref [92]; Copyright © 2010 Elsevier Inc.]

7. Applications of Natural Polymers

Natural polymers have a wide range of applications in packaging, pharmaceuticals, textiles, cosmetics, adhesives, etc. Packaging materials made of natural polymers are of great interest since they can be degraded by the action of microorganisms. In the pharmaceutical industry, the natural polymers have been widely used for drug delivery applications. Two of the major applications of natural polymers are described below.

7.1 In Packaging

The packaging industry is considered one of the largest markets for the plastics due to their relatively low cost and ample availability [93,94]. Natural polymer-based packaging materials can enhance the food quality by preventing the external contamination and extending the shelf life. Derivatives of different natural polymers such as starch and cellulose have been used for making the packaging films [95-97]. Table 2 shows the various literature reports on the blends of natural polymers, mostly fossil-based polymers, which can be used in the packaging application.

Table 2. Literature reports on the potential source of natural polymer blends that can be used in the packaging application. [Adapted with the permission from ref [98]; Copyright © Springer International Publishing Switzerland 2016]

Title of paper	Polyolefins	Reference
Electret-thermal analysis to assess biodegradation of polymer composites	LDPE/starch blends	[99]
Effect of compatibilizer on the biodegradation and mechanical properties of high starch content/low-density polyethylene blends	LDPE/starch blends	[100]
Photo biodegradation of low-density polyethylene/banana starch films	LDPE/starch blends	[101]
Studies on biodegradability, morphology and thermo mechanical properties of LDPE/modified starch blends	LDPE/starch blends/starch phthalate	[102]
Soil burial of Polyethylene -g- (Maleic Anhydride) Compatibilized LLDPE/Soya powder blends	LDPE/soya powder blends	[103]
Thermal degradation of biodegradable blends of polyethylene with cellulose and ethylcellulose	LDPE/cellulose/ ethylcellulose	[104]
Linear low-density polyethylene/soya powder blends containing PE-g-MA copolymer as a compatibilizer	LDPE/soya powder blends	[105]
A new approach for morphology control of poly(butylene adipate-co-terephthalate) and soy protein blends	poly(butylene adipate-coterephthalate) (PBAT)/soy protein concentrate(SPC)	[106]

Even though LDPE, a fossil-based polymer, is often blended with starch to improve its properties for packaging applications, it has been reported that the addition of starch can improve the degradation of the LDPE/starch blends to some extent [107-109]. However, there is a growing interest in packaging materials made from natural polymers, mainly to tackle the environmental pollution created by petrochemical-based packaging materials [98,110,111].

7.2 In the Biomedical field:

Natural polymers have been widely used in the biomedical field due to their biocompatibility and biodegradability [10,112]. Modified alginate is regularly employed for drug delivery applications [113-117]. For example, alginate-based mesalazine tablets were used for intestinal drug

delivery [118]. George et al. designed pH-sensitive alginate–guar gum hydrogel crosslinked with glutaraldehyde for the controlled delivery of protein drugs [116]. El-Sherbiny et al. developed a series of sodium alginate-based pH-responsive hydrogel microspheres encapsulating poly(d,l-lactic-co-glycolic acid) nanoparticles. Their results indicated that the prepared particles could be effectively used as biodegradable carriers with desirable sustained release profiles of silymarin in addition to enhancing the overall dissolution of silymarin and its oral bioavailability [119].

Table 3. Natural polymers used in fast dissolving tablets [120].

Sl. no.	Natural polymer	Marketed drug	Disintegration time	Concentration used
1	Chitin and chitosan	Cinnarizine	60 sec	3% w/w
2	Guar gum	Glipizide	30 sec	1% w/w
3	Gum karaya	Amlodipine, granisetron hydrochloride	17.10 sec	4% w/w
4	Agar and treated agar	Theophylline	20 sec	1-2%w/w
5	Fenugreek seed mucilage	Metformin hydrochloride	15.6 sec	4%w/w
6	Soy polysaccharide	Lornoxicam	12 sec	8%w/w
7	Gellan gum	Metronidazole	155 sec	4% w/w
8	Mango peel pectin	Aceclofenac	11.59 sec	0.1–4%w/w
9	Lepidium sativum mucilage	Nimesulide	17 sec	5–15% w/w
10	Plantago ovata seed mucilage	Granisetron HCl	17.10 sec	5%w/w
11	Aegle marmelos gum	Aceclofenac	8–18 min	6% w/w
12	Locust bean gum	Nimesulide	13 sec	10% w/w
13	Lepidium sativum	Nimesulide	17 sec	10% w/w
14	Mangifera indica gum	Metformin HCL, paracetamol	3–8 min	6% w/w
15	Hibiscus rosa-sinensis mucilage	Aceclofenac	20 sec	6%w/w
16	Dehydrated banana powder	Ondansetron HCl/propranolol, gabapentin	15–36 sec	6%w/w

Modified chitosan has also found applications in the drug delivery systems [121,122]. Chitosan succinate and chitosan phthalate were found to have the potential to serve as oral insulin carriers [123]. N-trimethyl chitosan was found to show enhanced transdermal permeation with different degrees of quaternization [124]. It was reported that the fluoride anion-modified gelatin nanogel system could act as an effective therapeutic technology platform for the controlled drug delivery system for cancer and other diseases [125]. Table 3 gives the details of natural polymers, which are used in fast-dissolving tablets.

8. Biodegradation of natural polymers

Biodegradation can be referred to as the chemical decomposition of polymers, which is triggered by the action of microorganisms. In the degradation process, first, the polymer is fragmented into lower molecular mass species by oxidation, photodegradation or hydrolysis, or biotic reactions, which is followed by the bioassimilation of polymer fragments by microorganisms and their mineralization. The decomposition of the polymer has a strong dependence on its chemical composition [126].

Several bacteria and fungi were reported to degrade cellulose. Cellulose can degrade under both aerobic and anaerobic conditions [127]. The β-1,4 glycosidic linkages in the cellulose are broken down by the enzyme called cellulase. Cellulases are divided into two classes: endoglucanases and cellobiohydrolases. Among these, endoglucanases hydrolyze the internal bonding and cellobiohydrolases act on the existing or endoglucanase-generated chain ends [127,128]. Even though the amorphous part of cellulose can be degraded by both endoglucanases and cellobiohydrolases, the crystalline portion is degraded only by the action of cellobiohydrolases. The degradation of lignin is very difficult mainly due to its structural complexity and insolubility. The degradation can be carried out by extracellular, oxidative, and unspecific enzymes. Lignin from the wood can be degraded in the presence of white-rot fungi [127,129]. The enzymes involved here are peroxidases and laccases, which act as low-molecular weight mediators to carry out the degradation. Another way of lignin degradation is alkaline-based solubilization [130].

9. Challenges and Future trends in plastic production using natural polymers

The natural polymer market is gaining growing attention majorly due to its medical and packaging applications. The growing demand for natural polymer-based materials has mainly arisen due to the concerns related to the environmental hazards created by the commonly used fossil-based plastic materials. However, a lack of information on the molecular properties of natural polymers and processing difficulties currently constrains the widespread use of natural polymers in various applications. For example, starch is an abundant natural polymer, but the molecular properties of the starch change from source to source and difficult to predict their molecular properties, which is critical for the processing and development of starch, based plastics. Therefore, there is a great need, and extensive investigation is required into the molecular structure of natural polymers for better materials design, processing, and property interpretation. Nevertheless, the penetration of natural polymer plastics into the market has been slow due to the high cost of composite materials. If the properties of natural polymers, such as strength, performance, and processability improve, our society will flourish with the uptake of products based on natural polymers. New applications for agricultural waste and byproducts of processing, as well as recycling of natural polymers, promise to make more efficient use of our natural resources.

10. Summary

Natural polymer-based plastics are moving ever closer to commercial reality, and have great potential for diverse applications in many sectors. The commercialization of plastics based on natural polymers will continue to rise over the coming years, especially for single-use plastic items. However, there are number of challenges that remain to be addressed regarding processing technologies that have the potential to modify the properties of natural polymers in an efficient and environmentally friendly manner. It is critical that intensive, commercially focused research is given priority so that natural polymer-based plastics can finally compete economically with synthetic plastics.

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02

Synthesis, Characterisation and Antibacterial Property of α-Mangostin-β-Cyclodextrin Inclusion Complex

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Abstract

Xanthone compounds in mangosteen (Garcinia mangostana Linn.) fruit have received great attention in the current research scenario due to its outstanding pharmacological properties. Of the various xanthones isolated from the pericarp of Garcinia mangostana Linn, α-Mangostin was found to be the major constituent. α-Mangostin, a xanthone derivative with two isoprenyl groups was known to possess several biological properties. The objective of this study was to synthesize an inclusion complex of α-mangostin with β-cyclodextrin (MN-CD). The complex was characterized by Fourier transform infrared (FTIR) spectroscopy and the antibacterial effect of MN-CD complex was assayed by using the agar disc diffusion method. The diameter of zone of inhibition was determined at concentrations of 10μl and 20μL of the samples and the formation of clear zone around the disc shows that MN-CD complex displayed an effective antibacterial activity against E coli.

Introduction

Plant based natural products have attained great interest in day today life owing to their numerous properties and applications in different areas [1,2, 3]. They are highly diverse based on their chemical structure, composition, solubility and the methods by which they are synthesized[4]. Mangosteen (Garcinia mangostana Linn) is a tropical tree and cultivated for centuries in South East Asia rainforests and can be found in many countries worldwide. It is an erect slow growing tree with a pyramidal crown and can attain a height of 6–25 m. In India, Mangosteen was introduced in Nilgiri Hills, Tinnevelly district, Kanyakumari district and Kerala. The major bioactive compounds found in mangosteens are phenolic acid, prenylated xanthone derivatives, anthocyanins and procyanidins. There is a renewed interest for the identification, isolation and utilization of the compound of natural products f o r several applications.

The pericarp of the mangosteen fruit contains large amounts of xanthones which are a group of oxygenated and heterocyclic compounds with a wide variety of pharmacological properties & considerable amounts of other bioactive compounds such as terpenes, anthocyanins, tannins, flavonoids and polyphenols.[5] By far, the most studied xanthone in mangosteen tree is α-mangostin (MN) for which anti-oxidant, anti- proliferative, pro-apoptotic, anti-inflammatory, anti-carcinogenic, and anti-microbial activities have been reported[6]. Eventhough a plenty of reports are available for the biological applications of MN, studies related with the synthetic modifications and complexes of MN are limited. MN is a highly functionalized xanthone derivative with isoprenyl side chains, hydroxyl groups and methoxy group. Similar to curcumin, the molecule possess an enolic O, O- donor ligand. The reaction of enolic O, O-donor ligand in naturally occurring curcumin with different molecules resulted in the formation of various complexes and improved biological properties.

Samikannu Prabu *et al*[7] reported the formation of supramolecular complex between the curcumin and β-cyclodextrin (LC) and the complex formation was confirmed using absorption and emission spectroscopy. The binding properties of probe LC with cations in water were observed for the first time via absorption and emission spectroscopies. The selectivity and sensitivity of fluorescence chemosensors have been studied using probe. The probe showed selective binding to Hg^{2+} and afforded new absorbance and fluorescence peaks at 379 nm and 502 nm, additionally to the prevailing

bands of LC at 432nm and 535 nm. It additionally showed apparent colour change from yellow to colourlessness and strong fluorescent to weak fluorescent owing to selective binding of Hg^{2+}ion, which was detected by naked eyes. No noticeable changes of colour and spectra were observed upon the addition of other metal cations such as [Ag^{+}, K^{+}, Na^{+}, Cs, $Ba^{2+,}$ Fe^{2+}, Mg^{2+}, Pb^{2+}, Mn^{2+}, Ni^{2+}, Cd^{2+}, CO^{2+}, $Cr^{3+,}$ Sn^{2+} and Zn^{2+}.

Owing to the resemblance in the ligand site of the curcumin, herein we have explored the synthesis and antibacterial property of the supramolecular complex between MN and β- cyclodextrin. (CD)

Materials and methods

Mangosteen is collected from one of the local market in our area. All reagents were procured from Aldrich, India. Deionised water was used throughout all experiments. The ^{1}H NMR spectra were recorded on a Brucker AV 400 MHz and ^{13}C NMR were recorded on a Brucker AV 100 MHz NMR system and chemical shift values are reported in parts per million (ppm) relative to tetramethylsilane (0.00 ppm). A diffused reflectance Fourier Transform Infrared (FTIR) spectrum of the sample was taken on Perkin-Elmer Spectrum 100 FTIR spectrophotometer at room temperature.

Isolation of MN

Mangosteen pericarps collected were dried (1 Kg), cut in to small pieces and ground into powder form. Soxhlet extraction was carried out using ethyl acetate as the solvent. The extract was collected and purified by column chromatography on silica gel (60-120 mesh) with the n-hexane – ethyl acetate as the solvent system.MN is obtained as yellow crystalline solid with >98% purity was confirmed by^{1}H and ^{13}C NMR. Characterization Data for MN: Yield 70%; Yellow solid; ^{1}H NMR (400 MHz, Acetone - d_6), δ 1.798 (s, 3H), 1.842 (s, 3H), 1.664, (s, 3H), 3.466 (d, J= 7 Hz, 2H), 4.144, (d, J= 7Hz, 2H), 5.28 (t, 1H) , 3.809 (s, 3H) 6.841 (s, OH), 9.675 (s, OH), 13.80 (s, OH). ^{13}C NMR(100 MHz, Acetone - d_6) δ 182.87, 162.98. 161.73, 157.39, 156.24, 155.74, 144.50, 138.14. 131.42, 124.76, 123.46, 112.03, 111.09, 103.65, 102.72, 93.17, 61.35, 30.35, 30.20, 25.91, 25.87,21.98, 18.27, 17.89.

Synthesis of MN-CD inclusion complex

The calculated amount of MN to be complexed was dissolved in a minimum volume of methanol at 60 °C and then added dropwise into the 2.5 equiv. of β-CD aqueous solution at 60 °C with continuous, intensive stirring. The

mixture solution was refluxed with vigorous agitation at 70°C for about 4 h. Then the reflux equipment was taken down and the solution was stirred for an additional hour at 70 °C to remove methanol. Then the system wascooled to room temperature. After stirring for 8 hour at ambient temperature, the reaction mixture was stored overnight at 4 °C and then filtered off on a sintered glass filter. The crystalline product was obtained and dried in a vacuum oven at an elevated temperature (50- 55 °C)

Antibacterial Assay: Disc Diffusion Method

The antibacterial effect of MN-CD complex was assayed by using the agar discdiffusion method described by Bauer *etal*.,1966 with some modifications.[15] Briefly, 100µL of a bacteria suspension was dispersed on Muller-Hington agar plates. Then, the sterilized paper disc (6mm in diameter) were impregnated with 20µL of the samples. The discs were placed on the surface of Muller-Hinton agar plates. Tetracycline and Chloramphenicol (10µL /disc) was used as a positive control. For diffusing the active compounds in the medium, the plates were kept at 4°C for 2 hr. After that, all the plates were incubated at 37°C for 24 hr. The antibacterial activity was then investigated by measuring the clear zones of inhibition to the nearest millimeter (mm).

Results and Discussion

The complex formation between MN and CD was confirmed by Fourier Transform Infrared (FTIR) spectroscopy. FTIR spectrum of the compound MN showed the characteristic absorption bands at 3400 (OH, broad), 1790 and 1735 cm^{-1} (carboxyl carbonyl groups) which confirms the xanthone skelton of MN. In the spectrum of the complex, the shifts in the peaks of MN-CD confirms the complex formation between MN and CD. (Fig 1)

The synthesized MN-CD complex exhibit an effective antibacterial activity against gram- positive and gram-negative bacteria.The result suggests that the complex undergo an interaction with bacterial cell and displayed strong action against Escherichia coli. In this study different concentration of MN, CD and MN-CD complex was tested on Escherichia coli. The formation of clear zone around the disc is an indication of antibacterial activity. The diameter of zone of inhibition was determined at concentrations of 10µl and 20µL of the samples as shown in fig. 2 and table 1to 3. From the findings, it was observed that the MN-CD complex

showed antibacterial activity. Therefore, the MN-CD complex can serve as an antibacterial agent.

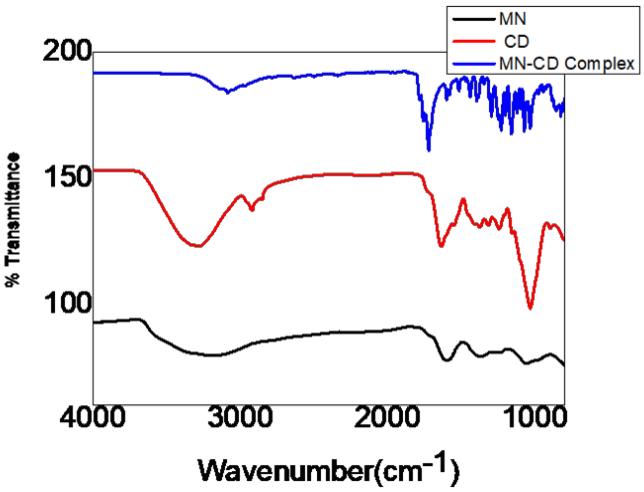

Fig. 1: FTIR spectrum of MN, CD and MN-CD complex

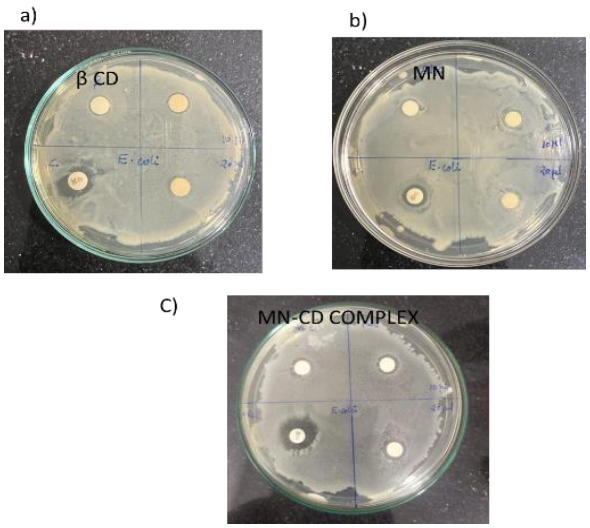

Fig .2: Antibacterial activity of a) MN b) CD and c) MN-CDcomplex on E coli bacteria

Table1: Antibacterial activity of MN

SL. NO	Name of Bacteria	Zone of inhibition in mm			
		Positive control	Negative control	MN (10µL)	MN (20µL)
1.	Escherichia coli	9mm	Nil	Nil	Nil

Table 2: Antibacterial activity of CD

SL. NO	Name ofBacteria	Zone of inhibition in mm			
		Positive control	Negative control	CD (10µL)	CD (20µL)
1.	Escherichia coli	10mm	Nil	Nil	Nil

Table 3: Antibacterial activity of MN-CD complex

SL. NO	Name of Bacteria	Zone of inhibition in mm			
		Positive control	Negative control	MN-CD Complex (10µL)	MN-CD Complex (20µL)
1.	Escherichia coli	10mm	Nil	4mm	6mm

Conclusion

α-Mangostin was isolated from the pericarp of mangosteen fruit and an inclusion complex of α-mangostin with β-cyclodextrin was synthesized. The complex was characterized by FTIR spectroscopy. On forming the inclusion complex, there occurs a shift in the peaks and the complex showed an excellent antibacterial property against E coli bacteria.

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03

Design And Characterisation of Poly Electrolyte Membrane's (PEM's) for Industrial Application

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Abstract

Poly electrolyte membrane's, PEM have a wide range of application over chemical, petrochemical industries, fuel cells, electrodialysis, ultrafiltration etc. This work is focusing on the design of polyelectrolyte membrane using Polyallylamine Hydrochloride, PAH and Polystyrene Sulphonate, PSS with Nylon 6,6 as supporting membrane by means of layer by layer,LBL method and characterisation of the multilayers with the assistance of analytical tools such as Scanning Electron Microscopy(SEM),Atomic Force Microscopy(AFM) , Fourier Transform Infrared spectroscopy(FTIR) and UV- Visible spectroscopy.

Keywords: PAH – polyallylamine hydrochloride, PSS – Polystyrene Sulphonate, LBL method - Layer by Layer method, PEM – Polyelectrolyte multilayer membrane

1. Introduction

Polyelectrolyte multi layer membranes can be prepared from a wide range of applicable substrates using layer-by-layer deposition method. These PEM's are obtained by the self assembly method of cationic and anionic polyelectrolytes which undergo layer-by-layer deposition in the aqueous solution. PEM's have many applications in the fields like bio optics, water purification, petrochemical industries, bio sensors, electrodialysis and so on. We are going to construct the polyelectrolyte multilayer membrane from Poly Allylamine Hydrochloride (PAH) and Poly Styrene Sulfonate using Nylon 6,6 as supporting membrane.

PEMs are used in Tissue Engineering due to their ability to interact with the biological molecules such as proteins or nucleic acid and also their sensitivity to external stimuli. HUMIC ACID, CS, Sodium Alginate etc are

natural PEMs used for this purpose. Khademhosseini et.al developed a bio compatible support based on PLL and HA. Multilayer consisting of two polyelectrolyte was deposited on a glass support and this was used to grow and differentiate two cell types like stem cells and fibroblasts. The result obtained showed that the cells were stable for about five days and also the viability of the support for the cell.

The surface modified PEM's show a wide range of application in the field of tissue engineering, bio sensors, removal of water pollution, environmental remediation. The modern energy conservation and storage systems are relying on these PEM's. Due to their long term stability and high performance other commercially available membranes were ruled out from the market. The objectives of the present styudy involves : Selection of appropriate supporting polymeric membrane for PEM, Selection of the promising polyelectrolyte for designing and developing PEM's, Utilization of LBL method for the deposition of PEM's, Characterization of newly designed PEM using analytical instruments, Proposal of the applications of newly designed and developed PEM's.

2. Materials and Methods

2.1. Materials

PAH, molecular weigt=65000 g/mol (0.5M), was purchased from Aldrich CO. and used without purification. PSS ,MW=70000 g/mol (0.5M), 30 weight percentage in water, purchased from Sigma Aldrich. 1M HCl to regulate pH, deionized water for rinsing and diluting the membrane, 250 mL beaker, spatula , Nylon-6,6 (no.4) as supporting membrane, 250 mL standard flask, glass rod, a pH meter.

2.2.Method

0.125g of PAH is weighed approximately then transferred to a 250 ml standard flask and made upto the mark. In another 250 mL standard flask 0.125g of PSS is made upto the mark. PAH being a weak electrolyte, it is pH dependent.1 M HCl is prepared to regulate the pH. 50 mL of each solution is transferred into 250mL beakers. A pH meter is immersed in PAH solution and its pH is adjusted to 6 by the addition of acid. The Nylon membrane is dipped in deionized water and keep it for 5 minutes. Then the membrane is dipped in the cationic electrolyte PAH for 15 minutes and then rinsed with deionized water. The washed membrane is then dipped into the anionic electrolyte PSS for 15

minutes and rinse it with deionized water. This procedure is repeated twice for 2 bilayers, 4 times for 4 bilayers, 6 times for 6 bilayers and 8 times for 8 bilayers.

2.3.Film Characterization

For the characterization of the bare membrane and the multilayer deposited membranes we use the analytical techniques IR ,UV-Visible, AFM and SEM.

3. Result and Discussion

Successfully fabricated 2,4,6 and 8 bilayers of PAH/PSS polyelectrolyte membrane via LbL method. The membranes are characterized and the fabrication is confirmed by using microscopic analytical tools such as ATR-FTIR, UV-Visible Spectroscopy, AFM and SEM.The results of the bilayers are compared with the bare membrane results and between the membranes.

3.1ATR-FTIR Analysis

IR is a simple and effective technique for characterization. The IR of sulphonate peak made on the Nylon 6 6 membrane is shown in the figure. The absorbance of bare membrane is shown in 0.00 cm^{-1}. The sulphonate group shows peaks at a range of 1020-1040cm^{-1} over pH range of

6. It is evident from the spectrum that the height of sulphonate peaks increases with increase in number of layers. The absorbance is exactly at 1034 cm^{-1} for the 8 bilayer membrane. The symmetric and antisymmetric deformation of NH^{3+} is usually shown in the region 1400-1700 cm^{-1}.

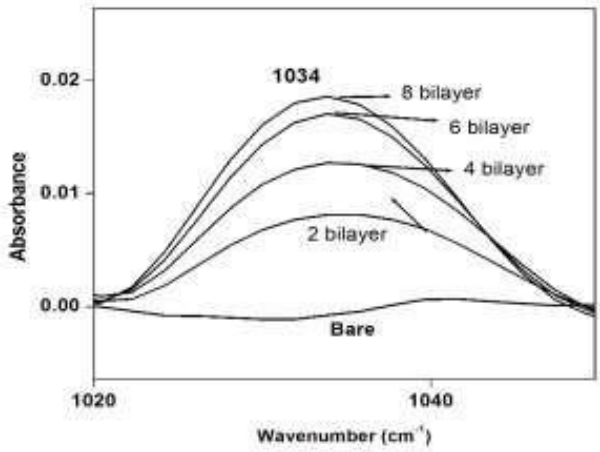


Figure 3.1 IR of sulphonate peak

3.2. UV-Visible Analysis

The growth of multilayers are analysed using uv-visible spectroscopy. The absorption of films increases linearly with the number of bilayers which means that the amount of material absorbed are same are same in each deposition step.

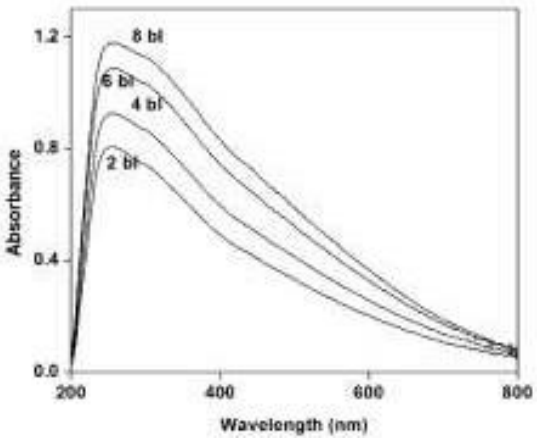


Figure 3.2 UV-Visible spectrum of synthesized bilayers

3.3.AFM Analysis

AFM gives globular morphological information and thickness of the bilayers on the surface of supporting membrane. All films present very smooth surface with root mean square roughness varying from 0.89 to 1.9 μm. The average thickness of PAH/PSS bilayers were found to be 2μm. Usually is both are weak electrolyte, the bilayers are expected to be fully charged. But here PAH is weak and PSS is strong, so PAH is expected to be fully charged and pH dependent. AFM gives 3D image of the bilayers where the morphology turns to be more and more globular and crowded when the number of bilayers are increased.

Figure 3.3 AFM of bare layer

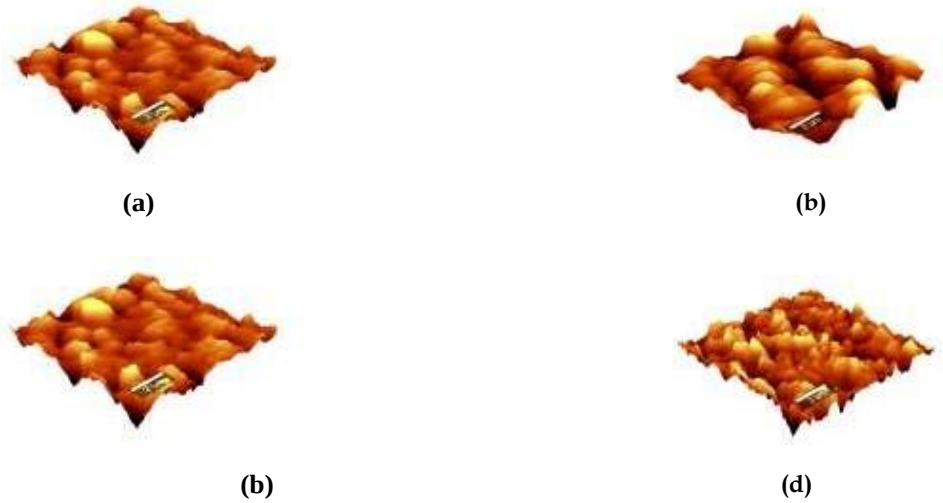
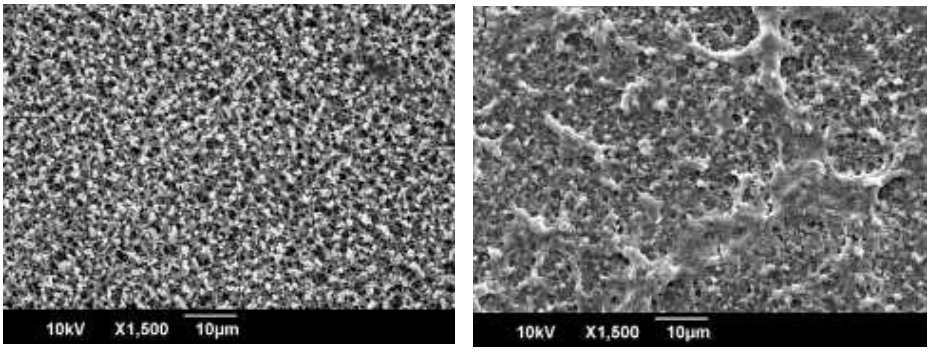


Figure 3.4 AFM of (a) 2 bilayer (b) 4 bilayer (c) 6 bilayer and (d) 8 bilayer membranes

3.4. SEM Analysis

The formation of multilayers on the surface of Nylon 6,6 supporting membrane has been investigated using SEM. Figure 3.4.1 is the bare membrane surface and figure 3.4.2 is the surface of 8 bilayer membrane. On examining the results we can see there is a slight decrease in the porous size of 8 bilayer membrane than the bare membrane. Which means as the number of bilayers increase, the sizes of the pores decreases proportionally.



(c) **(b)**

Figure 3.5 SEM of (a) bare membrane (b) 8 bilayer membrane

The fabricated PEM's were effectively characterized and the designing was confirmed usingthe above characterization tools. This work can be extend for industrial applications such as tissue engineering, waste removal from water, bio sensing application and so on.

4. Conclusion

Successfully synthesized PEM membranes consisting various bilayers such as 2,4,6 and 8 using LBL method by the alternate deposition of PAH and PSS on Nylon 6,6. The developed bilayers were characterized by UV-Visible spectroscopy, ATR FTIR spectroscopy, AFM and SEM. The analysis result shows the surface modification has become more selective by the addition of bilayers and offers meaningful industrial applications like tissue engineering, bio sensing,waste disposal, chemical cleaning.

4

Synthesis of Cerium Dioxide Nanoparticles Using Simple Sol-Gel Method

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Abstract

Cerium dioxide (CeO_2) nanoparticles have gained huge attention owing to their use in diverse applications. Current synthesis methods for CeO_2 nanoparticles including hydrothermal and chemical precipitation are time-consuming and require chemical organic reagents. In order to minimize the reaction time and avoid the use of organic reagents, a new method for CeO_2 nanoparticles were used, which provided an easy, efficient, and continuous bulk phase synthesis at room temperature. In the present study, ammonium cerium nitrate and ammonium hydroxide were used as precursors, and nitric acid was added as a stabilizer to separate the nucleation and growth processes of the nanoparticles to prevent their aggregation. The products were characterized by X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), transmission electron microscopy (TEM), scanning electron microscopy (SEM), and UV-Vis spectrophotometer. XRD pattern showed the cubic fluorite structure of the cerium oxide nanoparticles. The surface morphological studies from SEM and TEM depicted non homogeneous agglomerated spherical nanoparticles and the sizes of as synthesized CeO_2 NPs are between 20±5. The sharp peaks in FTIR spectrum determined the existence of Ce-O stretching vibration and the absorbance peak of UV-Vis spectrum showed the bandgap energy of 3.02 eV.

Keywords: Cerium oxide, Nanoparticles, bulk phase method, simple sol -gel synthesis, Spherical particles.

Introduction

Nanomaterial's have attracted extensive interest worldwide for their unique size and shape dependent chemical and physical properties[1] compared to bulk materials, owing to the enhanced surface area to volume ratio[2], quantum confinement, as well as their potential self-assembly for device applications[3]. Cerium dioxide based materials have been extensively studied and used in a variety of applications over the last two decades, including oxygen storage capacitors[4], catalysts[5,6],UV blockers[7,8], gas sensors[9,10], solid oxide fuel cells[11], and in chemical mechanical planarization[12]. Numerous methods have been reported to produce CeO_2 nanoparticles with promising control of size and properties. Among various chemical methods for producing metal oxide nanoparticles, sol-gel process proves advantageous over the other methods for its better homogeneity, controlled stoichiometry, high-purity and phase-pure powders at a lower temperature.

In recent years, the aqueous synthetic method has been intensively studied, modified, and improved to find simple and environmental friendly synthesis for fabrication of controlled metal oxide nanostructures[13]. Chemical precipitation methods are largely investigated for the industrial scale synthesis of CeO_2 nanocrystals. Hydrothermal treatments have been successfully used for shape-controlled synthesis of CeO_2 nanomaterials, such as nanopolyhedra[14], nanowires[15], and nanotubes[16]. All of these investigations highlighted the possibility of a convenient aqueous synthetic route to highly controlled CeO_2 nanocrystals, but all these methods need more time and require organic reagents.

For this, we have adopted the simple environmental friendly sol-gel method for the bulk phase preparation of CeO_2 NPs. Ammonium cerium nitrate was used as a precursor for the cerium oxide nanoparticle synthesis. In this paper, the crystalline nano cerium oxide nanoparticles were successfully synthesized by a facile sol-gel method and the formation of CeO_2 nanoparticles were investigated. This method has novel features which are of considerable interest due to its low cost, easy preparation and industrial viability. The structural, morphological and optical properties of the experimentally derived CeO_2 NPs have been analyzed with XRD, FTIR, SEM and TEM, UV-Vis characterization tools.

Experimental Section

Materials

Ammonium cerium nitrate [$(NH4)_2Ce(NO3)_6$] is purchased from E-Merck with 99% purity and all other reagents supplied by Rankem.Ltd.

Sol-gel Synthesis of Cerium Dioxide Nanoparticles

2.17g of Ammonium cerium nitrate ($(NH_4)_2Ce(NO_3)_6$) was weighed accurately and it is precipitated with 10% NH_3, until an yellow precipitate of $Ce(OH)_4$ is obtained. The formed supernatant solution is decanted off and precipitate is washed with double distilled water and centrifuged for 10 minutes at a speed of 3000 rpm. This is done at least 5 times. Then the residue is re-dissolved in 500 ml double distilled water using a magnetic stirrer. Then the pH of the solution is adjusted to 2 (acidic range) by adding 10% HNO_3. The acid addition is continued (drop wise) till a stable sol is obtained. The sol is then dried in an air oven at 100 °C. The dried sol is then calcined in a muffle furnace at 600 °C for 3 hours. The yellow CeO_2 NPs were kept in air-tight containers.

Sample preparation and characterization methods

The crystallinity and size of the obtained CeO_2 NPs was studied using a X-ray diffractometer (XRD Rigaku miniflex, Japan) employing CuKα radiation and the data was recorded over the range 20–80 in increments, at an angle 2θ. The size and morphology of formed CeO_2 NPs were studied using a Transmission electron microscope (JEOL JEM 1200 EX II, Japan) and Scanning electron microscope (JEOL 5200, Japan). FT-IR analysis were noted in the range of 400-4000 cm^{-1} by using a FTIR spectrometer (Schimadzu IR Affinity,Japan). The UV-Vis spectra of CeO_2 nanoparticles were measured between 200 to 800 nm using UV-visible spectrophotometer (Schimadzu, Japan).

Results and Discussion

Characterization studies on cerium oxide nanoparticles

The X-ray diffraction analyses of CeO_2 NPs were carried out and the results were compared with the standard International Centre of Diffraction Data (ICDD) and presented in Figure 1. The XRD peaks located at (2θ) angles 28.8, 33.1, 47.46 and 56.04 corresponds to the (111), (200), (220) and(311) planes, respectively, which indicate the cubic fluorite structure of CeO_2 NPs (JCPDS file no: 75-0076, of CeO_2).The average

crystallite size D of the sample is calculated using Debye-Scherrer's formula, average crystallite size = $0.9\lambda/\beta\cos\theta$, where λ is the wavelength of X-ray used (1.5405 A), β is the angular peak width at half maximum in radians and θ is the Bragg's diffraction angle. From the equation, the average crystalline size was calculated as 12 nm.

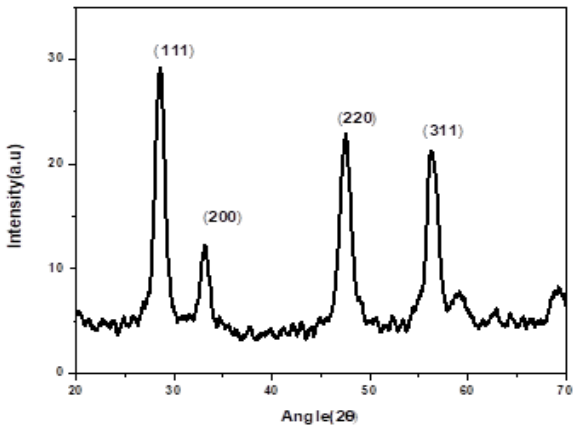

Figure1. Powder X-ray diffraction patterns of CeO_2 NPs.

The FTIR spectra of as prepared CeO_2 NPs were carried out and it is given in figure 2. The absorption peak at around 1630 cm^{-1} can be assigned to the OH bending vibration of water molecules. The bands located at around 1051 cm^{-1} can be attributed to the C-O stretching vibration. An intensive band at 2335 cm^{-1} is due to atmospheric CO_2. The intense band at 438 cm^{-1} corresponds to Ce-O stretching vibration.

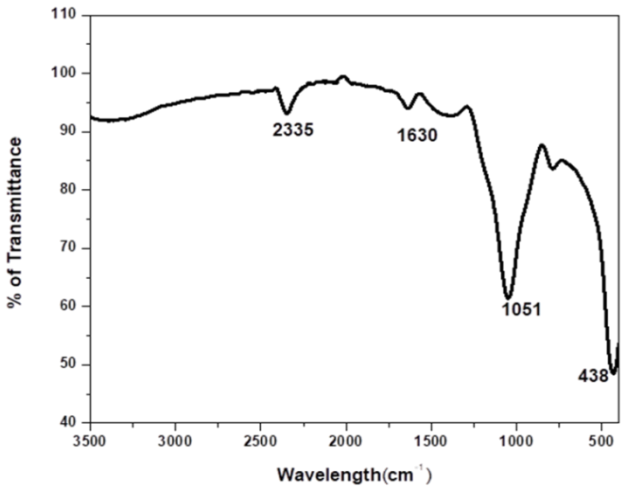

Figure 2. FTIR spectra of prepared CeO_2 NPs.

The UV-Vis absorption spectra of CeO_2 NPs are provided in Figure 3. The absorption peak found at 375 nm can be assigned to the excitation of electrons from the valence band to the conduction band of CeO_2 NPs in the presence of light. The band gap energy of CeO_2 NPs can be calculated from the equation,

$$E_g = hc/\lambda$$

Where h is the Planck's constant, c is the speed of light and λ is the wavelength. The small band gap energy value was measured to be 3.02 eV. From the analysis it can be confirmed that the obtained CeO_2 nanoparticles are highly transparent in the Visible region.

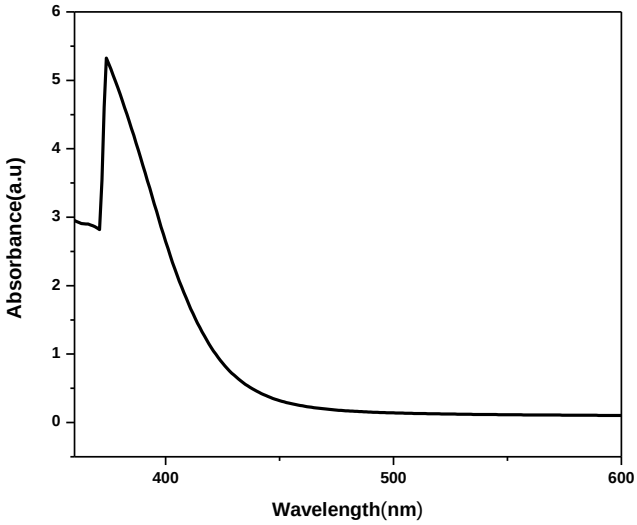

Figure3. UV- Vis absorption spectrum of CeO_2 NPs.

SEM and TEM analysis were carried out in order to find the size and shape of as-prepared CeO_2 nanoparticles. Figure 4(a) depicts SEM images of CeO_2 nanoparticles obtained using the present controlled sol- gel technique. The presence of strongly agglomerated non-homogeneous cerium oxide particles was confirmed by SEM analysis. From the TEM (Figure 4(b)) analysis, the studies indicated that the as prepared cerium oxide nanoparticles are constituted of spherical cerium dioxide nanoparticles.

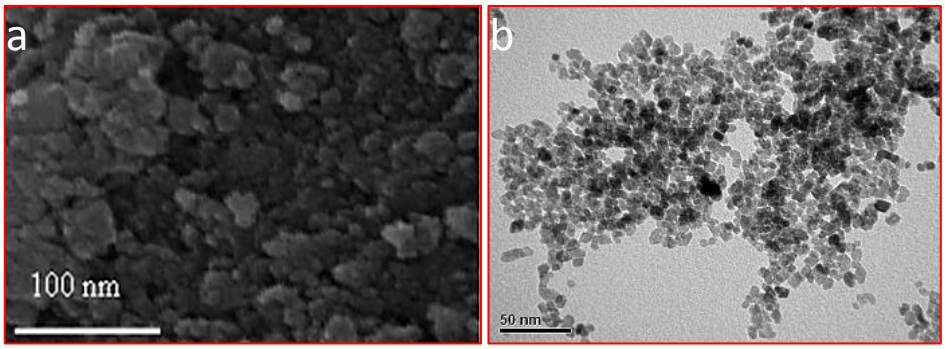

Figure 4: **a**) SEM images of CeO_2 NPs, **b**) TEM images of CeO_2 NPs.

Conclusions

Nanocrystalline CeO_2 NPs were successfully prepared from ammonium cerium nitrate by using simple controlled sol gel synthesis. The SEM and TEM images showed that obtained CeO_2 NPs are highly agglomerated nonhomogeneous spherical and smaller in size (20±5nm). XRD studies confirmed that the resultant crystalline nanosized cerium oxide have cubic fluorite structure. UV-Vis spectra confirmed that the prepared CeO_2 NPs are transparent in the visible region. The present method can be used for simple bulk scale production of cerium dioxide nanoparticles.

Acknowledgement

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5

Species composition of mosquitoes in the rubber plantation sectors of Kerala

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Abstract

Mosquitoes are the most important vector among arthropods that transmit diseases such as Malaria, Filariasis, Chikungunya (CG), Dengue Fever (DF), Yellow Fever, Japanese Encephalitis (JE) etc. Forest fringe associated rubber plantation areas are more prone to the spread of zoonotic diseases to rural and urban areas. In view of this, a study was conducted to assess the species composition and density of mosquitoes in the urban and rural areas of rubber plantation sectors of Kottayam district. Two villages from forest fringe associated rubber plantation areas and two wards from urban areas of Kottayam district were selected for the study. Immature and adult mosquitoes were collected based on WHO standard procedures. A total of 14 mosquito species were recorded in the present study in which five species belong to the Aedeine group. *Aedes albopictus* was the predominant vector species in the study areas. *Aedes albopictus* was found to be abundant in the urban areas while *Armigeres subalbatus* was recorded as the prevalent species in the rural areas. Per man hour density of mosquitoes were found maximum during June and July and density of *Aedes albopictus* found maximum during the month of May. Water storage containers were observed to be the major breeding habitat for *Ae.albopictus* in urban areas and discarded or unused rubber latex collection containers were found to be the main breeding source for *Ae. albopictus* in rural areas. Since *Aedes* transmitted diseases such as dengue and chikungunya are being reported in the study area entomological surveillance and its significance can be used to halt the outbreak as shown in this study.

Key words: **Rubber plantations, vector mosquitoes, *Ae.albopictus*, Dengue, Chikungunya**

1. Introduction

Among arthropod vectors, mosquitoes are the most important vector that transmit diseases such as Malaria, Filariasis, Chikungunya (CG), Dengue Fever (DF), Yellow Fever, Japanese Encephalitis (JE) etc. Rubber plantations are very much similar to manmade forests with lower temperatures and higher humidity under the canopy which provide suitable conditions for the mosquito vectors of dengue, chikungunya, malaria etc. Kerala state has the largest rubber plantations in the country to the tune of about 5.45 lakh ha. In Kerala, the forest fringe associated rubber plantations are located at the foothills of Western Ghats on the western coast of India. Forest fringe areas and associated rubber plantations are more prone to zoonotic diseases from where it spread to rural and urban areas[1]. During 2007 Chikungunya outbreak in India, 55.8% of suspected cases were reported from Kerala and was the worst affected state in the country[2]. In Kerala, Kottayam and Pathanamthitta were the worst affected districts contributing 44.33% and 14.37% of the total CHIKV cases, respectively[2].Also dengue fever cases has shown an increasing trend in Kerala since 2006. More than 13.1% of dengue cases were reported from Kerala during the dengue outbreak happened in India during the year 2017. All the four serotypes of dengue virus (DENV-1, DENV-2, DENV-3 and DENV-4) were reported in Kerala[3].The first case of dengue in Kerala was reported during 1997 from the forest fringe areas of Kottayam District[4] and continues to contribute the maximum number of dengue cases next to Trivandrum District in the state every year.

Topographically, Kottayam district has abundant rubber plantations (109, 582 ha) which support profuse breeding of *Aedes albopictus*, the main vector of Dengue and Chikungunya infection. Rainwater that accumulates in the latex collection containers during the monsoon season are the major breeding habitat of this species[2,4]. Massive deforestation, development of human settlements along forest fringe areas, transportation through different modes are the important human activity related to the spread of this vector species in Kerala[5]. As the cases of mosquito borne diseases are being reported frequently in Kottayam district a preliminary survey was carried out to understand the species composition and prevalence rate of mosquitoes in the urban and rural areas of Kottayam district.

2. Materials and Methods

Two villages in the forest fringe associated rubber plantation areas, Kootikal and Koruthode of Kanjirappally taluk and two wards in urban areas, Pallom (ward 13) and Puthuppally (ward 22) of Kottayam district were selected(Fig.1.1). Fortnightly survey were carried out in the 4 areas from May 2021 to November 2021. Larvae were collected using WHO standard methods. Outdoor resting mosquitoes were collected using sweep nets on man hour basis[6]. For larval survey all breeding sources or sites in and around 10 households covering an area of about 0.5Sq.Km were enlisted and checked for vector breeding both in urban and rural areas. Immatures collected from the positive sites were kept for emergence in the laboratory and emerged species were identified using Keys[7,8].

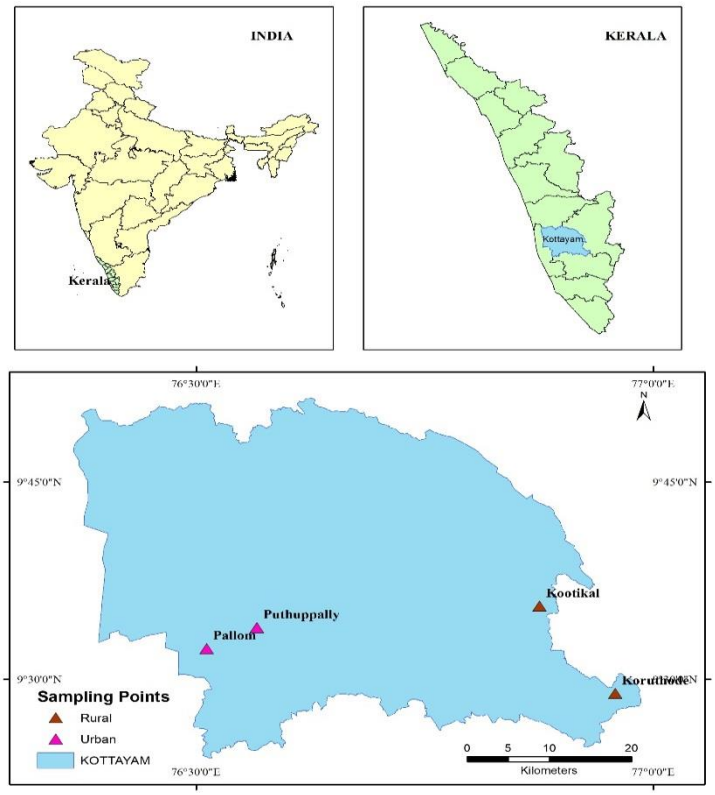

Fig.1.1 Study area showing sampling stations

3. Results

In the present study a total of 14 species of mosquitoes were recorded in the urban and rural areas of Kottayam district (Table 1.1). Five species

belong to the genus *Aedes* have been recorded. *Aedes albopictus*, the secondary vector of dengue virus were found to be abundant in both urban and rural areas. Other non-vector species recorded under *Aedes* include *Aedes crysolineatus*, *Aedes vittatus, Aedes pseudotaeniatus* and *Aedes cogilli*. Under the genus *Culex* 3 species were recorded *Culex uniformis*, *Culex quinquefasciatus* and *Culex gelidus*. *Anopheles stephansi* and *Anopheles subpictus* are the species recorded under genus A*nopheles*. Non vector species such as *Armigeres subalbatus*, *Toxorhynchites splendens*, *Heizmannia discrepens* were also collected from the study sites.

Table 1.1 Species composition and prevalence rate of mosquitoes in the study areas

Sl. no	Species	Kootikal (Rural)		Koruthode (Rural)		Pallom (Urban)		Puthuppally (Urban)	
		N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
1	*Aedes albopictus*	443	27.6	565	36.0	791	80.5	983	78.50
2	*Aedes chrysolineatus*	259	16.1	212	13.51	5	0.5	23	1.84
3	*Aedes vittatus*	0	0	4	0.25	3	0.3	21	1.67
4	*Aedes cogilli*	3	0.2	11	0.70	0	0	1	0.1
5	*Aedes pseudotaeniatus*	7	0.43	3	0.20	0	0	0	0
6	*Culex uniformis*	195	12.1	183	11.7	13	1.32	50	4.0
7	*Culex gelidus*	8	0.46	0	0	0	0	2	0.12
8	*Culex quinquefasciatus*	2	0.12	0	0	4	0.4	5	0.40
9	*Anopheles subpictus*	0	0	0	0	1	0.1	3	0.24
10	*Anopheles stephensi*	0	0	0	0	0	0	2	0.12
11	*Heizmannia discrepens*	0	0	3	0.2	0	0	1	0.1
12	*Mansonia uniformis*	0	0	0	0	1	0.1	1	0.1
13	*Toxorhynchites splendens*	2	0.12	2	0.12	0	0	1	0.1
14	*Armigeres subalbatus*	686	42.8	587	37.4	165	16.8	160	12.8
	Total	**1605**	**100**	**1570**	**100**	**983**	**100**	**1253**	**100**

N=Number of mosquitoes collected

Most prevalent species in both urban and rural area was *Aedes albopictus* and *Armigeres subalbatus*. Other species recorded were not much prevalent in both areas. In the rural areas of Kootikal and Koruthode, the most prevalent species recorded was *Armigeres subalbatus* (37.4% to 42.8%) followed by *Aedes albopictus* (27.6 % to 36.0%), *Ae. crysolineatus* (13.51% to 16.1%) and *Cx. uniformis* (11.7%to12.1%) (fig1.2and 1.3). In the urban areas of Pallom and puthuppally the most prevalent species recorded was *Aedes*

albopictus (78.50% to 80.5%) followed by *Armigeres subalbatus* (12.8% to 16.8%), *Culex uniformis* (1.32% to 4.0%) and so on (fig.1.4 and 1.5).

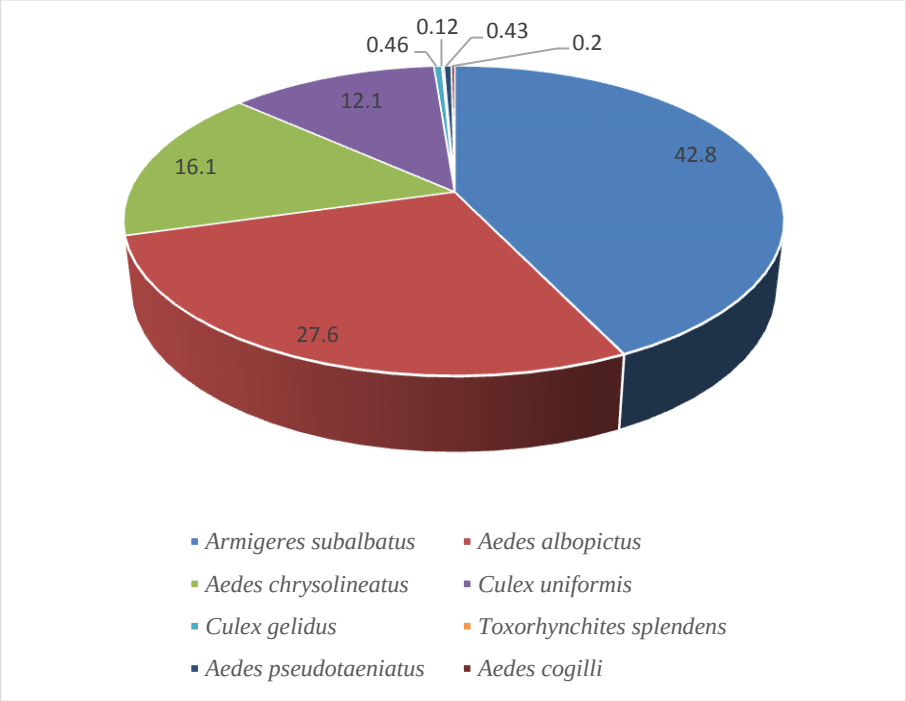

Fig.1.2 Species composition of mosquitoes in Rural areas of Kootikal

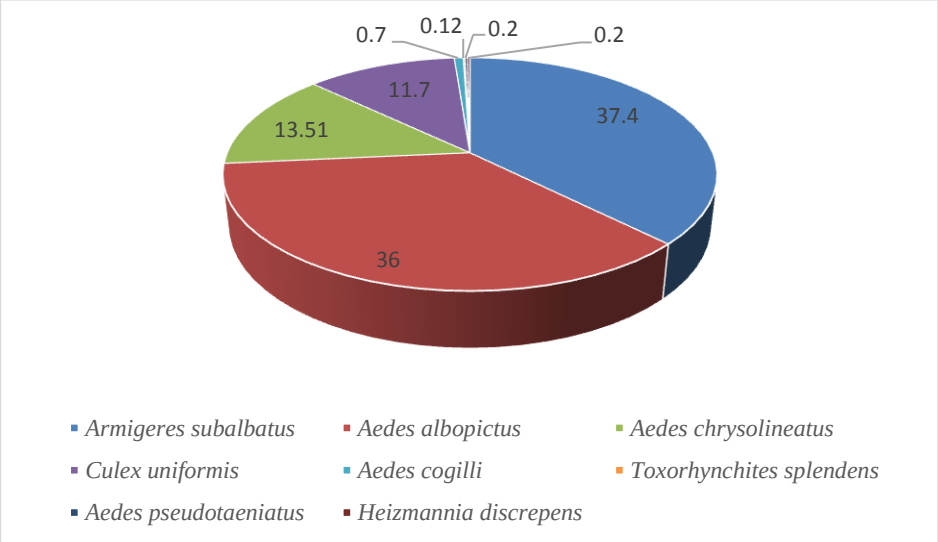

Fig.1.3 Species composition of mosquitoes in Rural areas of Koruthode

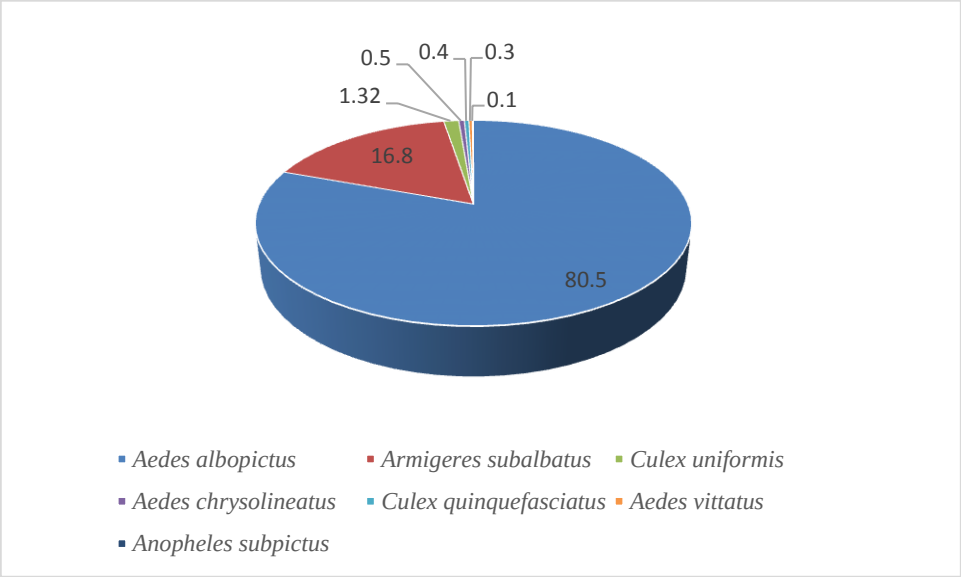

Fig. 1.4 Species composition of mosquitoes in urban areas of Pallom

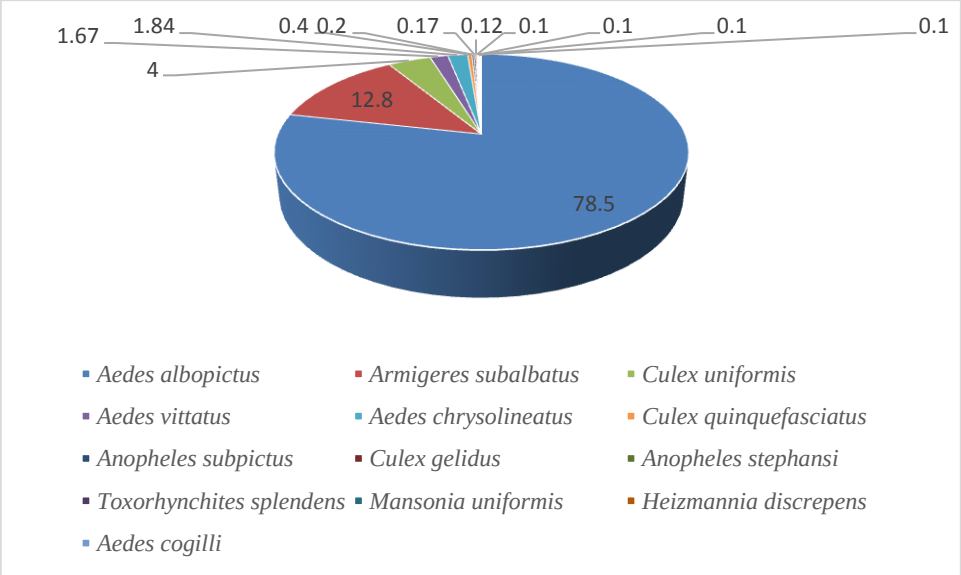

Fig. 1.5 Species composition of mosquitoes in urban areas of Puthuppally

Man hour density of total mosquitoes vary in different months both in rural and urban areas (fig.1.6 and 1.7). However there is no significant difference observed in the per man hour density of mosquitoes between rural and urban areas (t=1.43, p=0.178).When comparing different months total mosquito density was found to be high during the month of June and

July while density of *Aedes albopictus* was found to be high during the month of May both in urban areas and rural areas. Also man hour density of *Ae. albopictus* was found to be high in urban areas compared to rural areas.

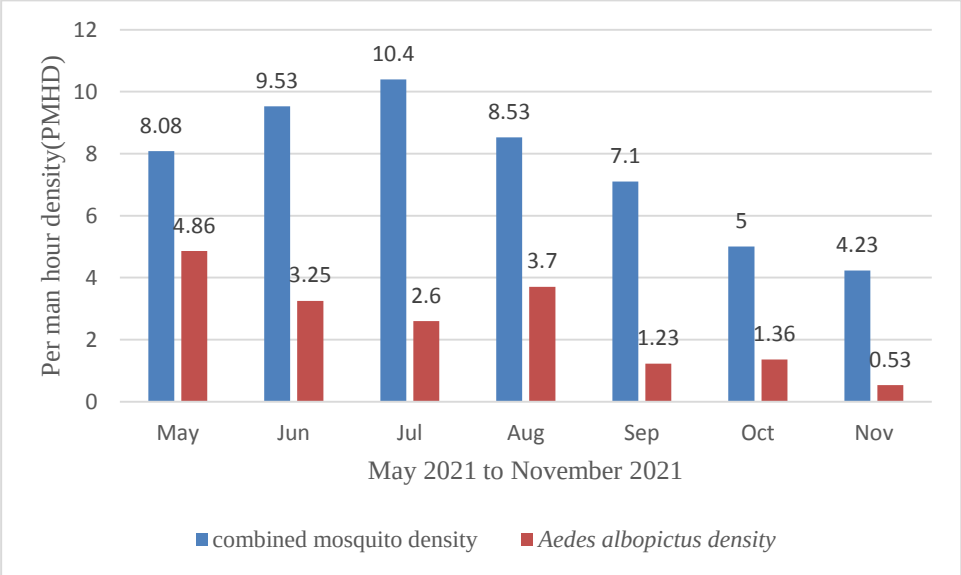

Fig. 1.6 Per man hour density of mosquitoes in the rural areas of Kottayam district

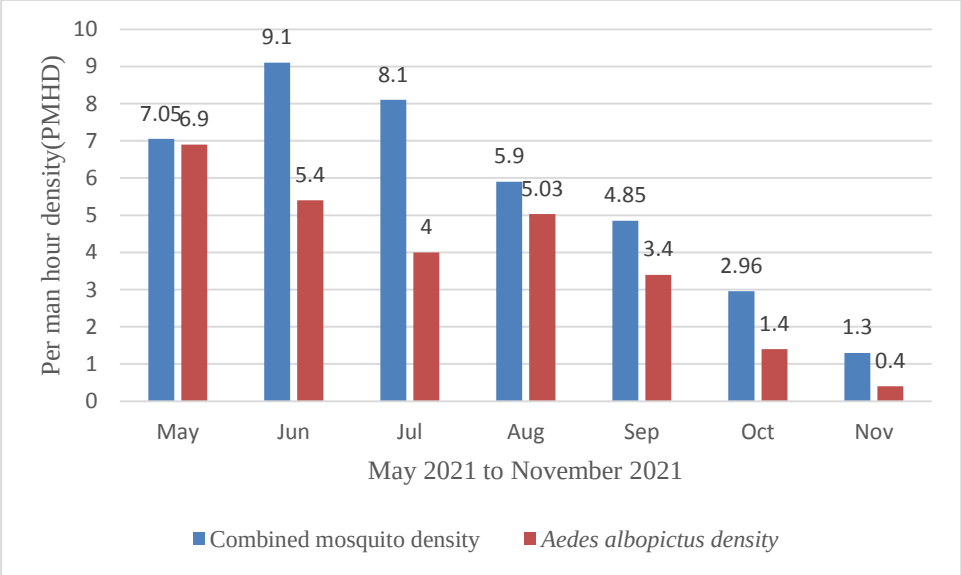

Fig. 1.7 Per man hour density of mosquitoes in the urban areas of Kottayam district

4. Discussion

Mosquito fauna of 14 species belonging to 7 genera were recorded in the study area and all the species were already reported from different parts of Kerala[9,10].Out of the 14 species of mosquitoes recorded in the present study, 8 were reported as vectors of various diseases in different parts of the world. Among the *Aedes* species collected from the study area *Aedes albopictus* was reported as the secondary vector of dengue and chikungunya[11]. The primary vector *Aedes aegypti* was not reported in any of the study area in the present study. *Ae. aegypti* was reported in urban areas of Thiruvananthapuram district of Kerala in an earlier study[12]. In the absence of the principal vector *Ae. aegypti, Aedes albopictus* is effectively transmitting dengue virus in the study area. In several south-east Asian countries *Aedes albopictus* has incriminated with dengue virus[13]. In Kerala *Ae. albopictus* was recognized as the primary vector for the transmission of Dengue and Chikungunya [14,15]. The prevalence of *Ae. albopictus* was maximum in urban areas compared to rural areas. Peridomestic water storage containers were found to be the major breeding source for *Ae. albopictus* in urban areas. Cement tanks, Plastic drums and cisterns were used to store water in these areas. Significant presence of unused or discarded latex collection containers were responsible for the profuse breeding of *Ae. albopictus* in rural areas. Man hour density of total mosquitoes were found to be maximum during the monsoon month of June and July as rainfall positively influence the density mosquitoes[16]. However density of *Ae. albopictus* were found to be maximum during the premonsoon month of May as the intermittent rainfall during the month of May provide water filled peridomestic containers suitable for breeding of this species. Heavy and continuous rainfall during the monsoon months cause flooding of containers which prevent the breeding of immatures in containers[12].

Armigeres subalbatus was found to be the most prevalent species in the rural areas of Kottayam district. This species is commonly found close to human dwellings with potential breeding habitat of poor sanitation that include polluted water such as septic tanks[17] and has been reported to be a vector of Japanese encephalitis virus[18]. In India, it has also been reported to be a vector of filarial worm *Wuchereria bancrofti*[19]. *Ae. vittatus* was identified as the main vector of yellow fever in many parts of the world[20]. *Ae. crysolineatus*, *Ae. psudotaeniatus* and *Ae. cogilli* have no vector status. Of

the three *Culex* species collected from the study sites *Cx. quinquifasciatus* is primary vector of bancroftian filariasis and suspected vector of Japanese encephalitis[21].*Cx. gelidus* is also incriminated as vector of JE and *Cx. uniformis* is a non-vector mosquito species. Genus *Mansonia* was represented by only one species, *Mn. uniformis* and was incriminated as secondary vector of JE in Kerala[22,23]and also have been implicated as vector of Brugian filariasis[24].Of the two *Anopheles* species collected *An.stephensi* is the primary vector of Malaria and *An.subpictus* is a suspected vector of Malaria in India. Also Japanese encephalitis virus was isolated from *An. subpictus* during the JE outbreak in Kerala in the year 1996[22].Species such as *Hz.discripens, Tx.splendens* are generally considered as non-vector species.

Species such as *Ae. albopictus, Ar. subalbatus, Cx. crysolineatus, Cx. uniformis* constituted more than 75% of the total mosquito species collected from the study area. Species such as *Anopheles stephensi, Anopheles subpictus, Mansonia uniformis* were least abundant one as only few specimens were obtained during the study. In forest fringe areas rubber plantation associated latex collection containers and peridomestic discarded containers were found to be the key breeding habitat for *Ae.albopictus.* During rainy season rainwater collected in the latex collection cup forms the main breeding habitat for *Ae.albopictus*[4]. Small and large scale rubber plantation is common and interspersed in the forest fringe areas.

5. Conclusion

Even though different vector and non-vector mosquito species were being reported in the forest fringe areas of Kottayam district, the most prevalent species recorded was *Ae. albopictus* especially in the urban areas. Extensive cultivation of rubber plants provide suitable situation for proliferation of *Aedes albopictus*. Since *Aedes* transmitted diseases such as dengue and chikungunya are being reported in the study area entomological surveillance and its significance can be used to halt the outbreak as shown in this study.

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06

A Comparative Study of Antioxidant and Antimicrobial Activity of Leaves and Flower Extracts of *Anacardium Occidentale* L. and *Mangifera Indica* L.

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Abstract

This study was carried out to detect the antioxidant activity and antibacterial activity of ethanol extract of leaves and flower of the medicinal tree species, *A.occidentale* and *M.indica*. DPPH free radical scavenging method and agar well diffusion method was used to assess the antioxidant activity and antibacterial activity respectively. In comparison with other extracts, cashew leaves showed greater antioxidant potential. The antimicrobial activities of ethanolic extracts were also screened against some human pathogens such as *Bacillus cereus*; *Escherichia coli* and *Staphylococcus aureus.* Therefore ethanol extracts of various plant parts of *A.occidentale* and *M.indica* can be used as a new potential source of natural antioxidants instead of synthetic ones and antimicrobial agent for pharmaceutical industries.

Keywords: *Anacardium occidentale*, *Mangifera indica*, Antioxidant activity, Antibacterial activity, DPPH

Introduction

Nowadays herbal medicine attained global importance both as medicinal and economical. *A.occidentale* is a tropical tree belongs to the member of the family Anacardiaceae, indigenous to Brazil, which is now widely grown in other tropical countries like India and is a multi-purpose plant (Togun, 1977). Many parts of this tree are used in traditional medicine. Commercially important two parts are cashew nut for diet and the liquid

from nut shell (CNSL) for various industrial and medical applications (Joseph 1990; Pillai *et al.,* 1990). Anacardic acid is having very much demand in the international market (Rodrigues *et al.,* 2006). Apart from this, a large number of other phenolic compounds are founds in very small quantities in the shell (Miraliakbari and Shahidi 2008). Phenol is seen throughout the plant system though it is mainly concentrated in the nut shell. The mango (*Mangifera indica* L.) is one of the plantation crops of tropical and sub-tropical regions of the world, especially in Asia. Its popularity and importance can easily be realized by the fact that it is often referred as 'King of fruits' in the tropical world (Singh *et al.,* 1991). Mangiferin is one of the phenolic compounds present in mango leaves, bark, peels and kernels and is particularly seen high quantities in young leaves (Barreto *et al.,* 2008). Mangiferin is also having biological activities such as anticancer, antimicrobial, anti-allergenic, anti-inflammatory, analgesic, immunomodulatory and hypolipidemia, as well as antioxidant activity (Masibo and He 2008).

The various plant extracts can defend human and plant pathogenic bacteria, fungi and virus without any side effects and environmental hazards. In recent years, researches are going on to find out the plant products with antimicrobial properties intensified. Bacterial infections are the major reason for health problems, physical disabilities and mortalities around the world. The phytochemicals are more effective as compared to commercial antibiotics so that they are used as an alternate remedy for the treatment of various diseases. Alkaloids, tannins, flavonoids and phenolic compounds are the major bioactive constituents of plants. In view of the above, the present study has been made to investigate the antioxidant potential as well as the antimicrobial activities of a traditionally used medicinal tree plants such as *A.occidentale* L. and *M.indica* L.

Materials and Methods

Source of plant materials

Plant materials (young leaves and flower) of *A.occidentale* and *M.indica* were procured from the mother stock trees grown at the Sree Narayana College Campus, Kollam, Kerala.

Preparation of plant extracts

Powdered samples were extracted with ethanol by maceration and kept it for a period of 24 hrs at room temperature at a ratio of 1:100 (g:ml).

Homogenized samples were centrifuged at 10,000 rpm for 15 minutes and supernatants were pooled. The extracts were filtered using Whatman No.1 filter papers and each extract was concentrated in a rotary evaporator to remove ethanol. The residue thus obtained was dissolved in ethanol and stored at 4-8°C in a refrigerator for further analysis (Kumarasamy *et al.,* 2007; Alzoreky and Nakahara 2003).

Determination of antioxidant activity using DPPH free radical

The 2,2-diphenyl-1-picryl-hydrazyl radical (DPPH) scavenging activity was measured (Bauer *et al.,* 1996). DPPH (20 mg) was dissolved in ethanol (250 ml) to obtain the concentration of 80 µg/ml. The plant extract was prepared in ethanol. Dilutions were made to obtain concentration of 20,40,60,80 and 100 µg/ml. Ascorbic acid was used as standard in 1-125 µg/ml concentration. 1 ml of the diluted plant extract was mixed with 1 ml of DPPH. After 30 minutes dark incubation at room temperature, spectrophotometric reading was taken at 517 nm.

$$\%\text{ of inhibition} = \frac{A_{control} - A_{sample}}{A_{control}} \times 100$$

IC_{50} value is the concentration of sample required to scavenge 50% of DPPH free radical and was calculated from the % inhibition versus concentration sigmoidal curve, using a non-linear regression analysis.

Determination of antibacterial activity

The antibacterial activity of the ethanol extracts was screened against some human pathogenic bacteria; *Bacillus cereus* (MTCC 2340); *Escherichia coli* (MTCC 56) and *Staphylococcus aureus* (MTCC 9760) obtained from the Microbiology Laboratory of the Department of Biotechnology, Sree Narayana College, Kollam, Kerala. Antibacterial activities of the different plant extracts were investigated by the agar well diffusion method (Zhao *et al.,* 2014; Jaiswal *et al.,* 2012) using Mueller- Hinton agar plates previously inoculated with 18 hour old nutrient broth culture for the bacteria. The zone of inhibitions produced by inhibitory action of different plant extracts and control were taken as the antibacterial activity.

Statistical analysis

Data were expressed as means ± standard deviation (SD) of three replicate determinations. All statistical analysis was carried out using a SPSS (Chicago, IL) statistical software package (SPSS for Windows, ver.17,

2008). To determine whether there were any differences among the means, one way analysis (ANOVA) and the Duncan's New Multiple range test were applied to the result at 0.05 level of significance ($p<0.05$).

Results and Discussion

Antioxidant activity

DPPH free radical scavenging activity of various ethanol extracts of *A.occidentale* and *M.indica* were determined. The results of the present study showed that all the plant extracts such leaves and flower had antioxidant activity.

Table 1: Free radical scavenging activities of various extracts of *A.occidentale* and *M.indica* measured using the DPPH assay

Test compound (Ethanol extract)		DPPH radical scavenging activity (%)				
		Concentration (µg/ml)				
		20	40	60	80	100
A.occidentale	Young leaves	43.44±0.58	44.11±1.34	45.97±1.23	46.96±0.91	47.31±1.71
	Flower	17.03±0.81	19.31±1.71	21.19±1.63	23.4±1.47	25.01±1.57
M.indica	Young leaves	32.31±0.63	33.5±1.79	34.3±0.87	35.31±1.74	36.91±1.23
	Flower	13.6±0.54	14.52±1.21	15.96±0.96	16.7±1.33	19.25±1.35
Control	Ascorbic acid	46.88±0.36	46.43±1.97	48.15±0.98	49.1±0.86	50.18±1.33

Results are expressed as means ± SD for triplicates

It has been observed that the percentage of scavenging effect on the DPPH radical was increased with the increase in the concentration of all the extracts from 20 to 100 µg/ml. The ethanol extract of young leaves of *A.occidentale* showed the highest percent of inhibition from 43.44±0.58% at 20 µg/ml to 47.31±1.71% at 100 µg/ml while the flower extract of *M.indica* showed the least (13.6±0.54% at 20 µg/ml and 19.25±1.35% at 100 µg/ml), which is comparable to the free radical scavenging activity of standard ascorbic acid (46.88±0.36% at 20 µg/ml and 50.18±1.33% at 100 µg/ml) (Table1). Studies have clarified the radical scavenging activities of plant phenolic compounds and also verified the relationship between phenolic compounds and antioxidant activity (Tan *et al.,* 2014) and many researchers have affirmed that phenolic compounds are most adequate antioxidants in *A.occidentale* (Silva *et al.,* 2016, Samba *et al.,* 2018). Free

radical scavenging activity of ethanol extract of flower, leaves and stem bark of *A.occidentale* were explored (Barreto *et al.,* 2016). The antioxidant activity of young leaves, barks, roots and kernels of *M.indica* were also studied (Chbisika *et al.,* 2014). Mangiferin is one of the major phenolics seen in mango leaves, bark, peels and kernels and is present in particularly high quantities in young leaves (Sujatha *et al.,* 2011).

The antioxidant activity of different plant part extracts of *A.occidentale* and *M.indica* were also expressed in terms of IC_{50} (µg/ml) values (Table 2) and it ranged from 157.41±1.74µg/ml to 479.78±1.67µg/ml. The result revealed that flower of *M.indica* showed weak antioxidant activity, with IC_{50} value of 479.78±1.67µg/ml.. While the ethanol extract of young leaves of *A.occidentale* showed the highest antioxidant activity, with IC_{50} value of 157.41±1.74µg/ml. The IC_{50} value for standard ascorbic acid was 97.34±1.33 µg/ml. The IC_{50} value decreased with the increase of antioxidant activity of each explant type and vice versa. The result of the present study showed that the IC_{50} value differ significantly ($p < 0.05$) among the various extracts (Figure 1).

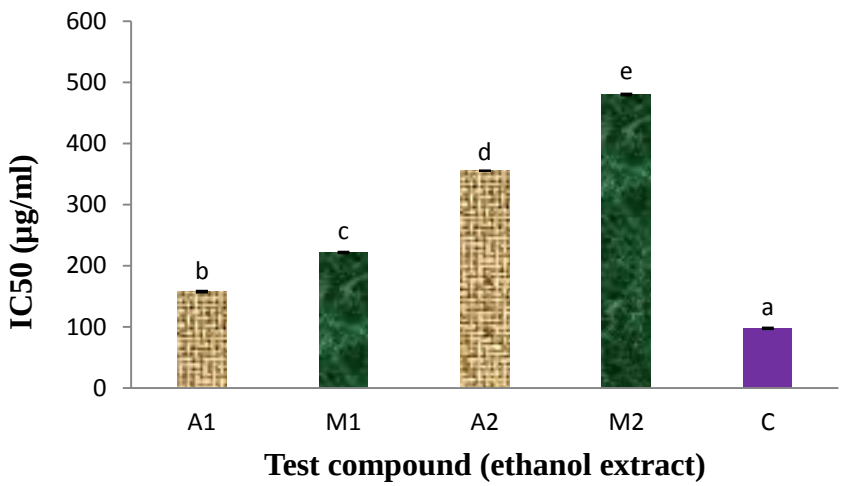

Fig.1: Antioxidant activity of investigated plant extracts of *A.occidentale* and *M.indica*

Values with different letters are significantly different by Duncan's multiple range test ($p < 0.05$),

(n=3, error bars represent standard deviation)

Young leaves (A1), Flower (A2) - *A.occidentale*

Young leaves (M1), Flower (M2) - *M.indica*

Control: Ascorbic acid

Antimicrobial activity

In the current study, various ethanol extracts of *A.occidentale* and *M. indica* were tested for its antibacterial activity against three human pathogenic bacterial strains of *Bacillus cereus* (MTCC 2340); *Escherichia coli* (MTCC 56) and *Staphylococcus aureus* (MTCC 9760)

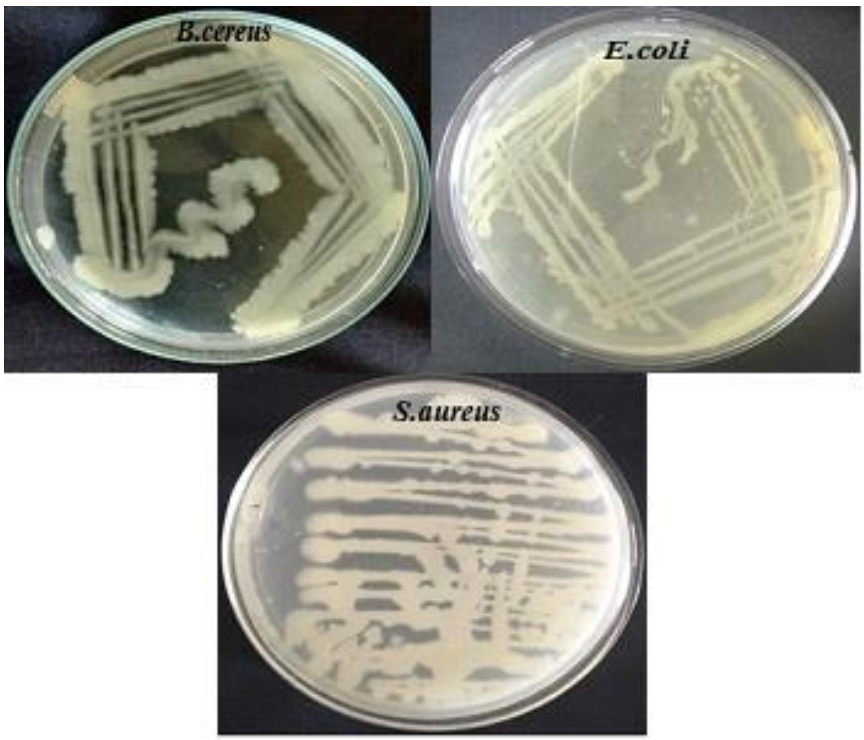

Fig.2: Pure cultures of *B.cereus; S.aureus and E.coli* on nutrient agar plate

All the plant extract of *A.occidentale* showed inhibitory action against *B.cereus* and *E.coli* whereas the ethanol extract of flower of *A.occidentale* and *M.indica* showed no inhibitory action against *S.aureus* as given in the Table 3. The control (ethanol) showed no zone of inhibition against three typical bacterial strains (Fig.3).

Table 3: Zones of inhibition produced by ethanol extracts of *A.occidentale* and *M.indica*

Test compound (Ethanol extract)		Zone of inhibition (mm)		
		Bacteria		
		B.cereus	*E.coli*	*S.aureus*
A.occidentale	Young leaves	19	19	21
	Flower	19	19	-
M.indica	Young leaves	17	23	22
	Flower	-	20	-

Young leaves (A1), Flower (A2) - *A.occidentale*

Young leaves (M1), Flower (M2) - *M.indica*

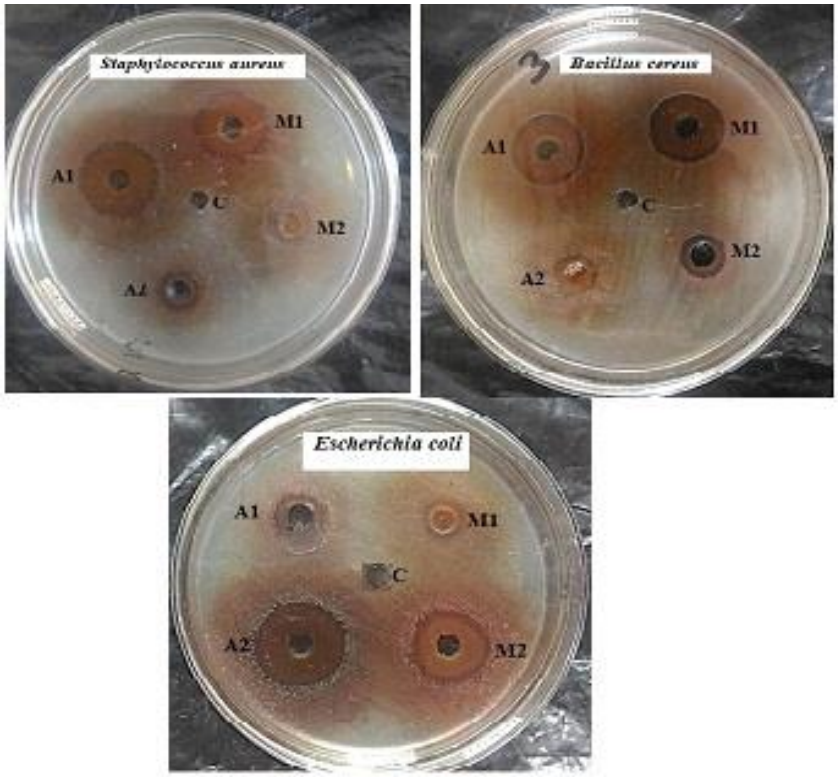

Fig.3: Zones of inhibitions revealed by various plant parts of *A.occidentale* and *M.indica* against *B.cereus, E.coli* and *S.aureus*

A1 (Young leaves), A2 (Flower) - *A.occidentale*

M1 (Young leaves), M2 (Flower) - *M.indica*: C-control

Among the two extracts of *A.occidentale* tested, flower showed maximum zone of inhibition (19mm) against *B.cereus* (Table 3 & Fig.3). It was observed that ethanol extract of young leaves showed the zone of inhibition of 12.5 mm and flower showed the zone of inhibition of 19 mm against *B.cereus* (Agedah *et al.,* 2010). Thus the present study is in compliance with early reports. The presence of a phenolic lipid known as anacardic acid and other chemical compounds such as tannins, flavonoids, phenols, alkaloids, saponins, steroids or triterpenes play a major role in the antibacterial activity of cashew tree (Sujatha *et al.,* 2011; Poongothai and Rajan 2013) .

Result of the present study also revealed that ethanol extract of young leaves and flower of *M.indica* showed zone of inhibition against *E.coli*. It also showed 22mm zone of inhibition against *S.aureus*, 17mm zone of inhibition against *B.cereus* (Table 3 & Fig.3).

It was also observed that young leaf extract of *M.indica* showed maximum zone of inhibition (23mm) against *E.coli* compared to the young leaf extract of *A.occidentale* (19mm) (Table 3 & Fig.3). Young leaf extract of *A.occidentlae* showed zone of inhibition (21mm) against *S.aureus* (Table 3 & Fig.3). This study was also supported by early study; there the antibacterial activity of young leaves of *M.indica* against *S.typhi* was investigated (Zakaria *et al.,* 2006). Antibacterial activities of plant extracts have the vast therapeutic potential to heal many infectious diseases and are associated with lesser side effects compared to the synthetic drugs.

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07

ദലിത് സ്വത്വാവിഷ്കാരം - പുതുരാമായണത്തിൽ

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കീഴാളരുടെ അടിച്ചമർത്തപ്പെട്ട സ്വത്വബോധത്തെ വെളിപ്പെടുത്തുന്ന സാഹിത്യമാണ് ദളിത് സാഹിത്യം. അവരുടെ ആത്മരോഷവും പ്രതിഷേധവും ഉയർത്തെഴുന്നേൽപ്പുമെല്ലാം ദളിത് സാഹിത്യത്തിൽ പ്രകടമായിട്ടുണ്ട്. സമൂഹത്തിൽ പാർശ്വവൽക്കരിക്കപ്പെട്ടവരുടെ ശബ്ദമാണ് സാറാ ജോസഫിന്റെ രചനകളിൽ മുഴങ്ങിക്കേൾക്കുന്നത്. സാറാ ജോസഫിന്റെ പുതുരാമായണത്തിൽ ആര്യ മേധാവിത്വത്താൽ പിൻതള്ളപ്പെടുന്ന ഒരുകൂട്ടം ജനതയെണ് ചിത്രീകരിച്ചിരിക്കുന്നത്.

ദളിത് തത്വാവിഷ്കാരം പുതുരാമായണത്തിൽ

സമകാല മലയാള സാഹിത്യത്തിൽ സ്വന്തമായൊരിടം നേടിയ ചിന്താപദ്ധതിയാണ് ദലിതെഴുത്ത്. അടിച്ചമർത്തപ്പെടുന്നവനുവേണ്ടി, അധിനിവേശകനെതിരെ നിലകൊള്ളുന്ന പ്രസ്ഥാനമാണിത്. എന്താണ് ദലിതെഴുത്ത്/ ദലിത് സാഹിത്യം എന്നതിനെ സംബന്ധിച്ച് വ്യത്യസ്ത അഭിപ്രായങ്ങൾ നിലനില്ക്കുന്നുണ്ട്. അവയിൽ പ്രധാനമായും മൂന്ന് അഭിപ്രായങ്ങളാണ് ഇന്ന് പരക്കെ അംഗീകരിച്ചിട്ടുള്ളത്.

1. ദലിതർ അംഗീകരിച്ചിട്ടുള്ളത്
2. ദലിതരെക്കുറിച്ച് ദലിതരല്ലാത്തവർ എഴുതുന്നത്
3. ദലിതർക്കുവേണ്ടി ദലിതർ എഴുതുന്നത്

അതായത് മുഖ്യമായും ദലിതരിൽ ഊന്നുന്നതും ദലിതരുമായി ഐക്യപ്പെടുന്നതും മുഴുവൻ ചൂഷിത വിഭാഗത്തെയും ഉൾക്കൊള്ളാൻ വ്യാപ്തിയുള്ളതുമായ സാഹിത്യമാണ് ദലിത് സാഹിത്യം. ദലിതർ എഴുതുക എന്നതുകൊണ്ട് അനുഭവമുള്ളയാൾ എഴുതുക എന്നാണർത്ഥം. മറിച്ച് അത് ജാതി സാഹിത്യമല്ല. ദലിതനായി ജനിച്ചതുകൊണ്ട് ഒരാൾ ദലിത് എഴുത്തുകാരൻ ആകുന്നുമില്ല. 'ദലിത്' അവബോധം ഉണ്ടാക്കുക എന്നതാണ് സർവപ്രധാനമായിട്ടുള്ളത്. ഇന്ന് എല്ലാ മർദ്ദിത ജനവിഭാഗത്തെയും കുറിക്കാൻ 'ദലിത്' ശബ്ദം പ്രയോഗിക്കുന്നുണ്ട്.

ആധിപത്യത്തിനെതിരെ പ്രതികരിക്കുന്ന അടിച്ചമർത്തപ്പെട്ടവന്റെ ശബ്ദമാണ് ദലിതെഴുത്തിൽ നാം കേൾക്കുന്നത്. അതാകട്ടെ, അവന്റെ സ്വത്വത്തെക്കുറിച്ചുള്ള തിരിച്ചറിവാണ്. ജാതീയമോ വിഭാഗീയമോ ആയ ആത്മബോധമല്ല ദലിത് സ്വത്വം. അത് ചരിത്രപരമായ തിരിച്ചറിവാണ്. ഇങ്ങനെ കീഴാള സംസ്കാരത്തിന്റെ ആത്മാഭിമാന ബോധത്തിൽ നിന്നും പാരമ്പര്യത്തിൽ നിന്നും രൂപംകൊണ്ട പുത്തനുണർവിന്റെ സ്വാംശീകരണമാണ് ദലിത് സ്വത്വത്തെ നിർണ്ണയിക്കുന്നത്. കീഴാളവർഗം എന്നും പ്രകൃതിയോടും സമൂഹത്തോടും ഇണങ്ങി ജീവിയ്ക്കാനാണ് ശ്രമിച്ചത്. അതിനാൽ ചൂഷണാധിഷ്ഠിതമായ എല്ലാത്തരം വ്യവസ്ഥിതിയെയും അവർ എതിർക്കും. ദലിത് സാഹിത്യത്തിന്റെ കേന്ദ്രം തന്നെ മനുഷ്യനാണ്. അവർ അവന്റെ സന്തോഷത്തിലും സങ്കടത്തിലും പങ്കുചേരുകയും അവനെ വിപ്ലവത്തിലേക്ക് നയിക്കുകയും ചെയ്യുന്നു. എന്നാൽ മനുഷ്യകേന്ദ്രിതമായ ആവാസവ്യവസ്ഥ എന്ന സങ്കല്പം ദലിത് ജീവിതത്തിലില്ല. കാരണം പ്രകൃതിയുടെ സുരക്ഷിതത്വവുമായി അഭേദ്യമായി ബന്ധപ്പെട്ടതാണ് അവരുടെ ജീവിതരീതി. ആർഷസംസ്കാരത്തിന്റെ യഥാർത്ഥ അവകാശികൾ തന്നെ ദലിതരാണ്.

സാറാജോസഫിന്റെ 'പുതുരാമായണ'ത്തിൽ അധികാരവർഗത്താൽ, പുരുഷാധിപത്യത്താൽ, ആര്യമേധാവിത്വത്താൽ ചവിട്ടിയരയ്ക്കപ്പെടുന്ന ദലിതരുടെ ജീവിത ചിത്രീകരണമാണ് നമുക്ക് കാണാൻ കഴിയുന്നത്. ഇതിഹാസ കഥാപാത്രങ്ങൾ പൊളിച്ചെഴുതപ്പെടുമ്പോൾ കീഴാള സ്വത്വത്തിന്റെ അടിച്ചമർത്തലുകളാണ് വെളിപ്പെടുന്നത്. 'ഭൂമിരാക്ഷസ'ത്തിൽ ഇക്ഷ്വാകു പുത്രനായ ദണ്ഡകനാൽ ബലാത്സംഗം ചെയ്യപ്പെടുന്ന ശുക്രാചാര്യപുത്രി അരജയും ജേതാവിനാൽ ലങ്കയിലെ മണ്ണിൽ ക്രൂരമായി വലിച്ചെറി

യപ്പെടുന്ന 'അശോക'യിലെ സീതയും കീഴാള വർഗത്തിന്റെ പ്രതിനിധികളാണ്. ഗുരുപുത്രിയെന്ന പരിഗണനഅരജയ്ക്കോ ധർമ്മപത്നിയെന്ന പരിഗണന സീതയ്ക്കോ ലഭിക്കുന്നില്ല. അധികാരിയുടെ കൈയ്യൂക്കും അഹമ്മതിയും ഇരുവരുടേയും ജീവതത്തെ തർകർത്തെറിഞ്ഞപ്പോൾ പ്രകൃതിയാണ് അവരോട് പകരം വീട്ടിയത്. ദണ്ഡകന്റെ സാമ്രാജ്യത്തിൽ മൺമഴ പെയ്യുകയും അനേകായിരം വർഷങ്ങൾ പുല്ലുപോലും മുളയ്ക്കാതെയും കിടന്നു. ജേതാവിനാൽ പിടിച്ചടക്കപ്പെട്ട ലങ്കയുടെ സ്ഥിതിയും മറിച്ചല്ല. അധികാരത്തിനുവേണ്ടി ജ്യേഷ്ഠനെ ഒറ്റി കൊടുത്ത വിഭീഷണന, കരിയും ചാരവും കനലും മാംസക്ഷ്ണങ്ങളും ബലിക്കാക്കകളും വിധവകളുടെ വിലാപങ്ങളും നിറഞ്ഞ ഊഷരമായ ലങ്കയാണ് രാമന കാഴ്ച വെയ്ക്കാൻ കഴിഞ്ഞത്. 'അശോക'യിൽ പരാജിതനായി ചിത്രീകരിക്കപ്പെടുന്ന രാവണൻ കീഴാള രാജാവാണ്. ഏതു ദുരിതവും നേരിട്ട് അദ്ദേഹം സ്വപ്രയത്നത്താൽ കെട്ടിയുയർത്തിയ കീഴാള സാമ്രാജ്യത്തെയാണ് വിഭീഷണന്റെ അധികാര മോഹവും രാമന്റെ ആര്യമേധാവിത്വവും തകർത്തെറിഞ്ഞത്. 'തായ്കുല'ത്തിലെ ശൂർപ്പണഖയും കീഴാളപ്പെൺകൊടിയാണ്. അവൾ സ്ത്രീത്വത്തിന്റെയും മാതൃത്വത്തിന്റെയും പ്രതിരൂപമാണ്. വനചാരിയും വൃക്ഷപ്രേമിയുമാണ്. കാടും ഭൂമിയുമായുള്ള അവളുടെ ആസക്തി നിറഞ്ഞ ആഭിമുഖ്യവും കരിങ്കാളിയുടെ നിറവുമെല്ലാം അതാണ് സൂചിപ്പിക്കുന്നത്. അവളുടെ കാതൽ വനമായ പഞ്ചവടിയിൽ ആധിപത്യം സ്ഥാപിച്ചത് രാമനും കൂട്ടരുമാണ്. അവിടെകണ്ട പുരുഷനോട് പ്രണയം തോന്നിയത് സ്വാഭാവികം മാത്രം. പക്ഷേ അധികാരവർഗം അവന്റെ സ്വച്ഛന്ദവിഹാരകേന്ദ്രം കൈയേറുകയും അവന്റെ പെണ്ണിന്റെ അവയവങ്ങൾ ഛേദിക്കുകയും ചെയ്തു. വരുംതലമുറയ്ക്കായി കാത്തുസൂക്ഷിച്ച അവളിലെ പെണ്മയെ, മാതൃത്വത്തെയാണ് അവർ തകർത്തെറിഞ്ഞത്. 'കറുത്ത തുളകളിലെ മന്ഥരയും അധികാര വർഗത്തിനുവേണ്ടി ബലിയാടാകുന്ന കീഴാള സ്ത്രീയാണ്. അവളുടെ കൂനിനെ 'കറുത്ത പാറയായാണ്' കഥാകാരി ചിത്രീകരിക്കുന്നത്. ഇവിടെ അവൾ രാജസ്ഥാപനത്തോട് പ്രതികാരം ചെയ്യുന്നുണ്ട്. ബാലിയുടെ വധത്തിനു കാരണമായതും ഈ നാഗരിക നിയമമാണ്. കാലാകാലങ്ങളായി അടിച്ചേൽപ്പിക്കപ്പെട്ട സനാതന ധർമ്മമാണ്. സുഗ്രീവനുവേണ്ടി രാമൻ ബാലിയെ വധിച്ച വാർത്ത നടുക്കത്തോടെയാണ് വാനരസംഘം കേട്ടത്. പക്ഷെ ആരും പ്രതികരിച്ചില്ല. ബാലിയുടെ നെഞ്ചു തകർത്ത അമ്പുകളാണ് അവരുടെ വായടപ്പിച്ചത്.

ദേഹം തുളച്ച് മറുവശത്തേക്കു പായുന്ന അവ ലളിതമായി മനുഷ്യരെ കൊല്ലുന്നു. ശംബൂകനെ കൊന്നതും അവന്റെ കുട്ടികളെ അനാഥരാക്കിയതും ഈ അധികാരഗർവുതന്നെയാണ്. മേലാളർ സ്ഥാപിച്ച നിയമങ്ങൾ കീഴാളരുടെമേൽ അടിച്ചേല്പിക്കുകയാണുണ്ടായത്. ആ അടിച്ചമർത്തലുകളുടെ നാറുന്ന കഥകളും അവയോട് കീഴാള സ്വത്വത്തിന്റെ പലതരത്തിലുള്ള ചെറുത്തുനില്പുമാണ് നമുക്ക് ഈ കഥകളിൽ വായിച്ചെടുക്കാൻ കഴിയുന്നത്.

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08

CAA-NPR-NRC- A Myth or Reality

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Abstract

The Citizenship Amendment Act, 2019 (CAA) is an act that was passed in the Parliament on December 11, 2019. The 2019 CAA amended the Citizenship Act of 1955 allowing Indian citizenship for Hindu, Sikh, Buddhist, Jain, Parsi, and Christian religious minorities who fled from the neighbouring Muslim majority countries of Pakistan, Bangladesh and Afghanistan before December 2014 due to "religious persecution or fear of religious persecution". However, the Act excludes Muslims. Under CAA 2019 amendment, migrants who entered India by December 31, 2014, and had suffered "religious persecution or fear of religious persecution" in their country of origin, were made eligible for citizenship by the new law. These migrants, will be granted fast track Indian citizenship in six years. The amendment also relaxed the residence requirement for naturalization of these migrants from eleven years to five.

There arise widespread protests across the country including the national capital region and north-eastern states against the CAA amendment. The protest in Assam and other north-eastern states turned violent over fears that the move will cause a loss of their "political rights, culture and land rights" and motivate further migration from Bangladesh. The agitators say that new amendment in Citizenship Act discriminates against Muslims and violates the right to equality enshrined in the Constitution of the country. Sects like Shias and Ahmedis also face persecution in Muslim-majority countries like Pakistan but are not included in the CAA. Questions were also raised on the exclusion of persecuted religious minorities from other regions such as Tibet, Sri Lanka and Myanmar.

Indian Citizenship Amendment-History

Routes to Indian Citizenship

The overall structure of India's citizenship laws denotes a shift from Jus soli to Jus sanguine. Before the 2004 amendment, any person born in India after 26 January 1950 was an Indian citizen, irrespective of whether one or both of her parents were illegal migrants. After the 2004 amendment, an individual born in India after 26 January 1950 but before 1 July 1987 is a citizen of India irrespective of whether one or both of her parents were illegal migrants. However, any person born in India on or after 1 July 1987 but before 3 December 2004 would be a citizen only if both her parents are Indian citizens, or, if one parent is an Indian citizen and the other is not an illegal migrant at the time of that person's birth. The descent path to Indian citizenship is applicable to those who are not born in India. Complex rules regulate this path. Here, a person born outside India before 26 January 1950 can become a citizen if either of her parents was a citizen at the time of her birth. A person born outside India after 26 January 1950 but before 10 December 1992 is a citizen if her father was a citizen at the time of her birth. A person born outside India on or after 10 December 1992 can be regarded as a citizen if either of her parents was a citizen at the time of her birth. However, if the father or mother were Indian citizens by descent only, then either birth outside India had to be registered at an Indian consulate within a specific period of time or, the parent must have worked for the Indian government. After 3 December 2004 registration of a person as an Indian citizen by descent is not possible unless her birth is registered at an Indian consulate within a specified time.

In general, the path of citizenship by registration is intended for persons of Indian origin and the spouses or children of citizens of India. Citizenship by naturalization is a route meant for those who have no ancestral relation to India. Also, if a new territory is incorporated into India, the central government has the power to specify who shall be Indian citizens by virtue of their connection to such a newly incorporated territory, by way of an order notified in the official gazette.

It must also be noted that the 2004 amendment foreclosed any possibility of an 'illegal migrant' obtaining Indian citizenship by registration or naturalization. The term 'illegal migrant' has been defined to refer to a foreigner who enters or stays in India illegally, that is enters lacking valid travel documents or enters with valid travel documents but stays beyond

the permitted time period. The CAA amends this complex legal regime on citizenship to carve out an exception for individuals belonging to select communities.

The 2019 Amendments

The CAA seeks to amend the parent Citizenship Act 1955 to pave the way for extending Indian citizenship to illegal migrants belonging to Hindu, Sikh, Buddhist, Jain, Parsi and Christian faiths (notably excluding Islam), who escaped persecution from Pakistan, Bangladesh and Afghanistan and entered India before 31 December 2014. Section 2 of the CAA amends Section 2(1)(b) of the Citizenship Act 1955 by holding that illegal migrants (as defined above) would not be considered illegal migrants for the purposes of the Citizenship Act 1955. Illegal migrants belonging to select faiths from selected jurisdictions can now seek Indian citizenship by registration or naturalization. Prior to the CAA, a person classified as an illegal migrant had no scope for legal conferment of citizenship. In fact, the Indian Supreme Court has held that in respect of illegal migrants, the Government of India has unfettered and absolute powers of expulsion. But, by virtue of Section 2, the covered class of illegal migrants is governed by a different legal regime contained within Sections 3, 5 and 6 of CAA. Section 6 of CAA reduces the residence requirement for Indian citizenship by naturalization. An applicant for citizenship by naturalization, generally, must reside in India for a twelve-month period before the date of her application. In addition to that, she must reside in India for at least eleven out of the fourteen years prior to the twelve- month period. The CAA reduces this residence requirement from eleven to five years for individuals covered by Section 2. This substantially eases the citizenship requirements for individuals who belong to one of the enumerated faiths, fled from the three specified jurisdictions and have migrated to India before the cut-off date. As per the Government, this bestowal of legislative largess was actuated by the desire to provide much needed sacessor to victims of persecution who had suffered at the hands of oppressive theocracies.

The Constitutional Validity Dispute of the CAA

The framers of the Constitution aimed to codify the 'Indian dream' in the groundnorm; highlighting the features of the kind of social system they resolved to build. They did this by myriad ways including protection for equality rights, particularly pertinent in a community life with caste and

class, based discrimination; by guaranteeing secularism in a nation fraught with communal antagonism and violence; and placing responsibility on the State to promote education in a country having a literacy rate of approximately 18 percent at the time of independence.

In light of that constitutional legacy, the CAA has been condemned for breaching the right to equality because of its use of invidious classifications and its assault on the secular character of Indian citizenship law. The strength of these claims can only be assessed with a clear picture of what the Constitution prescribes; it is imperative therefore, to probe the canons of equal protection and secularism, and then apply them to the CAA.

Article 14 of the Constitution synthesizes Dicey's conception of rule of law with the equal protection clause of the US. It guarantees every person in the territory of India the fundamental right of equality before law and equal protection of the law. This implies that non-citizens are entitled to rights under Article 14 if they are within Indian territory. A key component of this right is the entitlement of equal treatment for all those who are similarly situated; equals ought to be treated equally. Bearing that in mind, the Supreme Court has repeatedly held that judicial review of legislation and administrative action is a basic feature of the Constitution, including in the context of Fundamental Rights, it has developed a rich jurisprudence on the right to equality under Article 14 of the Constitution. As early as 1952, the Supreme Court started elucidating doctrinal tests for determining whether an impugned enactment survives the scrutiny of Article 14. It is now well settled that under Article 14, 'class legislation' is verboten, but 'reasonable classification' for the purpose of achieving specific ends is not In State of West Bengal v Anwar Ali Sarkar, the Supreme Court held that equality mandates two inquiries to determine whether a classification contemplated by an impugned statute is reasonable. First, the Court must assess the existence of an 'intelligible differentia' or a yardstick that separates elements within the class from those outside the class. And second, the Court will scrutinize the presence of a rational nexus between the yardstick of differentiation and the object that the statute seeks to achieve. This 'nexus test' has been applied and reiterated in numerous cases over the years. In 1960, however, the Supreme Court observed that the repetition of the test has become

mechanical and hackneyed. The Court even wondered if 'fanatical reverence' to the test would decimate the 'glorious content' of Article 14.

In response to academic criticism on the narrowness of the nexus tests, in Ajay Hasia v Khalid Mujib the Court enlarged the contours of Article 14 by holding that arbitrariness strikes at the very heart of the right to equality. Since then, 'protection against arbitrariness' has become a basic part of the equality doctrine under Article 14. But jurisprudential advancement on the determining factors of judicial review through Article 14 did not cease. Two changes in recent history are a watershed in the development of constitutional equality. First, the Supreme Court in Nagpur Improvement Trust v Vithal Rao, held that establishing a rational nexus between the 'differentia' and the 'object' would not fetch judicial imprimatur if the object of the classification is itself discriminatory. This explicitly expanded the scope of Article 14's enquiry beyond a mere nexus assessment to adjudicating on the constitutional repugnance of the legislature's objective in enacting a law. Second, in Navtej Singh Johar v Union of India, the Supreme Court added yet another caveat to the nexus tests. In this case, the Court was determining the constitutionality of Section 377 which criminalized sexual intercourse between consenting homosexuals. The Court rejected such criminalization and reasoned that a law that discriminates on the basis of an 'intrinsic and core trait of an individual' cannot be said to represent 'reasonable classification'.50 By this logic, the Court examined the 'constitutional relevance' or 'reasonableness' of a yardstick of classification, which in that case was sexual orientation, thereby holding that in case the yardstick is itself unreasonable, the impugned law would be contra legal. These two landmark developments signify an expansion in the scope of Article 14's enquiry in the nature of widening the reach of the scrutiny from determining mere intelligibility of the classification, whether its yardstick is discernible/understandable, to reasonableness, an analysis of which also requires a determination of whether the basis of the classification is just as per Navtej. This doctrinal evolution has transformed Article 14 into a bulwark against governmental iniquitousness.

The CAA's framework of granting privileges is predicated on two explicit classifications: the faith classification, only illegal migrants belonging to the six faiths enumerated earlier are worthy of protection via the citizenship path; and the nation classification, an illegal migrant only from

Afghanistan, Pakistan or Bangladesh can benefit from the CAA. Albeit, the government has tried to defend these classifications per its counter affidavit filed before the Supreme Court in response to the petitions challenging the law, but considered alongside the implicit premises of the CAA's structure, a cogent argument against its incongruence with Article 14's standards can be made.

Granting citizenship in a secular nation, like India, therefore, is supposed to be a secular affair. When scrutinized against this backdrop, it is apparent that the CAA has perverted the secular character of India's citizenship law. First, it has elevated religious persecution, out of a pool of myriad forms of persecution, to the pedestal of the only type of persecution that would be grave enough to warrant a claim to citizenship for an illegal migrant. This creates a classification where individuals who are persecuted on grounds other than religious beliefs are excluded. This implies that in the eyes of Indian law, persons who are persecuted on account of their political views, sexual orientation, race or ethnicity are less deserving of citizenship rights.

Citizenship by descent

Section 4 of the Citizenship Act divides citizenship by descent (jus sanguinis) into three categories: persons born outside India between 26 January 1950 and 10 December 1992 if the father was an Indian citizen at the time of birth; persons born outside India between 10 December 1992 and 7 January 2004, if either of the parents is an Indian citizen at the time of birth; and children born after 7 January 2004 if either of the parents is an Indian citizen and the birth is registered at an Indian consulate within one year. Section 4 also requires births to be registered at an Indian consulate within one year and that the minor does not hold another nationality. This is aligned with Article 4 of the 1961 Convention, which requires states to grant nationality to persons born outside the country of his/her parents nationality, if (s)he would otherwise be stateless. In comparison to citizenship by descent described above, it becomes clear that Indian laws make it is easier for persons of Indian descent born outside of India to gain Indian citizenship than for persons born in India.

Conclusion

It is perhaps a first time in independent India's political history. The protest against citizenship Amendment Act 2019 was spread to every

corner of the country, yet the reasons of the protest vary with geography. Some are protesting because the CAA allegedly violates the secular identity of the nation while other fear that it will endanger their linguistic and cultural identity. Yet others believe that the CAA itself is innocuous, combined with the proposed nationwide National register of citizens (NRC), an exercise that runs in the controversy in Assam, it will become a tool to exclude Muslim population of the country. That the union government has been hit hard by this allegation is evident from the fact that Prime Minister Narendra Modi has publicly contradicted Home minister Amit Shah's assertion that A nationwide NRC will be prepared by 2024.

According to the citizenship Amendment Act 2019, Hindu, Christian, Buddhist, Jain, Sikh and Parsi migrants who have entered India illegally that is without a visa- on before December 31, 2014 from the Muslim majority countries of Pakistan, Afghanistan and Bangladesh and have stayed in the country for 5 years are eligible to apply for Indian citizenship. The union government claims that the people of these, six faith have faced persecution in these three Islamic countries Muslims haven't. It is therefore India’s moral obligation to provide them shelter. The government says that this is a time bound provision to provide relief to immigrants who have suffered in Islamic countries because India got divided on religious lines. India has from time to time provide at citizenship to immigrants of religions from different countries. Sri Lankan Tamil Hindus to where given citizenship in the 1970 and 80s.

The Indian Constitution embeds the principle of secularism and send it entitles every person in India, not only citizens, to the equal protection of the law. Basic fundamental constitutional principles that any Indian law has to comply with. The principle of equal protection and treatment of law prohibits the government from distinguishing between two groups of people unless the distinction is reasonable and in non-arbitrary, and a clear purpose can be provided by the government for making the classification. The citizenship Amendment Act painfully contradicts this important constitutional principle. While certain groups of people from three countries are granted immunity from being deemed illegal migrants, and are given fast track to Indian citizenship, another group of from these countries will continue to be prosecuted as illegal migrants.

In response to any potential challenges to the law before Indian Supreme Court, it is unclear what constitutionally adequate rationale the government will provide for treating the illegal migrants differently based on their religion.

There is another dimension to the protesters across India – its implication for Indian citizens. Most centrally, protestors are worried about the combined effects of the CAA and governments controversial plant to create a national register of citizens (NRC). The basis for the NRC comes from both a 2003 amendment to the 1955 citizenship act and the rules issued in 2003 to operationalize the amendment. The NRC require every individual across India to demonstrate that they are Indian citizens through certain specified documents., the individuals will have to show proof of their residence and date and place of birth as well as citizenship of their and ancestors, going back to a cutoff date specified by the government. In large parts of India, the people are poor and illiterate and lack the kind of documents that will be required to prove citizenship. Those who are from poor and marginalized communities will disproportionately bear the burden of the implementation of the NRC. While there is no official link between the CAA and NRC there are concerns that the government is cloaking the CAA empathetic and inclusive legislation protecting those illegal migrants who have faced religious persecution but that it will in fact be strategic Lee used domestically to protect individuals from 10 vi non- Muslim religious who may be excluded from the Indian citizenship under the NRC.

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09

Academic Management System

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Abstract

An academic management system is a software application that is specifically designed to assist with the organization and administration of educational institutions. This type of system can be used by schools, colleges, universities, and other educational organizations to manage a wide range of tasks and processes related to the operation of the institution. Some of the key features of an academic management system include student enrollment, class scheduling, grading, report generation, and communication tools for students and faculty. By providing a centralized platform for managing these and other tasks, an academic management system can greatly improve efficiency and productivity for educational institutions.

Introduction

Academic Institutions are moving toward IT in a faster manner. The academic management system is a comprehensive tool designed to streamline and optimize various processes and tasks related to the management of educational institutions. From scheduling and enrollment to grading and report generation, this system aims to provide a single, unified platform for all academic management needs. It is user-friendly and intuitive, making it easy for administrators, teachers, and students to access and utilize its various features. The system also includes robust security measures to protect sensitive information and data. Overall, the academic management system is a valuable resource for any educational institution looking to improve efficiency and productivity.

Better care is exercised to make sure that all the conventional modules in an academic environment like Admin, HOD, Faculty, Student etc. are also made available in this project.

The main advantage of this information system is that the students get academic updates on a regular manner. Consolidated reports are made possible in the tip of the finger.

Students will get academic schedules in a faster way. The prediction module is an extension of AI where historic data (Previous student‟s data) is fed to the system for forecasting. For this purpose Google‟s Deep Learning framework called „Google Colab‟ is utilized.

Academic alerts are always mandatory for students for timely submission of documents like online test, online assignment etc. These kinds of alerts are set by the faculty in their concerned modules. Publishing of results will get greater pace as the report module provide them in a nice presentation manner.

System Analysis

The basic objective of the analysis stage is to develop the logical model of the system victimization tools like information, flowchart and elementary data description of the elementary algorithmic program.

System analysis isn't an exact science. It is if truth be told a lot of associate art, power-assisted by scientific approach to search out definition and recording knowledge, gathering ancient structures is barely one a part of the system analysis, following step is to visualize the info, analyze the case and providing the alternatives.

Existing System:-

At present despite the fact that we tend to area unit flooded with innumerable tutorial system, they're not customizable to the requirement of an educational atmosphere. The various modules out there in these systems might not be necessary for all systems. Emerging technologies like Prediction, Graphical news etc. aren't out there to all or any such systems. Majority of the systems area unit developed in proprietary platforms. This poses nice licensing challenges. It puts additional burden upon the shoulder of the establishments through significant fee.

Proposed system:-

Proposed system bridges all problems connected with the present system. It provides custom-made modules applicable for an educational establishment. The computer code is developed in open supply technologies. Because the development is completed in PHP, there aren't

any hidden prices within the method. Within the backend the system uses MySql information server.

Proposed system mainly focus on the below given modules.

1. Admin
2. Student
3. Faculty
4. HOD

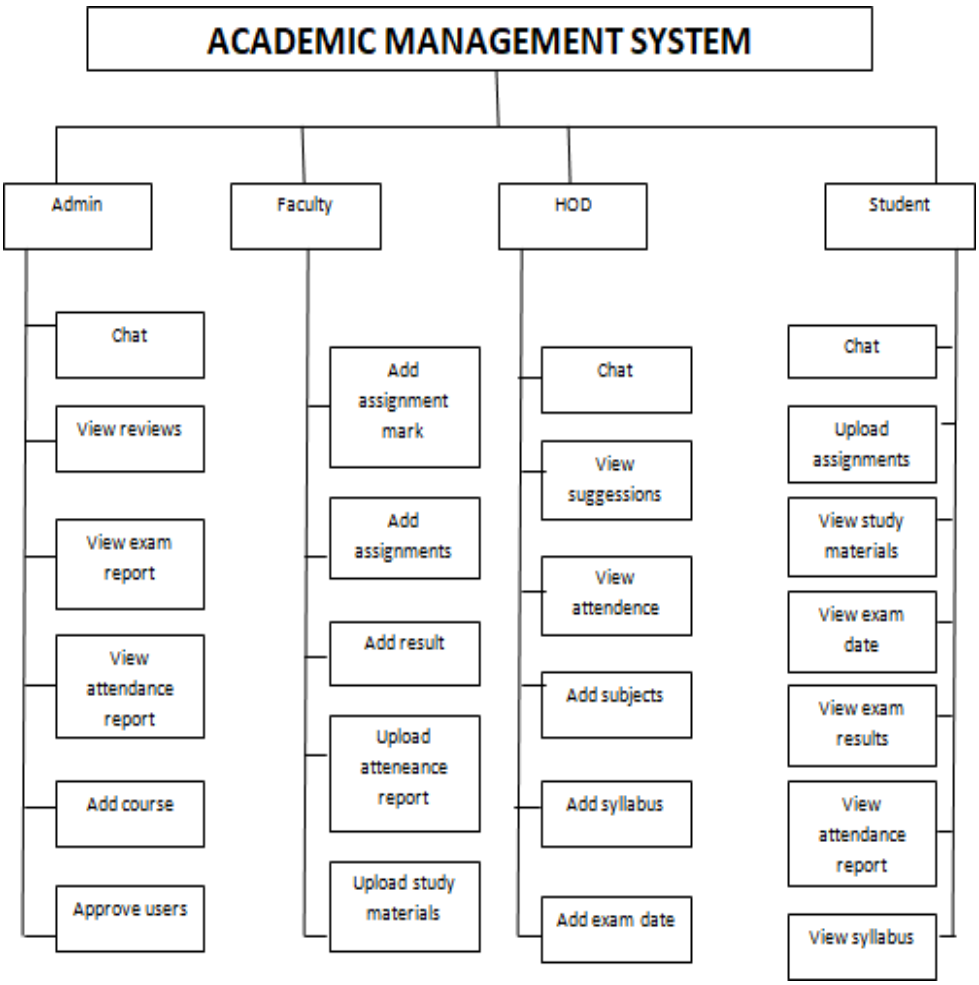


Figure 1: Structure Chart

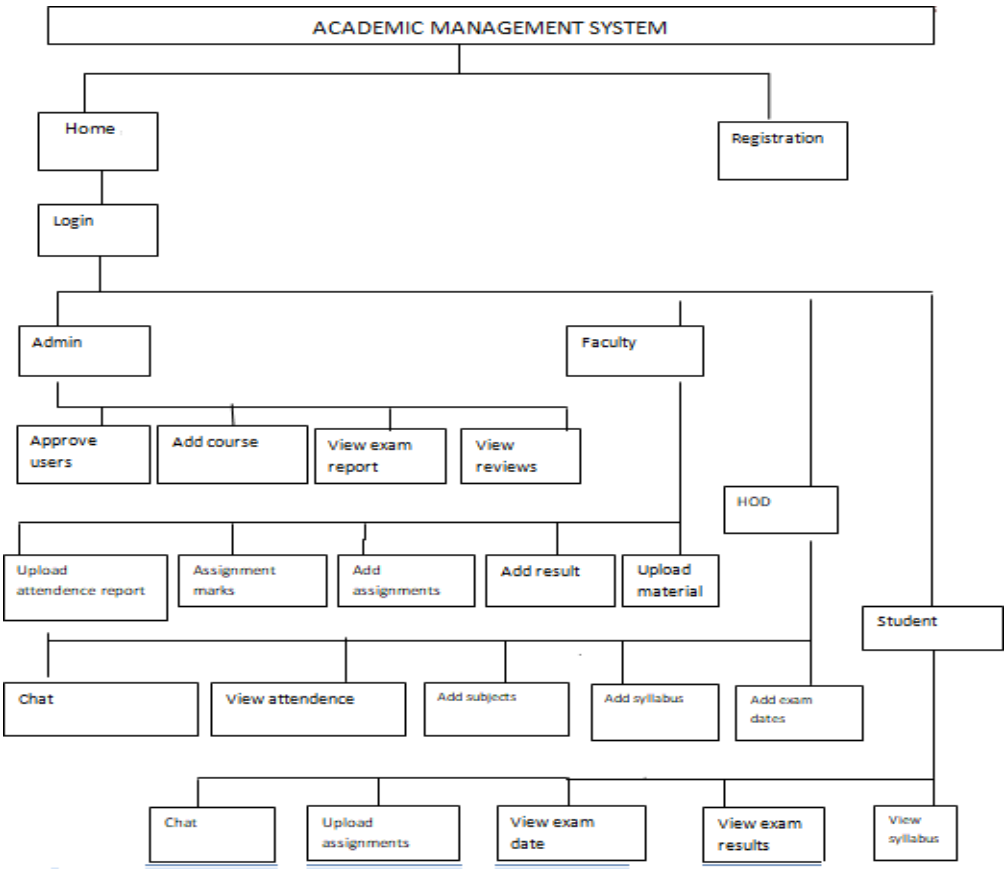


Figure 2: Menu Tree

System Implementation

Implementation is the process of bringing developed system into operational use and turning it over to the user. Implementation includes all those activities that takes place to convert from old system to new one. Implementation is the phase, in which one has to be cautious, because the efforts undertaken during the project will be fruitful only if the software is properly implemented according to the plan made. The system implementation was carried out using five main aspects:

- Transition planning
- Training
- Security
- Protection
- Quality control

Implementation Planning:-

Implementation of a system involves people from different departments and system analyst are confronted with the practical problems of controlling the activities of people outside their own data processing departments prior to this point in the project system, system analyst has interviewed department staffs with the permission of their respective managers. The implementation coordination committee should be responsible for a successful implementation. There should be at least one representative of each department affected by the changes and other members should be opted for discussion of specific topics.

Training:-

Training section must aim to give user staff the specific skills required in their new jobs. The training will be more successful if conducted by the supervisor with the system analyst is attendance to sort out any queries, new methods gain acceptable more quickly in this way.

Conclusion

The software we developed meets all the necessary requirements specified by the user. We have tested and confirmed that all the programs in the "Academic management system with sentiment analysis" are functioning properly. The system has been designed to be user-friendly and includes thorough documentation to facilitate smooth operation. The system, which was developed using PHP, aims to enhance user interactivity and minimize errors. Its primary goal is to serve as an information system for educational purposes, and it has successfully been implemented and tested.

Future Enhancement

Since every application should expand and it should provide a way for updating the system have been developed. Every module in this system have been developed carefully such that future enhancement do no affect the basic performance of the system. Through the current system in suitable the customer can be eager to use the most recent available development the system is faster and better than the existing once.

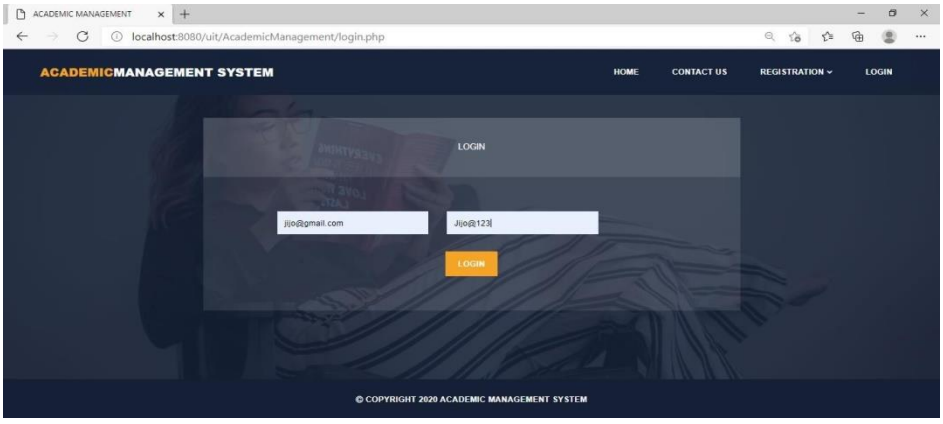
In future, we can incorporate "**Academic Management System**" with newer facility. So as to make it more attractive and ease to be used by the client. These may include artificial intelligence-powered systems that can

analyze data and make recommendations, or systems that use blockchain technology to securely store and manage student data. We can enhance these systems are more comprehensive and are used to manage all aspects of an educational institution, including finances, human resources, and operations.

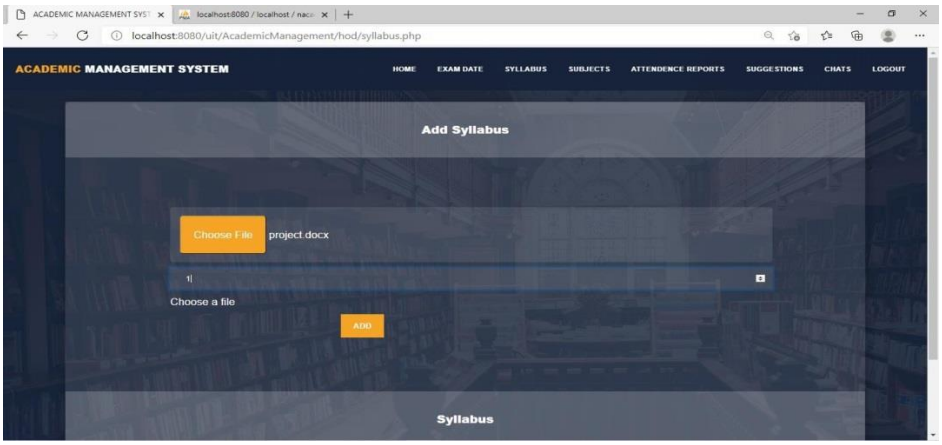
Results

Home Page

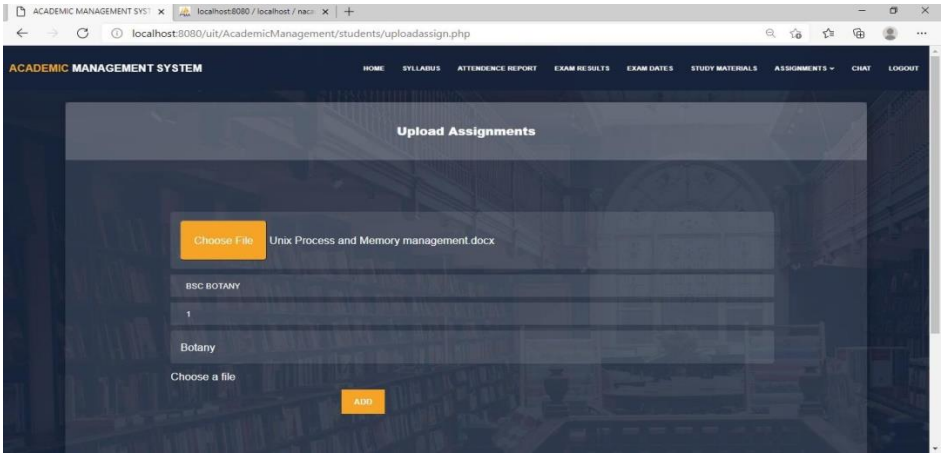
Login



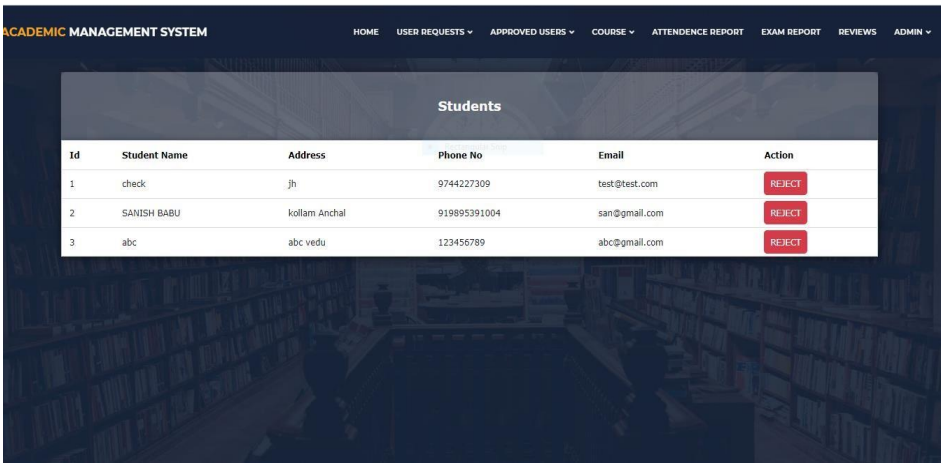
Add Syllabus



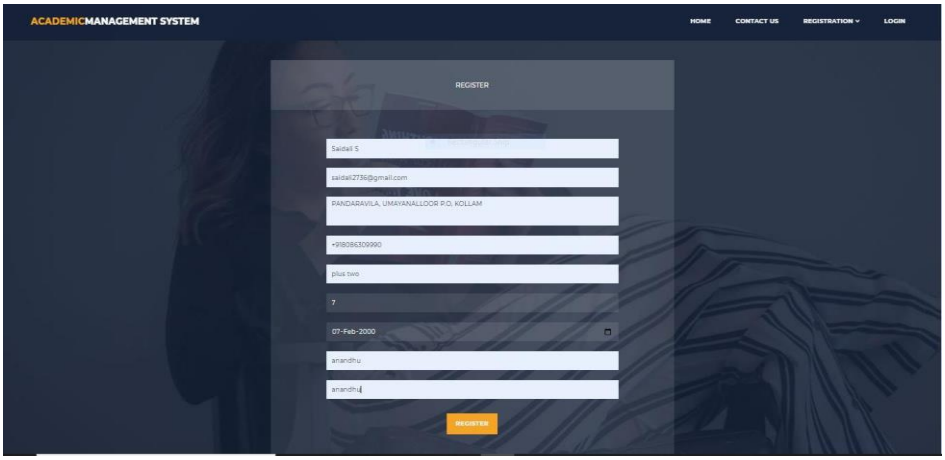
Upload Assignments



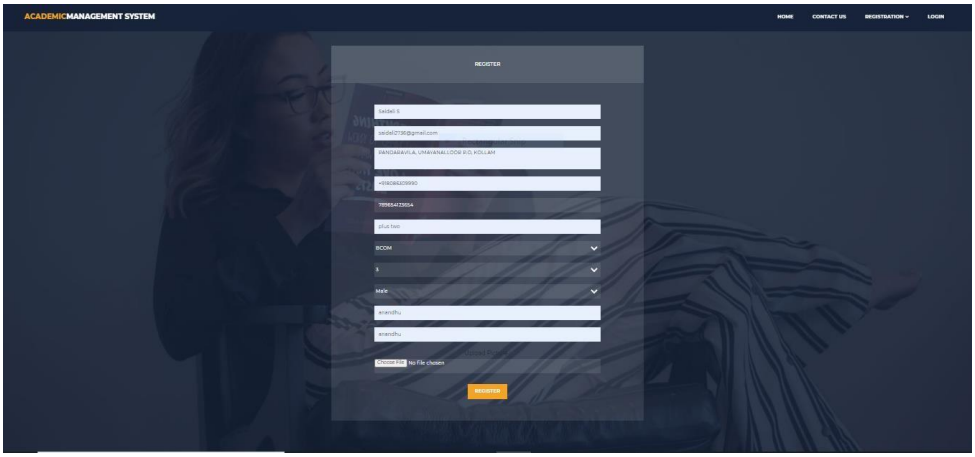
View Students List



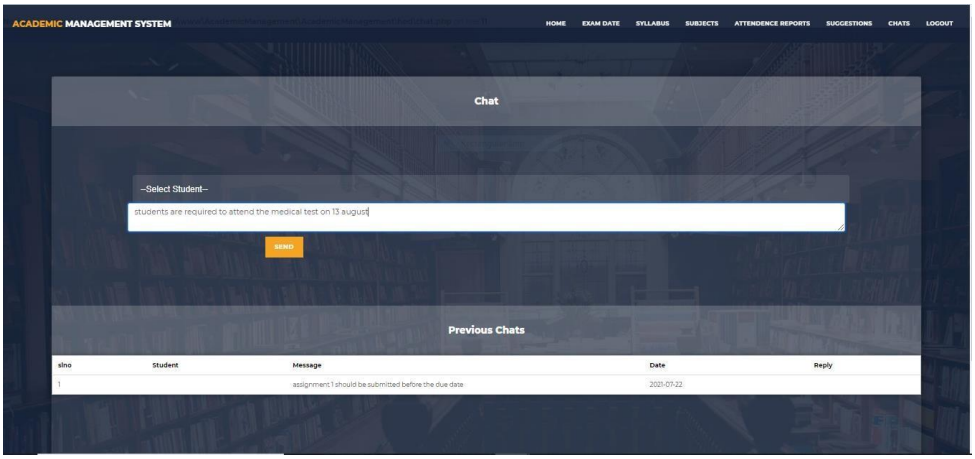
Faculty Registration



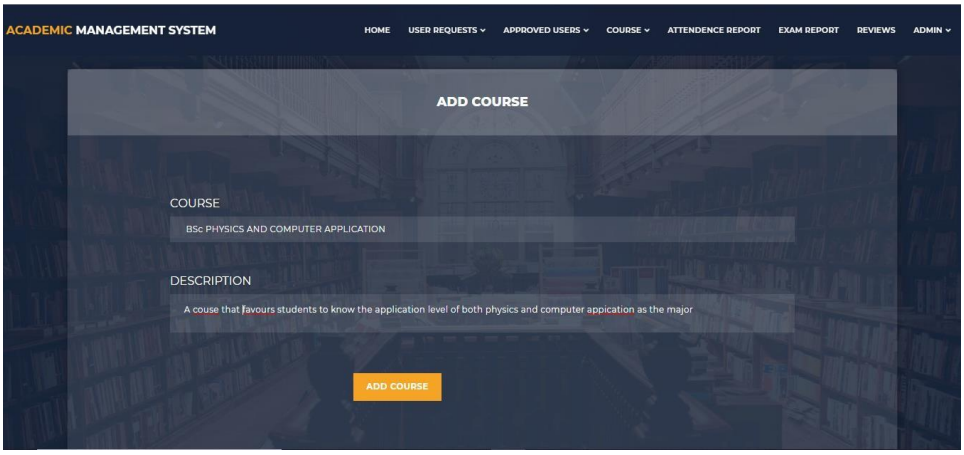
Student Registration



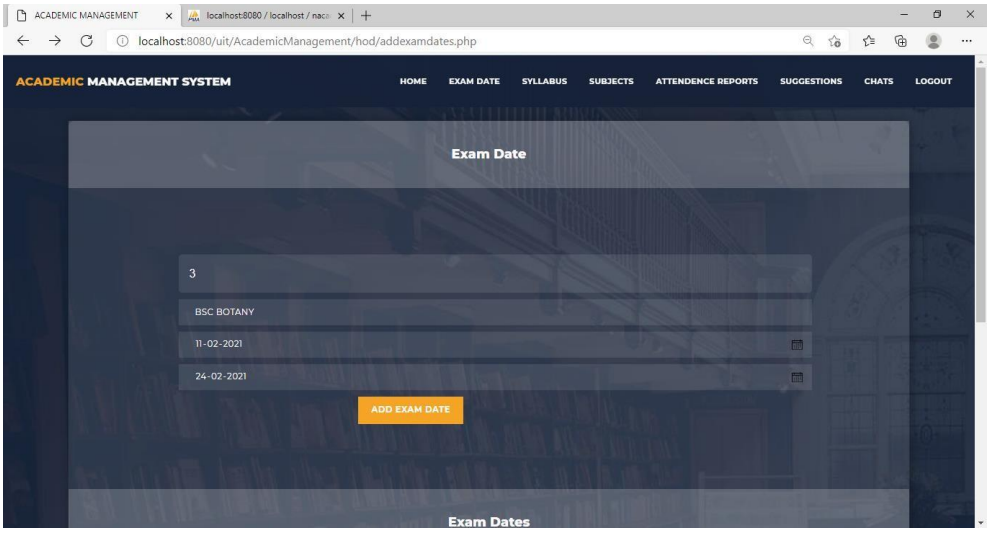
Chat Section



ADD NEWCOURSE



EXAM DATE



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10

Evaluation of *Invitro* Antioxidant and Antityrosinase Activities of *Ixora coccinea* Linn. Fruits

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Abstract

Herbal Cosmetics have growing demand in the world market and is an invaluable gift of nature. The correlation between the radical scavenging activity and tyrosinase inhibitory activity designate the ability of the compound in preventing free radical induced skin cell damage and reduce hyperpigmentation. *Ixora coccinea Linn* commonly known as 'vetchi' is a flowering shrub of Rubiaceae family used to treat various ailments in Indian Ayurvedic system of medicines. The present study was carried out to evaluate antityrosinase and antioxidant activities of fruit extracts from *ixora coccinea Linn* by different solvents. The methods for screening were based on phenol estimation, Antioxidant activity using DPPH radical scavenging efficiency, Inhibition of lipid peroxidation, ferric reducing power and Anti tyrosinase activity by inhibitory potency of mushroom tyrosinase. The methanolic extracts of *Ixora coccinea* fruits possessed the highest DPPH radical scavenging activity (IC_{50} value of 14.43µg.), Inhibition of lipid peroxidation, Ferric reducing power and Total phenolic content. Methanolic extracts of Ixora fruits showed tyrosinase inhibition with an IC_{50}value of 149µg. The current study proves that the Methanolic extracts of *ixora coccinea* fruits have superior skin whitening and antioxidant activities and serves as a potential source of ingredient for formulating the cosmetic products.

Keywords: Antioxidant activity, DPPH free radical, IC_{50} value, Antityrosinase, *Ixora coccinea* Fruits, Total phenolic content.

Introduction

Oxidative stress is the result of the imbalance between pro-oxidants and antioxidants in an organism, and it is significant in the pathogenesis of several degenerative disorders, such as arthritis, Alzheimer's, cancer, and cardiovascular diseases. Overexposure to sunlight, in particular UVA and UVB, induces the overproduction of reactive oxygen species (ROS). Excessive ROS increases overexpression of collagenase, a protease that degrades collagen which can result in photoaging and wrinkling of the skin (Lopez-Camarillo *et al.*,2012). In addition, abnormal production or distribution of melanin is the cause of various dermatological disorders such as melasma, lentigines, age spots and post-inflammatory hyperpigmentation (Yamaguchi *et al.*, 2007). Herbal cosmetics claimed to have efficacy and intrinsic acceptability due to routine use in daily life and circumvent the side effects which are commonly seen in synthetic products.

Tyrosinase (EC 1.14.18.1) is the rate-limiting enzyme involved in melanin synthesis. Melanin is the major pigment for the color of human skin. Melanin provides a beneficial effect in preventing skin damage under normal condition by preventing UV damage and removing reactive oxygen species. Although, the human body is well protected with endogenous defense systems, their efficiency is insufficient in some situations (Rabiskova *et al.*, 2009). Melanin synthesis in melanocytes is accompanied by the generation of hydrogen peroxide, which if inappropriately processed, can lead to the formation of hydroxyl radicals and other ROS. ROS cause biological damage in exposed tissues *via* iron-catalyzed oxidative reactions. Oxidative stress is also involved in the pathogenesis of skin disorders, and ROS scavengers or inhibitors, such as antioxidants, reduce hyper-pigmentation (Yamakoshi *et al.*, 2003). In order to treat hyperpigmentation related problems, cosmetics claiming to have skin-whitening properties, which acts by inhibiting tyrosinase in melanin pathway. But It often poses adverse effects to the skin namely allergic contact dermatitis which have been reported with the tyrosinase inhibitor kojic acid (Cheun-Bin et al., 2006). Many Studies have revealed that herbal cosmetics are more effective inhibitors of melanogenesis which are safe, non-nontoxic and cost effective (Hong-Xin Cui *et al.*,2018).

Ixora coccinea (or jungle geranium, flame of the woods, and jungle flame) is a species of flowering plant in the Rubiaceae family. It is a beautiful

flowering shrub native to Asia, with several medicinal properties. *Ixora coccinea Linn* commonly known as 'Thechi'in Malayalam or 'vetchi' in Ayurveda. It is a dense, multi-branched evergreen shrub, commonly 4–6 ft (1.2–2 m) in height, but capable of reaching up to 12 ft (3.6 m) high. The glossy, leathery, oblong leaves are about 4 in (10 cm) long, with entire margins, and are carried in opposite pairs or whorled on the stems. Flowers are widely used in Hindu pujas and rituals in South India. Fruits are globose, fleshy, and have 2-seeded berries. The fruits, when fully ripe, are used as a dietary source. ("Fig1").

Fig 1: Fruits of *Ixora coccinea*

Ixora coccinea showed; hepatoprotective (Ballia and Kurian 2012, Elumalai et al., 2012), chemo protective (Latha and Panikkar.,2001), (Latha et al., 2004),(Sun and Peng., 2008) antimicrobial (Sharma and Smita.,2010) antioxidant,anti-nociceptive (Ratnasooriya et al., 2005), anti-mitotic, anti-inflammatory, cardio protective, anti-ulcer,anthelmintic, antiasthmatic, hypolipidemic and hypoglycemic activities (Versiani et al., 2012). From ancient times different plant parts have been used in the treatment of diarrhoea, dysentery, leucorrhoea, dysmenorrhea, haemoptysis and catarrhal bronchitis (Banerjee *et al*., 2011). *Ixora coccinea* showed strong reducing power and total antioxidant capacity (Moni Rani Saha *et al.*, 2009). The leaves yield flavonoids, kaempferol, quercetin, anthocyanidins, phenolic acids and ferulic acid. Phytochemical studies have shown that the major compounds present in *I. coccinea* are lupeol, oleic acid, linolic acid, ursolic acid, oleanolic acid, stearic acid and sitosterol (Prabhu. and Yasmeen., 2011).

The present study was carried out to evaluate the antityrosinase and antioxidant activities of *ixora coccinea* fruits in various solvents. The

methods for screening are, antioxidant activity using 2, 2-diphenyl picryl hydroxyl (DPPH) radical scavenging, inhibition of lipid peroxidation, ferric reducing power, phenol estimation and antityrosinase activity by inhibitory potency of mushroom tyrosinase.

Materials and Methods

Fruit extract preparation

Fruits of *Ixora coccinea* (IC)were collected from the fields of Kerala. The Fruits were shade dried and grind into fine powder.1gram of herbal powder was dissolved in 10 ml of Methanol/ Water/ Ethyl acetate/ petroleum ether. The mixture was heated in a boiling water bath at 60 - 80 ^{0}C for 60 minutes. It was cooled to room temperature and centrifuged at 6500 rpm for 10 minutes. The supernatant was filtered and the filtrate was used for analysis. A total of four extracts of *Ixora coccinea* Fruits viz; Methanol extract (ICME), Aqueous extract (ICAQ), Ethyl Acetate extract (ICEA) and Petroleum Ether extract (ICPE) were prepared.

*B. **Determination of total phenolics***

The total polyphenols present in the crude extracts were estimated by Folin's ciocalteau method (Mallick and Singh., 1980) Phenols react with phosphomolybdic acid in Folin-ciocalteau reagent in alkaline medium and produce a blue colored complex (molybdenum blue) that can be estimated calourimetrically at 650 nm. Pipetted out different aliquots (0.2 to 2 ml) into test tubes. Made up the volume in each tube to 3.0 ml with distilled water and 0.5 ml of Folin-Ciocalteau reagent was added. After 3 minutes, added 2.0 ml of 20% (w/v) sodium carbonate solution to each tube. Mixed thoroughly, placed the tubes in a boiling water bath for exactly 1 minute, cooled and measured the absorbance at 650nm against reagent blank. The amount of phenols present is expressed as mg catechol equivalents/g of plant material.

*C. **Antioxidant assays***

The following assays were performed for evaluating the antioxidant efficacy of the plant material.

DPPH radical scavenging Assay

DPPH (2, 2-diphenyl-1-picrylhydrazyl) radical scavenging assay was carried out according to the method *(*Mensor *et al., 2001)***.** DPPH (2, 2-diphenyl 1-picryl hydrazyl) is a commercially available, commonly used

stable free radical, which is purple in colour. Antioxidant molecules when incubated, reacts with DPPH and converts it to diphenyl hydrazine, which is yellow in colour. The degree of discoloration of purple to yellow was measured at 520 nm, which is a measure of scavenging potential of plant extracts. 5 µl of plant extract was added to 195 µl of DPPH solution (0.1mM DPPH in methanol) in a microtiter plate. The reaction mixture was incubated at 25 ^{0}C for 10 minutes, after which the absorbance was measured at 520 nm. The DPPH with corresponding solvents (without plant material) served as control and methanol with respective plant extracts served as blank. The DPPH radical scavenging activity of the plant extract was calculated as the percentage inhibition.

%Inhibition of DPPH radical = $[(Ac - As)/Ac] \times 100$

Ac-Absorbance of control, As- Absorbance of sample.

Lipid peroxidation inhibition Assay

Lipid peroxidation inhibition assay was carried out by Ferric thiocyanate method (Mistuda., 2003). In this assay, linoleic acid is used as the model system for measuring the levels of lipid peroxidation. This was used to determine the amount of peroxide formed during the lipid peroxidation, in which peroxide will react with ferrous chloride and form ferric ions. Ferric ions will then unite with ammonium thiocyanate and produce a ferric thiocyanate complex whose colour is measured at 500nm. A mixture containing 10 ml of 0.05 M-phosphate buffer (pH 7.0), 5.9ml of water, 0.1 ml of plant extract and 4 ml of 2.5% linoleic acid in absolute ethanol was placed in a vial with a screw cap and then place in a dark oven at 40^{0}C overnight. To 0.1ml of this incubation mixture, added 9.7ml of 75% ethanol and 0.1 ml of 0.02M ferrous chloride in 3.5% HCl. Add 0.1ml of 30% ammonium thiocyanate, precisely 3 minutes after the addition of ferrous chloride. The absorbance of the red colour was measured at 500nm. A mixture without the plant sample was used as the negative control. (Note: Instead of plant extract, use 0.1 ml of Methanol/water/Ethyl acetate / petroleum ether as control).

Ferric reducing power assay

The reducing antioxidant power of the plant extracts was determined by the method of **(**Oyaizu., 1986). Different concentrations of plant extracts in 1 ml of distilled water were mixed with phosphate buffer (2.5 ml, 0.2 M, pH 6.6) and potassium ferricyanide [K_3Fe (CN)6] (2.5 ml, 1% w/v). The

mixture was incubated at 50°C for 20 min. Then, trichloroacetic acid (2.5 ml, 10% w/v) was added to mixture, which was then centrifuged for 10 min at 3000 rpm. The upper layer of the solution (2.5 ml) was mixed with distilled water (2.5 ml) and FeCl3 (0.5 ml, 0.1% Materials). The absorbance was measured at 700 nm against a blank using UV-Vis spectrophotometer after 30min. Increased absorbance of the reaction mixture indicates increase in reducing power. The reducing power of the plant material was expressed in terms mg of gallic acid equivalents/g of plant material.

D. ***Skin whitening assay or***

Antityrosinase assay

Mushroom tyrosinase was used for the bioassay (Ye *et al*,2009) Since the mode of inhibition depends on the structure of both the substrate and inhibitor, L- DOPA was used as the substrate in this experiment. Therefore, the inhibitors discussed in this paper are inhibitors of diphenolase activity of mushroom tyrosinase, and their effect on the enzyme was determined by spectrophotometry, based on dopachrome formation at 475nm. All the samples were first dissolved in dimethyl sulfoxide (DMSO) and used for the experiment at 30 times dilution. L-DOPA solution (0.87ml, 4.5mM) was mixed with 0.9ml of 0.1M phosphate buffer (pH6.8) and incubated at 30°C for 5minutes. Then 0.9ml of various concentrations of extracts, followed by 0.03ml of the aqueous solution of mushroom tyrosinase (4000 units) was added to the mixture and the enzyme reaction was monitored by measuring the change in absorbance at 475nm (30°C), corresponding to the formation of dopachrome, for 25minutes at 1minute intervals. Controls, without inhibitor but containing 3.3%DMSO, were routinely determined. The percent inhibition of the enzyme by the active compounds was calculated as follows; inhibition (%) = [(A control- A sample)]/A control] x 100.

Statistical evaluation was done using SPSS- 20 package one-way analysis of variance (ANOVA)). Difference was considered to be significant at $P<0.05$. The results are average of 6 replications and are represented as mean ± SEM.

Results and Discussion

The methanolic extracts of *Ixora coccinea* fruits possessed significantly higher levels of phenolic content,28,42mg equivalents of catechol when compared with aqueous and ethyl acetate extracts. The Aqueous and

ethyl acetate extracts also exhibited significantly higher phenolic content in comparison with petroleum ether extracts ("Fig 2".) The least amount of phenolic content was present in petroleum ether extracts. Results showed that methanol, water and ethyl acetate were the most suitable solvents for extracting all polyphenolic classes in Ixora coccinea fruits, compared with petroleum ether.

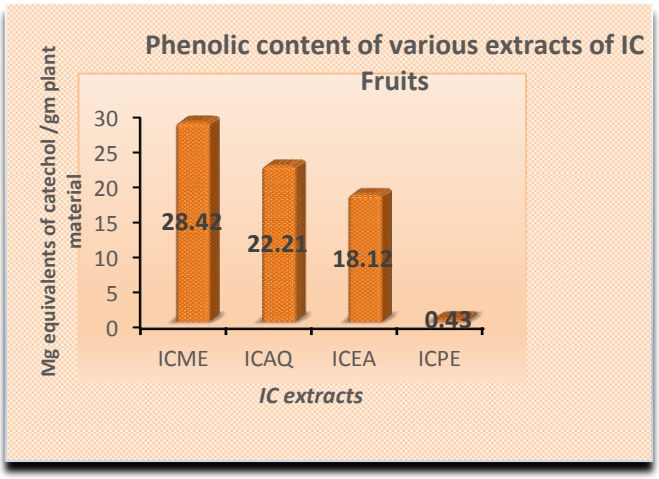

Fig 2:Phenolic content of various extracts of Ixorcoccinea fruits.

Table 1. Inhibition of DPPH and Tyrosinase by Fruit Extracts of *ixora coccinea*.

Extracts	% Inhibition	
	DPPH	Tyrosinase
ICME	97.14±0.14[a]	70.25±0.21[a]
ICAQ	63.19±0.33	34.16±0.12
ICEA	25.59±0.18	23.60±0.08
ICPE	12.07±0.18	12.82±013

Results are expressed as mean± SEM. (n= 6). a P<0.05

The methanolic extracts of *Ixora coccinea* fruits showed the maximum inhibition of DPPH radical (97.14%), followed by aqueous extract (63.19%) and ethyl acetate (25.59%). The least inhibition of DPPH radical was observed in petroleum ether extract (12.07%) "Table 1". The methanolic extracts showed a significant DPPH inhibitory activity was further

investigated for ascertaining the IC_{50} values, with a reference slandered gallic acid

Concentration dependent Inhibition of DPPH by various extracts of IC fruits

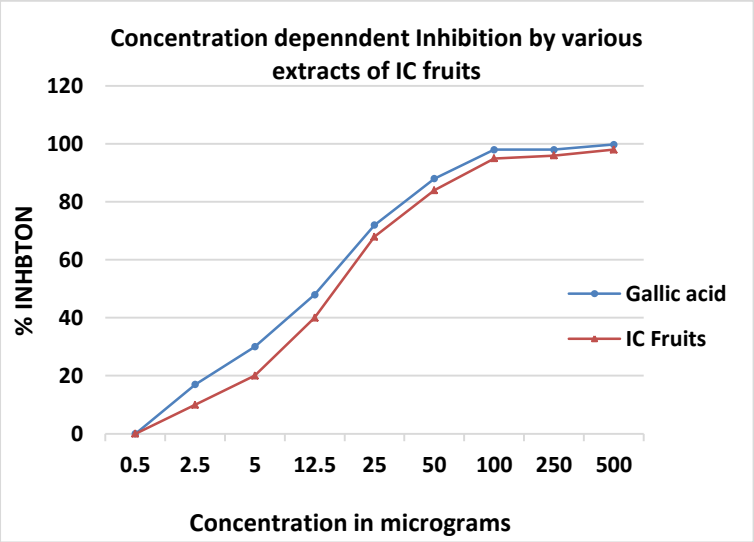

Fig 3. Concentration dependent inhibition of DPPH by methanolic extracts of Ixora fruits.

The methanolic extracts of *Ixora coccinea* fruits showed DPPH inhibition in a dose dependent manner, with an IC_{50} value of 14.43 µg, identical with Gallic acid reference standered with an IC_{50} 13.93 µg. ("Fig 3").

Table 2. Lipid peroxidation inhibition assay and Ferric reducing power by various extracts of IC fruits.

Extracts	% Inhibition of Lipid Peroxidation	Ferric reducing power (mgs of gallic acid equivalents/g of plant material)
ICME	63.24±0.73[a]	15.17±0.37[a]
ICAQ	44.68±0.32	6.08±0.18
ICEA	28.6±0.29	1.92±0.18
ICPE	4.00±0.20	0.15±0.11

Table 3: Concentration dependentInhibition of Tyrosinase by various extracts of I. coccinea fruits

		Kojic acid	
Concentration(µg/ml)	Concentration (µg/ ml)	%Inhibition	
	ICME	Concentration (µg/ml)	%Inhibition
5	5.12±0.23	1.56	29.50±0.18
10	10.64±0.26	3.12	38.21±0.19
25	18.64±0.29	6.25	50.53±0.24
50	34.69±0.31	12.5	72.22±0.28
100	51.00±0.35	25	90.45±0.41
500	70.45±0.13		
IC_{50}	149	-	7.26

Results are expressed as mean± SEM. (n= 6). a P<0.05

The methanolic extracts of *Ixora coccinea* fruits showed a significantly higher percentage of lipid peroxidation inhibition and ferric reducing ability when compared with aqueous, ethyl acetate, petroleum ether extracts. Ethyl acetate and aqueous extracts also possess significantly higher percentage of inhibition when compared with petroleum ether extracts. (Table 2).

The methanolic extracts showed the maximum tyrosinase inhibition (70.25%), followed by aqueous extract (34.16%) and ethyl acetate extract (23.60%) The least inhibition of DPPH radical was observed in petroleum ether extract (12.82%) "Table 1". The methanolic extracts of *Ixora coccinea* fruits were further investigated for their concentration dependent tyrosinase inhibition as shown in "fig.4", Various concentrations ranging from 5µg to 500µg were studied. The methanolic extracts of *Ixora coccinea* fruits showed tyrosinase inhibition in a dose dependent manner with an IC_{50} value of 149 µg, compared with Kojic acid, a reference standered, with an IC_{50} value of 7.26µg ("Fig 4").

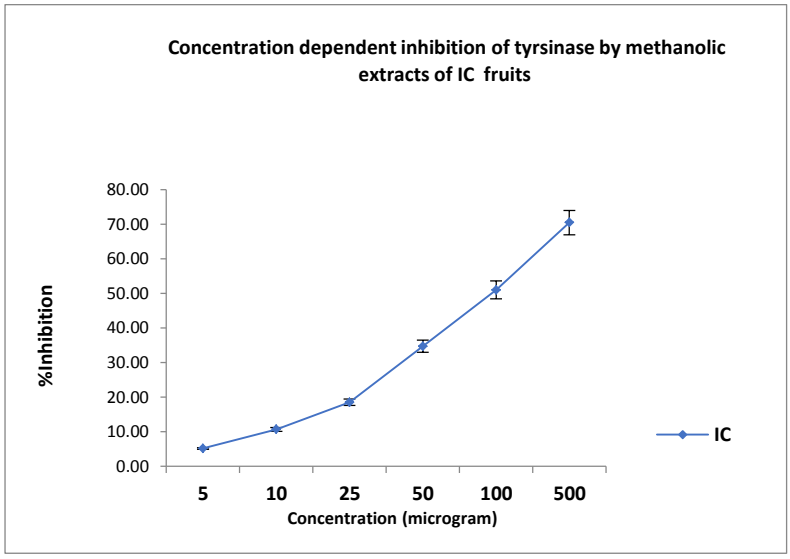

Figure 4. Concentration dependent inhibition of tyrosinase by methanolic extracts of Ixora fruits

The results obtained indicate that, methanolic extracts of *Ixora coccinea* fruits have significant antioxidant and antityrosinase activity. The significant antioxidant and antityrosinase activities of methanolic extracts of fruits may be endorsed due to the presence of higher amounts of phenolics. It has been reported that plants with high total phenolic components which include phenols, tannins etc. have exhibited excellent antioxidant effects, (Ramanuj Rauniyar *et al.*,2014.). The phenolic extracts protect the skin by scavenging the ROS, reducing the ROS reactivity, absorbing the UV light, inhibiting the oxidation, and suppressing the catalytic activity of tyrosinase. This reduces the risk of wrinkle formation and protect the skin from aging. (Azila Abdul Karim et al,2014). Previous studies have shown that compounds with high antioxidant and radical scavenging activities exhibit significant antityrosinase activities and can be used to develop skin-whitening and cosmetic formulations. (Nithya et al.,2011, Fatiha et al.,2015.). The maximum inhibition potential of methanolic extracts from *ixora coccinea* fruits indicated that the active principle is highly soluble in methanol and evaluation needs to be carried with animal models to explore the active component responsible for pharmacological activity.

Conclusion

It is evident from this study that methanolic extracts from *ixora coccinea* fruits have significant antioxidant potential as well as strong antityrosinase activity. High content of phenolic compounds appears to be responsible for these activities, comparable with commercial standards. This work provides new insights that will contribute to the commercial application of *Ixora coccinea* as an economic natural source of bioactive molecules with potent antioxidant and anti-tyrosinase activities. The potential of this easily accessible source of natural antioxidant should be explored by the pharmaceutical and cosmetic industries as an alternative for synthetic chemicals.

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11

Vaishnavism

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Abstract

Vaishnavism is the most important of the Pauranic religious system. Vaishnavism is the name given to the Bhakti religion which recognises Vishnu , Vaishnavism had already made its appearance by the middle of the 5th Century AD . Vaishnavism was very much developed in South India.

Vishnu is a Vedic deity the most glorified among the gods . Vishnu is the soul of all creatures and foremost among the all beings . Vishnu is known by the name of Narayana, Hrsikesa. Govinda and Kesava. The three gods Brahma , Vishnu and Siva are just one form . The conception of Lakshmi as the Divine consort of Vishnu . Vaishnavism had its beginnings in the North . The Vaishnavite saints known as the Alvars .

Vishnu will incarnate in the world in various forms and shapes . Vishnu`s avataras full under two primary heads Gunavataras and Lilavataras . Gunavataras is the Vishnu stated to have taken up the form of Brahma , Vishnu and Mahesa . Lilavatara refers to the ten Incarnations.

Vaishnavism

Evam enmahi loke lokanistharakaaranam

Thasya vishnoho paresasya naanavigrahadharinaha

The three great divisions of modern Hinduism are Vaishnavas, Saivas and Saktas. The Vaishnavas are identified with Vishnu rather than with Brahma and Siva . Vaishnava means a follower of Vishnu. Its etymological meaning however, is of relating to Vishnu, and the Puranas have used the word in both the senses . Vaishnavism is the most important of the pauranic religious system in the early stage of their evolutionary and formative period . Vaisnavism not very disastrous to Saivism , which had

been deeply rooted in the hearts of the people . Vaishnavism began receive state support in Bengal. Vaishnavism came from time immemorial hand had unique correlation of cultural movements. The influence of Christianity or of Islam on Vaishnavism, based more on conjectures than on history, cannot be proved.

Vaishnavism is the name given to the Bhakthi religion which recognises Vishnu called Bhagavath, Narayana, Hari, as the sole God. The worship of Vishnu, Narayana, Vasudeva and Krishna is still prevalent throughout India , In Nepal in the North, Bengal in the East Kathiawar in the West, an also in the South, their the Vaishnava tradition has been maintained specially by the devotional song of the Alvars

Vaishnavism had already made its appearance by the middle of the fifth Century AD . The point is that the cult of the Vyahas continued to exist as apart of Vaishnavism . It did not disappear in the Guptha age , but also continued to flourish in different parts of India up to a later period . In the present state of hour knowledge that Vaishnavism flourished has a theistic religion in the Vedic age

Vaishnavism too made rapid progress during the subsequent periods . It was patronised by the Guptha , Chalukya and Hoysala kings , in among others , and the large number of temples with Vishnu images indicates its wide extend all over India . It also spread to Indian colonies in the Far East

The power and influence of Vaishnavism was very much developed in South India by the Alvars or Vaishnava devotees who held same position as the Nayanars among Saivas . Vaishnavism or Krishnavism of the common man is somrthing like the Vaishnavism of the Alvars in the South . The first tree Alvara, Tirumanassai, Nam – Alvars and Kulasekhara were known respectively as Pogai , Petan an Pey , all indicating that they were mad but mad only with love of Krishna

But the devotional cult of Vaishnavism was faced with a great danger from two sides. One the one hand, there was the vigorous growth of the Mimamsa school represented by Sabarasvamin and Kumarila Bhatta , who maintained that the old Vedic sacrificial rites were only way to Salvtion . On the other hand , there was an upheaval of philosophical teachings which laid stress upon spiritual knowledge rather than on faith , love or devotion as the chief means of salvation .

The cult of Vaishnavism had for its chief rival Saivism which is even today a very popular creed in south India. While Saivism prevailed in South India even before the Christian era, it received grea strength from its opposition to Buddhism and Jainism, which it along with Vaishnavism, overcome about the fifth or the sixth century after Christ

The most important Vaishnava Acarya after Ramanuja was Madhava or Anandatirtha who flourished in the 13 th Century AD. Ramanuja is a name well known in the history of Vaishnavism in the South of India , but even prior to this there existed Bhagavata devotees in the South called by the name of Alvars Ramanuja`s religion was Vaishnavism advocating the worship of apersonal God who was characterised by love . He defines bhakti as contemplation on God, accompanied by love. TheSribhasya of Ramanuja insists on a sevenfold improvement of mind and body (Sadanasaptaka) as a preliminary duty of the bhakta. Madhava, who, preached Vaishnavism, has large support on the west coast of India and in the Karnataka State.

According to Madhava, the Supreme Being possesses an infinite number of gunas -s and is the Essential Truth. He is entirely different from the individual soul and the world. Brahman is independent and everything else is derived from it .God Jiva and the world are eternity distinct, but Jiva and the world, through distinct are subordinate to God. Again, there is an eternal distinction between God and the Jiva between God and the inanimate world, between the Jiva and the inanimate world, between one Jiva and another and between one inanimate object and another

The Ultimate Reality is Vishnu the personal God of love and Grace, possessing the usual attribute of sat, cit, aananda .He is nirguna in the sense that He is free from the qualities of Prakriti and Saguna since He has the qualities of omniscience, omnipotence, etc. These qualities are bound to him by the relation of Svarupasambanda. They express the nature of Brahman and in here in Him as the source, support and end of world , the material and efficient cause of the universe. He is the efficient cause through his higher energy Parasakthi and material cause through his other energies called Apara Sakthi and Avidya Sakthi. His former nature is unchangeable , while his latter nature is subject to modifications

Vaishnavism became almost the national religion of India. Although intervened by powerful sovereigns like Yasovarman and Harsha adherents to non- Vaishnava creed, the impact of Vaishnavism was strong

upon the people so as to countenance attacks from Acharya Sankara who flourished several centuries later . Vaishnavism has permeated among the saints of mediaeval India, resulting in the emergence of four Vaishnava schools by Ramanuja, Nimbarka. Vallabha and Madhava. Its appeal conquered the hearts of Tamil Saints the Alvars. Vaishnavism processes a unique vitality that satisfies the deep – seated spiritual hunger in mam

The Vaishnava bhakti movements could not have started earlier than the middle of the Seventh Century AD. The earliest records of Vaishnavism and Saivism are contained in the Mahabharatha. The term Vaishnavism is very comprehensive in its connotation , but the modern Vaishnavas consist generally of the Pancharathras and the Bhagavathas .Tnese two sessions , through originally different are designated by the generic term Vaishnava on account of the identification of their respective sectarian deities with Vishnu.

The Bhagavatha religion came to be known as Vaishnavism as well and became an important sect of Hinduism.

Origin of Vaishnavism

Vaishnavism had its beginning in the North . Vaishnavism was eminently suited to contributed very valuable elements to the European Renaissance of the twentieth century. The Basarh seals suggest that Vaishnavism was popular with artisans also. The Vayupurana states that Brahmanas Ksatriyas and Vaisya of the city of Campavati were worshippers of Vishnu . Nothing is said about Vaishnavism among the fourth Varna the Sudras, for they were socially too insignificant to be mentioned in these records. Vaishnavism was accepted by members of all classes and Varna`s, An idea of the popularity of Vaishnavism may be gained from analysis of the names mentioned in the Sultanpur copperplate inscription of AD .440. Out of total of ninety names, twenty -two have Vaishnavite and nineteen Saivite affinities.

Vaishnavism took a metaphysical turn in south and developed a new form called Acharya Vaishnavism. But it is the cult of the few; while the common man`s Vaishnavism is the Alvars and Chaitanya Vaishnavism.

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Democracy and Politics in India: Challenges of Secularism in Assam

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Abstract

The state and governments have a particular responsibility to ensure that people are able to enjoy their rights. They are required to establish and maintain laws and services that enable people to enjoy a life in which their rights are respected and protected. In a democratic state like India, the rights of the citizens are challenged by the state. India is a secular state by constitution with multiple religions trying to exclude a particular religious group in Assam. The state sponsored exclusion created a vast minority people as stateless. In India, the citizenship rights is not yet inclusive rather the basic fundamental rights, civil rights or the citizens of around 3 lakh people have been neglected by the state in Assam only because of their religion, and being non-Hindus.

The identity assertions of excluded sections are questioned by the changing political hegemony both at the centre and the states. The negligence of citizens' rights by the state, suppressing it by coercive measures cause political violence in the country, the best example is the issues happening in the north-eastern region in India. The demands for group rights and citizenship rights were suppressed by the state using AFSPA. The Bharatiya Janata Party, the current ruling party at the centre and the state is religiously hegemonic in nature and engaged in imposing stringent laws for the exclusion of non–Indians means non-Hindus on blaming the so called as 'illegal migrants.' It is ideologically rooted in BJP and it is purely political. This helps the BJP to consolidate Hindu votes in Assam. It is a move of current regime's ideological stand on religious minorities. In Assam, the state is a combination of politics of the Assamese nationalism and Hindutva Majoritarianism, restricting the human rights of the minority sections.

Keywords: Democracy, Politics, Secularism, Hindutva , Majaritarianism, Fundamental Rights, Citizenship Rights, Political Violence, Hegemony

Introduction

Human rights recognise our freedom to make choices about our lives and they are about living a life free from fear, harassment or discrimination. Ideas about rights and responsibilities have been an important part of all societies throughout history. Since the World War II, there has been a united effort by the nations of the world to decide what rights belong to all people and how they can be protected and promoted. Human rights include the right to life, the right to fair trial, freedom of speech, freedom of religion, and the right to an adequate standard of living. The state and governments have a particular responsibility to ensure that people are able to enjoy their rights. They are required to establish and maintain laws and services that enable people to enjoy a life in which their rights are respected and protected. (Guardnner 2016)

Through globalization the welfare function of the third world nation-states are diminishing. Globalization has led to two issues mainly: the rise of identity claims as part of democratic demands and the regulation of human rights by supranational institutions. Globalization itself possess the multiculturalist global democracy, in such a context, the uprisings, demands and notions of a particular ethnic, neglected group for citizenship should be addressed in a democratic state. But the human rights of the citizens are also challenged by the state. Religion, nationhood, Hindutwa all these terms are matters for the current ruling regime and not the minority rights, human rights of so called citizens of India. In a democratic state like India the citizenship is not yet inclusive rather the basic human rights, civil rights or the citizenship of around 3 lakh people have been neglected by the state in Assam. The negligence of citizens' rights by the state, suppressing it by coercive measures causes political violence in the country. The demands for group rights and citizenship rights were suppressed by the state using AFSPA. The identity assertions of excluded sections are questioned by the changing political hegemony both at the centre and the states.

In Assam there are enumerable numbers of citizens who are migrated from other neighbouring countries to India around 50 years earlier. Insurgency in Assam rose in a political context, but the government has viewed it as a security problem, and has adopted policies to root out insurgency militarily. And it has aggravated the human rights violations drastically. And later they married to Indian origin partners. Most of them

have any kind of identity of citizenship neither Indian nor their birth countries. In Assam they are treated as migrants or foreigners. Most of them are Non- Hindus and Muslims. Even their next generation does not have any kind of records of their Indian citizenship. Assam is one of India's border states of India with Bangladesh. According to the government reports, 1.9 million people in Assam have been in uncertainty with the publication of the final NRC. This bureaucratic exercise has delegitimised the political rights of the excluded sections. The NRC of Assam government has a dual purpose: the main aim is to identify the Indian origin citizens and to detect the non- Indian origin citizens to depot from India by naming them as migrants, non- citizens. The NRC is a legacy of Assamese nationalism: the sons-of–the soil movement of the 1970s, which is determined the Indian origin citizens only have the right of land, natural resources, cultural capital and Assamese citizenship. Who have not come under NRC has named as illegal migrants from Bangladesh in Assam. (Engineer 1999).

The Bharatiya Janata Party, the current ruling party at the centre and the state is engaged in imposing stringent laws on the so called 'illegal migrants.' It is ideologically rooted and political. The exclusion of non–Indians means non-Hindus, Muslims. The state government deleted the names of such illegal immigrants from the electoral rolls and not allowed to vote, not been included in the NRC. The persistence of AFSPA seems to be critical which may leads to ethnic cleansing. BJP viewed that not all the immigrants are equal. Bengali Hindus, the refugees fled from Bangladesh can be accommodated in India, at the same time Bengali Muslims are infiltrators from Bangladesh who are need to be expelled from Assam (Moidi 2015). This helps the BJP to consolidate Hindu votes in Assam. The state machinery led by a majoritarian government is depriving the rights of minorities. Declaring a minority section as alien's, becomes a sections of the people thrown out as stateless. It is a move of current regime's ideological stand on religious minorities. In Assam, the state is a combination of politics of citizenship and the Assamese nationalism and Hindutva Majoritarianism, restricting the human rights of the minority sections. The modern ideas of citizenship has been used as weapon for imposing their political agenda and which has been backed by the draconian laws such as AFSPA (Jha 2009).

The right- wing Hindu nationalist Bharatiya Janata Party (BJP) has been particularly trying to exclude the Bangladeshi Infiltrators. Assam became a starting point for prevalent "anti-infiltrator" sentiments in the state. Agitators demanded for the update of 1951 NRC for the entire country. The Supreme Court got involved in 2009, an NGO filed a writ petition for the deletion of "illegal migrants'" names from voters list in Assam. It led the Indian Supreme Court's order of 2014 updating the NRC. Right wing politics have been perpetuating a "national fear" and created the two levels of differentiation of "foreigners" and "nationals". The increasing number of illegal immigrants, speaking Bengali language and religiously non Hindus over a hundred of year in Assam created the government to exclude them from the state. The problem arouse here that the state perpetuated exclusion, and AFSPA gave unquestionable power to the state to handle the ethnic minorities. Section (4) of this act gives officials the power to shoot to kill in case of the commission or suspicion of offences which is contrary to article 21 which talk about right to life in Indian constitution. (Ganguly 2014)

AFSPA equip the government to declare emergency in any area of the country and bringing the region under the head "disturbed areas". Critics of AFSPA argue that in international law, even during such violence in conflict zones, the right to life and liberty remain valuable (Hamid 2019). Emergency laws too need to be utilized with certain safeguards to ensure that they do not become being despotic or dictatorial in nature. If AFSPA creates conditions for the violation of basic human rights and rights enshrined in the Constitution, then the responsibility of such laws lies with the government. It is evident from the judicial reviews; the law recognizes the requirement of such a law in disturbed areas. Presently, AFSPA 1958 is operational in entire States of Assam, Nagaland, Manipur Arunachal Pradesh, and Assam. (Bureau 2019) The imposition of such draconian laws certainly causes severe human rights violations. All these developments have to be discussed in the framework of state and citizenship question in the north-east India particularly Assam.

The state sponsored exclusion created a vast chunk of minority people as stateless. The citizenship law of the state is being used in favour of the interest of the right wing party, the BJP; they are appropriating the currents for political advantage. The state is using Armed Forces Special Powers Act (AFSPA) for suppressing opposition from the people's side.

This act is giving extra ordinary and vast powers to the Military, Police, and CRPF, which caused large scale human rights violations in the state. The suppression and negligence of basic rights of a larger community by the state and resultant human rights violations needs to be discussed seriously.

It is the responsibility of the Indian government to question the granting citizenship on the basis of religion, but it is the failure of UPA government in the centre that they did not file any official response to the court. After that the NDA came to power in 2014, its leaders including the BJP chief Amit Shah spoke in rallies in Assam that IS About assuring citizenship to Hindus who had fled to India to escape from religious persecution in Bangladesh. And also the Indian Prime Minister Narendra Modi and Amit Shah said in Lok Sabha after the 2014 Lok Sabha election that the BJP would get rid of illegal immigrants or "infiltrators" from India. The BJP at the centre has declared the immigration policy which has been there major agenda and policy to contest the Assam assembly elections in 2016. At that juncture the government has issued a statement that is the government decided to enact a law for the rehabilitation of Hindu refugees from Pakistan and Bangladesh.

Afspa and Citizenship

In July 2004, a Manipuri woman named Manorama was raped and murdered at the headquarters of the Assam rifles in Manipur, and after that incident a group of women were gone there and stood naked in front of the headquarters, challenging the army Jawans "to take their flesh". The army in north eastern region of India has immunity from judicial scrutiny under the AFSPA (Armed Forces Special Powers Act) which has been in operation in the North-Eastern states of India since 1958. In 2000 Irom Sharmila, a Manipuri women started a continuous hunger fast demanding the lifting of the AFSPA, is an expression of citizenship through the Gandhian idiom of non-violent resistance, protest against the changing regimes in India. She had faced imprisonment, force feeding for a long period. AFSPA created violence towards the protestors that stretched across the country- the states in north –east India, Kashmir, Chhattisgarh, Jharkhand, where regimes of impunity operated under the impact of extra ordinary laws, in the wars released by the state against its own citizens, on people protesting peacefully against, dispossession of their land, citizenship and resources.

Conclusion

India by constitution is a secular state, but in this current era it's challenging by the policies and practices of the democratic nation under right political parties. The political agenda of BJP and their Hindutwa ideology rooted in the exclusion of non –Hindus from the nation is the biggest threat, challenges to the secularist principle of India. The bureaucratic exercises in the north - east particularly Assam delegitimised the political rights of the Muslims because of their historical lineage with Bangladesh which came in to existence in 1971. The NRC has dual purpose: the main aim is to identify Indian origin citizens of Hindus and to detect and exclude the others by labelling of illegal migrants in Assam. For excluding the citizens from the state, the successive governments have been using Armed Forces Special Powers Act (AFSPA).The law is using inappropriately for the exclusion of Indian citizens in Assam who does not possess any valid records, documents, proofs of citizenship. The state doesn't recognize them as citizens and neglecting their voice. In a multi-cultural democratic state like India, the state has the responsibility to hear the voices of minority sections, but the government of Assam acts only for the majority. Conflict between State and citizenship rights is historical in north-east India; however, it made serious impacts in Assam more than any other states in India.

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Pharmacognostic and antibacterial activities of *Adiantum pedatum* L.

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Abstract

Adiantum pedatum L. (Adiantaceae) is commonly known as "Maiden hair fern". Its leaves has been reported to have potential use in folklore medicine to treat various ailments like stomach and liver problems. This plant is collected from different localities. It was identified taxonomically and used for the present study. The fresh plant and its ethanolic extract were subjected to pharmacognostical and preliminary phytochemical studies by using standard methods. The phytochemicals present in this plant are flavonoides, terpenoids, phenols, glycosides and steroids. Pharmacognostic study includes parameters which help in identifying adulteration in dry powder form of a medicinal plant as it is necessary because once the plant is dried and powdered, loses its morphological identity and easily prone to adulteration. In the present study, a comprehensive analysis of *Adiantum* was carried out for its macroscopy, microscopy (leaf, stem and rhizome), powder analysis, physico-chemical parameters etc. The result of the study revealed unique anatomical features of various plant part like presence of anomocytic stomata on the lower leaf surface and powder microscopic analysis showed the presence of xylem fibre, xylem tracheids, xylem vessels with pitted thickening in plant powder. To supplement the necessary information for the systematic identification and authentification of this particular species, pharmacognostic standardization of various parts of this plant as per WHO guide lines and phytochemical studies on crude extracts obtained from the whole parts of this plant were carried out to widen the scope of further study, and to know more about various phytochemicals present in them. Antibacterial activity was evaluated against clinically important bacteria using agar disc diffusion method. The result showed that the antibacterial activity was more effective in acetone and ethyle acetate fractions of leaf extract than aquous fractions and minimum inhibitory concentrations were also determined. It is expected that this study would help to widen the scope for further studies and to know more about phytochemical and pharmacological importance of this plant.

Key words: *Adiantum pedatum*, microscopic, pharmacognostic, phytochemical screening, adulteration, flavonoides, terpenoids.

Introduction

Adiantum pedatum L. (Adiantaceae) is commonly found in moist places such as banks of rivers and canals (Subash Chandra *et al*., 2008). This plant is collected from different localities of Kollam district. It was identified taxonomically and used for the present study. Pharmacognostic studies help in identification and authentification of the plant material. Correct identification and quality assurance of the starting materials is an essential prerequisite to ensure reproducible quality of herbal medicine which will contribute to its safety and efficacy(Akbar *et al*., 2014). Main objectives are

- Providing local name, botanical name and families for easy identification of plants without any confusion
- To study the morphological characters of collected plants
- To study the anatomical characters of plants
- Providing information about morphologically useful parts of the plant
- Contribution of economic importance of this plant
- To study the preliminary phytochemicals present in this plant
- To study the antibacterial activity of *Adiantum pedatum*

Materials and Methods

The plant specimen for the present study was taxonomically identified with the help of Flora Of Presidency Of Madras (Gamble, 1935) and collected from different localities of our campus NSS College, Nilamel, Kollam. The whole plant were collected and thoroughly washed with running water to remove the adherent impurities. The collected plants were dried in shade, powdered using mechanical grinder and stored in air-tight glass containers. The powder was then passed through Sohxlet apparatus and extracted with ethanol, acetone, ethyle acetate and hexane. This was then used for phytochemical and pharmacognostical and antibacterial investigation. In the present study, a comprehensive analysis of *Adiantum* was carried out for its macroscopy, microscopy (leaf, stem and rhizome), powder analysis, physico-chemical parameters etc (Trease and Evans, 1989).

Test microorganisms

The four bacterial cultures of different strains Staphylococcus aureus, Klebsiella pneumonia, pseudomonas aeruginosa and E.coli obtained from the authenticated stock culture of Department of Biotechnology lab CEPC, Kollam. Stock cultures were maintained at 4ºC on agar slants of nutrient media. Active cultures for experiment were prepared by transferring a loop full of microorganisms from the stock culture to ependorff tubes which contained 1ml of distilled water.

Screening for antibacterial activity

The disc diffusion method was used to screen the antimicrobial activity. The plates were prepared by pouring 15 ml of nutrient agar media into sterile petriplates.The plates were allowed to solidify for 5min. 1µl of suspension culture was spread uniformly and the inoculums was allowed to dry for 5min. Each extract was loaded (1.25mg/disc) on 6mm sterile disc. The loaded disc was placed on the surface of media and allowed to diffuse for 5min. and the plates were kept for incubation at 37ºC for 24 hr. .At the end of the incubation inhibition zone formed around the disc were measured with scale in millimeter. (Perumalsamy and Ignacimuthu, 2000).

Result And Discussion

1. Pharmacognostic studies of *Adiantum*

1.1. Macroscopic and organoleptic characterization

In macroscopic and organoleptic evaluation various sensory parameters of the plant material such as its external morphology, colour, odour and tastes were recorded. The results were presented in Table 1 and 2.

Table: 1. Macroscopic characters of *Adiantum*

Part of the plant		Leaf	Stem	Rhizome
Surface		smooth	smooth	smooth
Colour	Upper	Dark Green	Brown	Brown
	Lower	Light Green		
Odour		No characteristic odour	No characteristic odour	No characteristic odour
Taste		Tastless	Tastless	Tastless

Table 2: Organoleptic characters of *Adiantum*

Macroscopic parameters	Observation
Phyllotaxy	Alternate
Type	Pinnate

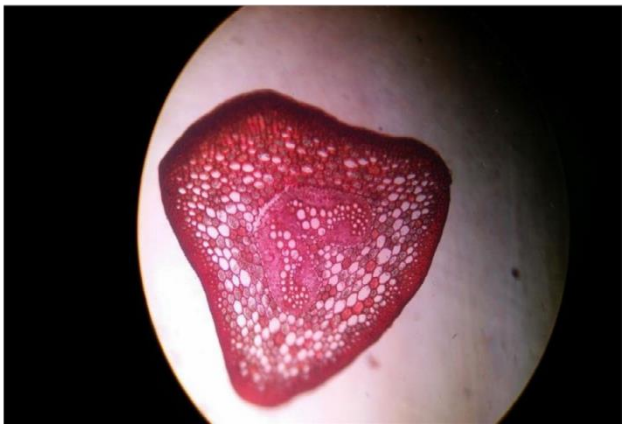
Table: 3. Quantitative leaf microscopy of *Adiantum*

Lamina size	Length	5.00-6.5 cm
	Width	2.5-3.5 cm
Shape		Fan shaped
Apex		Acuminate
Margin		Entire
Venation		Reticulate
Base		Cuneate
petiole		2.5-3.5cm

Sl. No.	Parameter	Range	Mean+SD
1	Stomatal Number – Upper epidermis	0	0
2	Stomatal Number – Lower epidermis	2	2
3	Subsidiary cell length	1.5	1.5
4	Subsidiary cell width	1	1
5	Stomatal index- Upper epidermis	0	0
6	Stomatal index- Lower epidermis	3.5	3.5

a. Petiole- Cross section of the petiole is circular in out line. Internally petiole is differentiated into epidermis, hypodermis, ground tissue and vascular strand. Epidermis is single layered with cuticle. Hypodermis is sclerenchymatous. Ground tissue is parenchymatous. The central part of ground tissue is made up of two arc shaped vascular strand. Strand is

surrounded by a layer of endodermis and pericycle . Strand is made up of xylem surrounded by phloem.



Anatomy of petiole

b. **Rhizome -** Cross section of root is circular in out line. Rhizome is differenciated into epidermis, hypodermis and ground tissue with many meristeles. Hypodermis is sclerenchymatous and ground tissue parenchymatous. Each stele is dictyostelic.

c. **Leaf** –Transverse Section of the leaf shows three distinct regions namely epidermis, mesophyll and vascular tissue. Epidermis- The epidermis cosists of upper epidermis (adaxial epidermis) and lower epidermis (abaxial epidermis). The upper epidermis consists of uniseriate trichomes with tapering ends. The outer walls are cutinized. The stomata occur on the lower epidermis. Stomata are anomocytic type. Mesophyll – The mesophyll is differentiated into palisade tissue and spongy tissue. Palisade tissue is composed of vertically elongated and compactly arranged parenchyma cells with chloroplast. Vascular tissue- The protoxylem is turned to the upper epidermis.Xylem is collateral and closed. Xylem consists of tracheids, vessels and xylem parenchyma. Phloem consists of sieve tube members, companion cells and phloem parenchyma. Each vascular bundle is surrounded by a parenchymatous bundle sheath.

d. **Powder analysis -** Analysis of *Adiantum* leaf powder revealed the presence of xylem fibre , xylem vessel and xylem trachieds (Hariprasad *et al.*,2011)

Table 4: Preliminary phytochemical analysis

Sl. No	Phytoconstituent	Ethanol extract
1	Protein	_
2	Flavonoid	+
3	Glycoside	+
4	Tannin	_
5	Terpenoid	+
6	Carbohydrate	_
7	Saponin	_
8	Phenol	+

Key word, '+' indicates presence and '- ' indicates absence

Antibacterial activity

Table 4. Antibacterial activity of the crude extracts of *Adiantum pedatum*

Inhibition	**Extracts & Inhibition(cm)**			
	Acetone	**Ethyle acetate**	**Ethanol**	**Hexane**
Staphylococcus aureus	2.4±0.03a	1.0±0.02c	NA	NA
Klebsiella pneumonia	1.25±0.03b	0.7±0.02d	NA	NA
Pseudomonas aeruginosa	1.5±0.02b	0.8±0.03c	NA	NA
E.coli	0.9±0.02c	0.7±0.02d	NA	NA

NA- No Activity

The antibacterial activity of the extracts of *A.pedatum* is presented in Table 4. The acetone and ethyle acetate extracts showed significant antibacterial

activity. The antibacterial activity of the acetone extract of *A.pedatum* is much higher than of ethyle acetate. Acetone and ethyle acetate extracts of *A. pedatum* also have activity against all the organisms tested at different range. The acetone extract exhibited more activity against gram positive Coccus bacteria, Staphylococcus aureus followed by ethyle acetate but other two extracts not shown any activity on bacteria tested. The inhibitory activity may be due to the presence of phytochemicals in the extract.

The present investigation has shown that acetone and ethyle acetate extract have active phytochemicals (terpene, cardiac glycosides, steroids and phenols) which are able to inhibit pathogenic bacteria. Antimicrobial activity may be due to strong occurrence of polyphenolic compound such as terpenoids, cardiac glycosides, steroids and phenols. These findings provide scientific evidence to support traditional uses and indicate a promising potential for the development on antimicrobial drug from *A.pedatum* plant.

Summary and Conclusion

The phytochemicals present in this plant are flavonoides, terpenoids, phenols, glycosides and steroids. The result of the study revealed unique anatomical features of various plant part like presence of anomocytic stomata on the lower leaf surface and powder microscopic analysis showed the presence of xylem fibre, xylem tracheids, xylem vessels with pitted thickening in plant powder (Harborne., 1973). The present investigation has shown that acetone and ethyle acetate extract have active phytochemicals (terpene, cardiac glycosides, steroids and phenols) which are able to inhibit pathogenic bacteria. To supplement the necessary information for the systematic identification and authentification of this particular species, pharmacognostic standardization of various parts of this plant as per WHO guide lines and phytochemical studies on crude extracts obtained from the whole parts of this plant were carried out to widen the scope of further study, and to know more about various phytochemicals present in them.

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Qualities of Bride in Manusm¤ti

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Abstract

The literature of each period throws much light on the knowledge of Ancient Indians' way of life and culture. The customs and manners, beliefs, social life and culture of ancient India can be realised from the Vedas, Purāṇas, Epics, Dharmasūtras and Smṛtis etc. The rules, customs, practices and manners available there in, were meant not only for men, but also for women.

Bride in Manusm¤ti

The term Dharmaśāstra comes under two broad heads- the Dharmasūtras and Smṛtis. Smṛtis are the main textual source of Hindu-Dharma and its origin is traceable from the ritual Kalpa Sūtras, which is one of the six limbs of the Vedas (Vedāṅgas). The Kalpa Sūtras, which are classified into the Śrauta Sūtras, Gṛhya Sūtras, Dharma Sūtras, and Śulva Sūtras. The Dharmasūtras, explain social and moral duties and rights, which are dealt with in detail in numerous Smṛtis. The treatment of the subject matter in the case of Dharmasūstras is not so methodical and systematic as it is in the case of Smṛtis.[i] Manu defines Smṛti as such - श्रुतिस्तु वेदो विज्ञेयो धर्मशास्त्रं तु वै स्मृतिः*[ii] A complete Dharmaśāstra consists of three portions-treating of Ācāra, Vyavahāra and Prāyaścitta. Gautama Dharmasūtra says -

श्रुतिस्मृतिविरोधे तु श्रुतिरेव गरीयसी।

अविरोधे सदा कार्यं स्मार्तं वैदिकवत्सदा**[iii]

The exact number of Smṛtis is not known. Scholars have varying opinion regarding the number of Smṛtis. Some say, they are more than 200. Among them the most important and ancient Smṛti is Manusmṛti.

This Smṛti is also known as Mānavadharmaśāstra or Manu-Samhita. It is believed that the Svāyambhuva Manu is the author of this work. The present

version of Manusmṛti contains 2685 verses divided into twelve chapters. Manu has clearly defined the systematic life-style and rules based on the values of life seen in the Vedas and Dharmasūtras.

He proclaimed that the family life was more superb than the ascetic life and he advocated the duties of the couple - "the wife is a 'must' for the householder to beget progeny and fulfil of the three debts and practise sacrifice and worships, and give warm hospitality to guests and Gurus and attain salvation."[iv]

Preceptors enforced certain norms and conditions in the matter of marriage. Manu stated eight forms of marriages, which was practised in accordance with the Varṇas. They are – Brāhma, Daiva, Ārṣa, Prājāpatya, Āsura, Gāndharva, Rākṣasa and Paiśāca.[v] In all these forms of marriages, except Paiśāca, the girl is treated as a precious person. In the first four type of marriages, the woman is treated as the more precious material to be kept in the safe custody of the father or the guardian than the other forms of marriages and to be handed over to an appropriate person at the proper time. Manu proclaimed that in this way, only pure progeny will be the result. The father who gives away his daughter in marriage to a proper husband gains good reputation and reap the harvest of the ten thousand Agniṣṭoma sacrifices.[vi] Samvarta says:

अलङ्कृत्य पिता कन्यां भूषणाच्छादनासनैः ।

दत्वा स्वर्गमवाप्नोति पूजितस्तु सुरादिषु**[vii]

"The father who gives away his daughter in marriage to a proper husband, clothed with gorgeous costumes and beautified with ornaments is deserved to enter the heaven and is worshipped along with gods".

From this, it can be realised that the father has got a venerable position in the society and salvation, not only with son-birth but also with daughter-birth and as a bride, the girl enjoyed special considerations. Hence, it was the duty of the father to find a noble, handsome groom of the same caste and give her away to him in marriage. Those who fail to do this properly will be despised in the society. [viii]

Important Qualities of a Bride

During the period of Smṛti, there was a clearer view about the qualities of the bride and groom. Manu is also more strict about it. In Manusmṛti he states the important qualities of the bride - 1) The bride should be good qualities and of

the same Varṇa (caste) - उद्वहेत द्विजो भार्यां सवर्णां लक्षणान्विताम्*[ix] 2) The age of the bride should be younger than that of the groom, i.e., one third.[x] 3) Her virginity should be flawless. 4) They should not belong to the same clan. The members of the same clan were regarded the descendants of one seer. Therefore they are sisters and brothers and that is why the marriage of same clan is denied. 5) Both of them should not be Sapiṇḍas -

अस्पिण्डा च या मातुरसगोत्रा च या पितुः*[xi]

The distance of the blood relation of them is also stated. That is the bride should not be in between seven generations on the side of the father, and five generations on the side of the mother. In South India, in certain places, some men and women are being united in marriage having the same blood relation. In Kerala, a man marries the daughter of his mother's brother or the daughter of his father's sister. In Tamil Nadu, a man marries his sister's daughter. Manu is against of these kinds of marriages. 6) Bride should be a high born one. Manu says that girls belonging to ten kinds of clan must be avoided.[xii] 6.1) those who not performed the Jātakarma rite i.e.Vrātyas, Pratilomas, Caṇḍālas etc. 6.2) The one that has no male progeny. That is the preceptors are against the marriage of the girl (Putrikā) having no brothers. Because she is given in marriage on the condition that the son born of her is the rightful person to perform the funeral ceremony of her father. That is the grand father has more right to possess the grandson than his father. Probably the daughter who is given in marriage on the above mentioned condition resides in her on house. So it is clear that she has no more importance in the field of marriage.

6.3) The other is those who are not practising the Vedas.

6.4) Those families in which have long hairy bodies.

6.5) The families suffering from piles.

6.6) The families suffering from tuberculosis.

6.7) The family having weak digestion.

6.8) The family having epilepsy.

6.9) Those who have white sports on body.

6.10) Those who have leprosy.

Because those who have long hairy bodies are considered despicable persons. It can be understood that the above mentioned diseases are hereditary and therefore Manu suggests to avoid such families.

7) It is also very important that the bride must be elegant.

So a man should not marry a girl who have golden hair in her head or has an extra limb or is sickly or has no body hair or too much body hair or talks too much or has eyes with yellow and red mixed color.[xiii] This verse which indicate the same meaning is found in Bhaviṣya Purāṇa also.

Let us examine why Manu avoids a girl having all these features. In many books, both good and bad features of man and woman are described following the chiromancy. Such descriptions are found in Visṇupurāṇa, Bhaviṣyapurāṇa, Kṛtyakalpataru and Nītikalpataru etc. Nītikalpataru says - 'Generally woman are croaked and men are light hearted and therefore contact with them after keen observation.

प्रकृत्या कुटिला नार्यः प्रकृत्या सरला नराः।

तस्मात्समागमं यायात्परीक्ष्य पुरुषः स्त्रियम्*[xiv]

In the above book, on the basis of chiromancy, the girl with brown haired may be cruel. That is why Manu warns to avoid such girls - परुषैः कपिलैः क्रूरा स्कन्धकेशी च शोभना*[xv] "The girl with rough and brown hair is cruel, and the girl with long hair reaching to shoulders is well - mannered."

In another verse, woman's sixteen bad deportments are described - the woman with eyes having the yellowish-reddish coloured, having dimples, voice resembling to that of an ass, having the thick and lengthy haired, the wild eyed, curved nose, lack of teeth, the black tongued, the deformed, having joined eyebrows, the very short and the more lengthy, are always cruel, wicked and not giving any comfort.[xvi] From all these, It is clear why Manu suggests to avoid the above said bad featured girl.

8) The name of the girl must be sweet, say Manu.[xvii] Bride's name must not have the meaning of the following objects- star, tree, river, low caste, mountain, bird, snake, serfs.[xviii] The reason behind the suggestion to avoid these names is described elaborately while studying the concept of Nāmakaraṇa ceremony. Therefore no need mentioning it here. The concepts of Manu is that even the name of the bride should not bear any blashful or despicable traces. It is also

notable that the verse of Manu describing about naming the bride is found in Bhaviṣyapurāṇa too.

नर्क्षवृक्षनदीनाम्नीं नान्त्यपर्वतनामिकाम् ।

न पक्ष्यहिप्रेष्यनाम्नीं न च भीषणनामिकाम्**[xix]

Manu urges that one must avoid the brides belonging to the above mentioned ten families though having sound financial position.[xx]

But he again says - though the girl belonging to any one of the above mentioned ten families and having good qualities and symmetry, a Dvija can marry her.[xxi] For instance he indicates that Akṣamālā, though born of the lowest caste, when united to Vasiṣṭha and the bird Sāraṅgī when unitd to Mandapāla became worthy of honour-

अक्षमाला वसिष्ठेन संयुक्ताऽधमयोनिजा ।

शारङ्गी मन्दपालेन जगामाभ्यर्हणीयताम्*[xxii]

From this it can be concluded that in the period of Manusmṛti, If the Brāhmiṇs who are desirous of entering the married life must choose the first four forms of marriage, especially in Brāhma marriage, they will select the brides having the above mentioned qualities. The Śūdra must marry the Śūdra girl in accordance with the customs and manners of his caste.

Conclusion

In Smṛti period, the factors that determines the status of the bride was virginity, caste, clan, family, wealth and symmetry. The latter Smṛti writers also accepted the above mentioned qualities of the bride and still the good character, caste, family status, health and wealth of bride and groom are considered in the case of marriage. Considering the qualities of bride, Manu is more admant than other p[receptors. He pictured woman as the goddess of prosperity (Lekṣmī) in a house. She should be a symbol of beauty, virginity, chastity, health, patience, forbearance and virtue etc., and she leads the family and society into progress and prosperity. Even the name of her should not bear any blashful or despicable traces. Because, Manu thought that the progeny born from the best couple will be beautiful and endowed with the quality of lucidity, rich and famous, enjoying life to the fullest, most religious and they lived a hundred years. More over, one can attain salvation and the fulfillment of three debts only through the participation and help of a good wife. From this, it can be realised that even in

ancient times, the preceptors knew that the characteristics of the progeny were hereditary.

References

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ii Manusmṛti, 2.10.

iii Gauthama Dharmasūtra, 1.1.1.2.

iv M.S., 9. 27-28.

v Ibid., 3.21.

vi Ibid., 61-63.

vii Samvarta Smṛti, (Bis., vol.2), 1.64.

viii M.S., 9.4.

ix Ibid., 3.4.

x Ibid., 9.94.

xi Ibid., 3.5; 5.60.

xii ·· ाहान्त्यपि समृद्धानि गोजाविधनधान्यतः।
स्त्रीसंबन्धे दशैतानि कुलानि परिवर्जयेत्।।
हीनक्रियं निष्पुरुषं निश्छन्दो रोमशार्शसम्।
क्षय्यामयाव्यपस्मारिश्वित्रिकुष्ठिकुलानि च**
Ibid., 3.6-7.

xiii नाद्वहेत्कपिलां कन्यां नाधिकाङ्गीं न रोगिणीम्।
नालोमिकां नातिलोमां न वाचालां न पिङ्गलाम्**
Ibid., 8.
Bhaviṣya Purāṇa, Brāhma Parva; Ch.5; v.100.

xiv Nītikalpataru, Strīrakṣāprakāra Kathanam, Kusuma section, 95.2.
Mahajan, V.P. (ed.), Nītikalpataru of Vyāsadāsa Kṣemendra, Bhandarkar, Oriental Research Institute, Poona, 1956.

xv Ibid., Strīlakṣaṇa Śākha, v.117, p.243.

xvi Ibid., Kulakṣaṇaṣodaśakam, v.148,p.245.

xvii M.S., 2.33.

[xviii] Ibid., 3.9.

[xix] Bhaviṣya Purāṇa, Brāhma Parva; Ch.6, 101.

[xx] Ibid., 3.6.

[xxi] Ibid., 2,238.

[xxii] Ibid., 9.23.

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എം. സുകുമാരന്റെ കഥകൾ മലയാളത്തിൽ വേറിട്ട ശൈലി പുലർത്തുന്നവയാണ്. സമൂഹത്തിന്റെ വികാസ പരിണാമങ്ങൾക്ക് അനുസൃതമായ പ്രമേയങ്ങളെയാണ് അദ്ദേഹം സ്വീകരിച്ചിരിക്കുന്നത്. ആയിരത്തി തൊള്ളായിരത്തി അറുപതുകളിലും എഴുപതുകളിലും കേരളത്തിന്റെ സാമൂഹ്യമണ്ഡലത്തിൽ ഏറെ സ്വാധീനം ചെലുത്തിയിരുന്ന തീവ്രവാദ രാഷ്ട്രീയ പ്രസ്ഥാനത്തിന്റെ - നകസലൈറ്റ് പ്രസ്ഥാനത്തിന്റെ - വളർച്ചയും തളർച്ചയും ഈ കഥകളിൽ കാണാം. ഒപ്പം കമ്മ്യൂണിസ്റ്റ് പ്രസ്ഥാനത്തിന വന്ന നയവ്യതിയാനത്തെയും ചർച്ച ചെയ്യുന്നു.

താക്കോൽ വാക്കുകൾ

തീവ്രവാദ രാഷ്ട്രീയം, നകസലേറ്റ് പ്രസ്ഥാനം, ഉന്മൂലന സിദ്ധാന്തം, വസന്തത്തിന്റെ ഇടിമുഴക്കം

എം സുകുമാരന്റെ കഥാപ്രപഞ്ചം

മലയാള ചെറുകഥയിൽ പുതിയ പന്ഥാവ് വെട്ടിത്തുറന്ന എഴുത്തുകാരനാണ എം. സുകുമാരൻ. തന്റെ കാലഘട്ടത്തിലെ കേരളീയ സമൂഹത്തിന്റെ ഒരു നേർചിത്രം അദ്ദേഹത്തിന്റെ കഥകളിൽ നമുക്ക് ദർശിക്കാം. അറുപതുകളിലും എഴുപതുകളിലും കേരളത്തിന്റെ സാമൂഹ്യ മണ്ഡലത്തെയും രാഷ്ട്രീയമണ്ഡലത്തെയും സ്വാധീനിച്ച ചിന്താ ധാരകളെല്ലാം തന്നെ എം. സുകുമാരന്റെ കഥകളിലുണ്ട്. അദ്ദേഹം തന്റെ നോവലുകളിൽ തീവ്രവാദ പ്രസ്ഥാനത്തിന്റെ പ്രവർത്തനം, നിയമസംഹിത, വളർച്ച തുടങ്ങിയവയെ സവിസ്താരം പ്രതിപാദിക്കുന്നുണ്ട്. എന്നാൽ

കഥകളിലേക്ക് വരുമ്പോൾ പ്രസ്ഥാനത്തിന പിൽക്കാലത്തുണ്ടായ പരാജയത്തെ വിവരിക്കുന്നതിനാണ് കൂടുതലും ശ്രദ്ധ കേന്ദ്രീകരിച്ചിരിക്കുന്നത്. താൻ ഏറെ വിശ്വസിച്ച പ്രസ്ഥാനത്തിന പിൽക്കാലത്ത് ഉണ്ടായ അപചയമായിരിക്കാം ഇങ്ങനെയൊരു മാറ്റത്തിന അദ്ദേഹത്തെ പ്രേരിപ്പിച്ചത്. സ്വാതന്ത്ര്യാനന്തരം ഭാരതീയരുടെ സങ്കൽപ്പങ്ങൾക്കനുസൃതമായ ഒരു സാമൂഹികക്രമമല്ല ഇവിടെ സൃഷ്ടിക്കപ്പെട്ടതെന്ന് വലിയ ഒരു വിഭാഗം ചിന്തിച്ചു. സാമൂഹിക പുരോഗതിക്കായി രൂപം കൊണ്ടതും പ്രവർത്തിച്ചതുമായ പ്രസ്ഥാനങ്ങളെല്ലാം അപചയത്തെ നേരിട്ടു. ആദർശം സാമൂഹിക പ്രതിബദ്ധത തുടങ്ങിയവയ്ക്ക് ക്രമേണ മൂല്യശോഷണം സംഭവിച്ചു. ഏത് ലക്ഷ്യത്തിനു വേണ്ടിയാണോ പ്രവർത്തിച്ചത് അതിൽ നിന്നും വ്യതിചലിച്ച് പുതിയ മാർഗ്ഗങ്ങൾ തേടുന്നതിന ഇത് പ്രസ്ഥാനങ്ങളെ പ്രേരിപ്പിച്ചു.

ആയിരത്തിതൊള്ളായിരത്തി നാൽപ്പത്തിയേഴിന ശേഷം രാഷ്ട്രീയ പ്രസ്ഥാനങ്ങളെല്ലാം അധികാരത്തെ മുഖ്യലക്ഷ്യമാക്കിയുള്ള പ്രയാണത്തി ലായിരുന്നു. ഇന്ന് ഇന്ത്യയിൽ കാണുന്ന രാഷ്ട്രീയ പാർട്ടികളുടെ ആധിക്യം സൂചിപ്പിക്കുന്നത് ഇതാണ്. രൂപീകരിക്കുമ്പോഴുള്ള ഉദാത്തമായ ലക്ഷ്യത്തെക്കുറിച്ചുള്ള വാചാടോപമല്ലാതെ പ്രായോഗിക തലത്തിൽ അവയൊന്നും പ്രതിഫലിച്ച് കാണുന്നില്ല. ചില പ്രസ്ഥാനങ്ങളുടെ പ്രസക്തി തന്നെ നഷ്ടപ്പെട്ടു. അതിലൊന്നാണ് കമ്മ്യൂണിസ്റ്റ് പാർട്ടിയുടെ തന്നെ സന്തതിയായ തീവ്രവാദ രാഷ്ട്രീയപ്രസ്ഥാനം അഥവാ നക്സ ലൈറ്റ് പ്രസ്ഥാനം. എല്ലാ രാഷ്ട്രീയ പ്രസ്ഥാനങ്ങളിലും അപചയം കണ്ടെത്താമെങ്കിലും തീവ്രവാദ പ്രസ്ഥാനത്തിൽ അപചയത്തിന്റെ വേഗതയും തോതും അതിശയകരമായിരുന്നു. ആ കാലഘട്ടത്തിലെ മറ്റ് സാമൂഹ്യപ്രസ്ഥാനങ്ങളെപ്പോലെ സമവായത്തിന്റെയോ കൂടിയാലോചന യുടെയോ മാർഗ്ഗമല്ലായിരുന്നു തീവ്രവാദത്തിന്റേത്. സാമൂഹ്യ പുരോഗതിക്ക് വിഘാതം സൃഷ്ടിക്കുന്ന പ്രസ്ഥാനങ്ങളെയും വ്യക്തികളെയും ഉന്മൂലനം ചെയ്യുകയെന്നതായിരുന്നു ഇവരുടെ പ്രവർത്തന ശൈലി. ഭാരതത്തിന്റെ സംസ്കാരത്തിനും പാരമ്പര്യത്തിനും യോജിക്കുന്നതല്ലായിരുന്നു ഉന്മൂലന സിദ്ധാന്തമെങ്കിലും ഈ നയത്തോട് യുവജനതയ്ക്ക് വലിയ ആഭിമുഖ്യം തോന്നി. എന്നാൽ ഭൂരിപക്ഷം ജനത ഇവരുടെ പ്രവർത്തനങ്ങളോട് വൈമുഖ്യം പ്രകടിപ്പിക്കുകയാണുണ്ടായത്. ഇവർ പിന്തുടർന്നു വന്ന ഉന്മൂലന സിദ്ധാന്തത്തോട് പ്രതിപത്തി

പ്രകടിപ്പിക്കുവാൻ ഇവർക്കായില്ല. സാമൂഹ്യപുരോഗതിയുടെ പേരിൽ ഇവർ നടപ്പിലാക്കിയ അക്രമങ്ങളും കൊലപാതകങ്ങളും സാധാരണ ജനങ്ങളിൽ നിന്നും ഇവരെ അകറ്റി നിർത്തി. മാത്രവുമല്ല പാർലമെന്ററി വ്യാമോഹം നേതാക്കന്മാരിൽ കടന്നു കൂടുകയും ചെയ്തു. തീവ്രവാദ പ്രസ്ഥാനത്തിന്റെ രൂപീകരണവും പ്രവർത്തനവും ലക്ഷ്യവും മാർഗ്ഗവും യുവജനതയ്ക്ക് ഇതിനോടുള്ള ആഭിമുഖ്യവും എഴുത്തുകാരെ വല്ലാതെ ആകർഷിച്ചു. തീവ്രവാദരാഷ്ട്രീയ പ്രസ്ഥാനത്തിന്റെ രൂപീകരണം മുതൽ അപചയ കാലഘട്ടം വരെയുള്ള വിവിധ അവസ്ഥാവിശേഷങ്ങളെ തങ്ങളുടെ കൃതികളിലൂടെ ഇവർ ആവിഷ്കരിച്ചു. അക്കൂട്ടത്തിൽ പ്രധാനിയാണ് എം. സുകുമാരൻ. അദ്ദേഹത്തിന്റെ ഓരോ രചനയും തീവ്രവാദപ്രസ്ഥാനത്തിന്റെ - നകസലൈറ്റ് പ്രസ്ഥാനത്തിന്റെ - വിവിധ വശങ്ങളുടെ ആഖ്യാനമാണ്.

എം. സുകുമാരൻ തന്റെ പല കഥകളുടെയും രചനയ്ക്ക് പശ്ചാത്തലമായി സ്വീകരിച്ചിട്ടുള്ളത് മാർക്സിയൻ ദർശനങ്ങളാണ്. ഇതിന നിദർശനമാണ് തൂക്കുമരങ്ങൾ ഞങ്ങൾക്ക്, മരിച്ചിട്ടില്ലാത്തവരുടെ സ്മാരകങ്ങൾ, വെള്ളെഴുത്ത്, സിംഹാസനങ്ങളിൽ തുരുമ്പ് തുടങ്ങിയവ. സാമൂഹ്യമാറ്റങ്ങൾക്ക് അനുസൃതമായി വളർന്നു വികസിക്കുന്ന ഒരു രചനാശൈലിയുടെ ഉടമ കൂടിയാണദ്ദേഹം. പ്രത്യക്ഷമായ രാഷ്ട്രീയ പ്രമേയത്തെയാണ് അദ്ദേഹത്തിന്റെ ആദ്യകാല കഥകൾ ചർച്ച ചെയ്യുന്നത്. സംഘഗാനം, ചരിത്രഗാഥ എന്നിവയുടെ കാലം ആകുമ്പോഴേക്കും താൻ വിശ്വസിക്കുന്ന പ്രസ്ഥാനത്തിന്റെ വിശകലനമാണ് നടത്തുന്നത്. പിൽക്കാലത്ത് തന്റെ വിശ്വാസ പ്രമാണങ്ങളിൽ സംഭവിച്ച അപചയത്തെ ചൂണ്ടിക്കാണിക്കാനും വിശകലനം ചെയ്യുവാനും അദ്ദേഹം തയ്യാറാകുന്നു.

ചരിത്രഗാഥ മനുഷ്യ സമൂഹത്തിന്റെ കഥയാണ്. അപരിഷ്കൃത ലോകത്ത് നിന്നും പരിഷ്കൃത ലോകത്തേക്കുള്ള മനുഷ്യന്റെ അനുസ്യൂതമായ പരിണാമത്തിന്റെ കഥയാണ്. അപരിഷ്കൃതമായ ലോകത്ത് പ്രകൃതിയെ മാത്രം ആശ്രയിച്ച് കഴിഞ്ഞിരുന്ന ഒരു കാലഘട്ടം, കൃഷിയുടെ ആരംഭം, സ്വകാര്യ സ്വത്തിന്റെ ആവിർഭാവം, ചൂഷണനയം, വർഗ്ഗ-വർണ്ണവിഭജനം, ജന്മി കുടിയാൻ വ്യവസ്ഥിതിയുടെ ആരംഭം, സാമൂഹ്യബോധം സംഘടിത ശക്തിയിലേക്കുള്ള പരിണാമം എന്നിവയുടെ ഒരു വിവരണം ചരിത്രഗാഥയിൽ കാണാം. ഈ അർത്ഥത്തിൽ ചരിത്രഗാഥയെ സമൂഹത്തിന്റെ ഒരു പരിച്ഛേദമായി നമുക്ക് കാണാം. പിൽക്കാലത്ത് സുകുമാരൻ പ്രകടിപ്പിക്കുന്ന വിപ്ലവാഭിമുഖ്യ

ത്തിന്റെ ഒരു നാന്ദി കുറിക്കൽ കൂടിയാണ് ചരിത്രഗാഥയെന്ന് വിശേഷിപ്പിക്കാം. സാമൂഹ്യ പരിണാമത്തിന്റെ വിവിധ ദശകളെ വർണ്ണിക്കുന്ന കൂട്ടത്തിൽ കഥാകൃത്ത് വിപ്ലവമാർഗ്ഗത്തിലൂടെ ചൂഷണ വ്യവസ്ഥിതിക്കെതിരെ പോരാട്ടം നടത്തുന്നതിന്റെ ഒരു വിവരണം കൂടി ഈ കഥയിൽ ഉൾപ്പെടുത്തുന്നുണ്ട്. വെള്ളെഴുത്ത്, കൽപ്പവൃക്ഷത്തിന്റെ ഇല, ജലജീവികളുടെ രോദനം എന്നീ കഥകൾ പ്രമേയത്തിന്റെ പ്രത്യേകത കൊണ്ടും അവതരണശൈലി കൊണ്ടും പ്രസക്തങ്ങളാണ്. ജലജീവികളുടെ രോദനം കേരള ചരിത്രത്തിൽ കുപ്രസിദ്ധാനായി ത്തീർന്ന ഒരു പോലീസ് ഓഫീസറുടെ വാക്കുകളിലൂടെ കേരളത്തിലെ നക്സലൈറ്റ് പ്രസ്ഥാനത്തെ വിവരിക്കുകയാണ് ഭരണകൂടത്തിന്റെ പ്രതിനിധിയായി കഥയിൽ പ്രത്യക്ഷപ്പെടുന്ന പോലീസുദ്യോഗസ്ഥന്റെ പരിഹാസദ്യോതകമായ വാക്കുകളിലൂടെ അന്നത്തെ ഭരണകൂടത്തിന ഈ പ്രസ്ഥാനത്തോടുണ്ടായിരുന്ന മനോഭാവം വ്യക്തമാക്കുന്നു. കഥയുടെ പേര് തന്നെ ദുഃഖസാന്ദ്രമാണ്. ഭരണകൂടത്തിന്റെ മർദ്ദനത്തിന വിധേയമാവുകയും നാശോന്മുഖമാവുകയും ചെയ്ത പ്രസ്ഥാനത്തിന്റെ കഥ അവതരിപ്പിക്കുന്നതുകൊണ്ടാണ് കഥാകൃത്ത് ഇങ്ങനെയൊരു പേര് സ്വീകരിച്ചത്. വിപ്ലവത്തിന്റെ ഊഷരഭൂമിയായിരുന്ന വയനാടൻ മണ്ണിൽ ഇന്ന് തല ഉയർത്തി നിൽക്കുന്നത് വിപ്ലവകാരികളല്ല മറിച്ച് കുറുന്തോട്ടികളാണെന്ന പരിഹാസ പരാമർശവും ജയകൃഷ്ണൻ എന്ന ജയറാം ഉയർത്തുന്നുണ്ട്. ഒരു സാഡിസ്റ്റാണ് ഈ ഉദ്യോഗസ്ഥൻ. പേരിലെ സാമ്യവും പ്രവൃത്തിയും നോക്കിയാൽ തീവ്ര വിപ്ലവകാരികളെ അടിച്ചമർത്തുന്നതിന നേതൃത്വം നൽകിയ ജയറാം പടിക്കലാണ് ജയകൃഷ്ണനെന്ന് മനസ്സിലാക്കാം.

വെള്ളെഴുത്ത് ഒരു പ്രതീകാത്മക കഥയാണ്. ഒരു യഥാർത്ഥ കമ്മ്യൂണിസ്റ്റുകാരന അനുഭവിക്കേണ്ടിവന്ന മാനസിക സംഘർഷത്തിന്റെ കഥയാണ്. താൻ വിശ്വസിച്ചിരുന്ന പ്രസ്ഥാനത്തിന്റെ പ്രത്യയശാസ്ത്രത്തിൽ സംഭവിച്ച അപചയത്തെയാണ് ഈ കഥ വെളിപ്പെടുത്തുന്നത്. വിയറ്റ്നാം - ചൈന യുദ്ധമാണ് പശ്ചാത്തലം. വിയറ്റ്നാമിൽ ഹോചിമിന്റെ നേതൃത്വത്തിൽ അമേരിക്കൻ സാമ്രാജ്യത്വത്തിനെതിരെ പോരാട്ടം നടന്നപ്പോൾ അതിന സർവ്വാത്മനാ പിന്തുണ കൊടുത്ത ചൈന പിൽക്കാലത്ത് വിയറ്റ്നാമിന്റെ ശത്രുപക്ഷത്തായി. മാത്രവുമല്ല ചൈനയും വിയറ്റ്നാമും തമ്മിൽ യുദ്ധവുമുണ്ടായി. ഒരു കമ്മ്യൂണിസ്റ്റ് രാഷ്ട്രം മറ്റൊരു കമ്മ്യൂണിസ്റ്റ്

രാഷ്ട്രവുമായി യുദ്ധത്തിൽ ഏർപ്പെടുകയെന്നത് ഒരു കമ്മ്യൂണിസ്റ്റുകാരനെ സംബന്ധിച്ചിടത്തോളം അചിന്ത്യമായ ഒന്നാണ്. ഒരു കമ്മ്യൂണിസ്റ്റുകാരനിൽ ഇത്തരമൊരു അവസ്ഥ സൃഷ്ടിച്ച വിഭ്രമാവസ്ഥയുടെ പ്രതിഫലനമാണ് വെള്ളെഴുത്ത്. ഈ കഥയിൽ പ്രസ്ഥാനത്തോട് നൂറ് ശതമാനം കൂറ് പുലർത്തിയിരുന്ന പ്രവർത്തകരുടെ വ്യക്തിജീവിതത്തിലും സാമൂഹ്യ ജീവിതത്തിലും സംഭവിച്ച മാറ്റങ്ങളെയാണ് പ്രതിപാദിക്കുന്നത്. അപ്രതീക്ഷിതമായി പലരുടെയും വെള്ളെടുത്ത് കണ്ണട ഉടയുന്നതോടെ അവരുടെ ദിനചര്യയിൽ പോലും വ്യതിയാനങ്ങൾ സംഭവിച്ചതായി കഥാകൃത്ത് പറയുന്നു. കണ്ണട ഉടയുക എന്നത് ഒരു പ്രതീകം മാത്രമാണ്. യഥാർത്ഥത്തിൽ പ്രസ്ഥാനത്തോട് കൂറ് പുലർത്തിയിരുന്നവരുടെ വിശ്വാസപ്രമാണങ്ങളാണ് ഉടഞ്ഞത്. കമ്മ്യൂണിസ്റ്റ് പ്രസ്ഥാനത്തിലും സമൂഹത്തിലും ഉണ്ടായിക്കൊണ്ടിരിക്കുന്ന മാറ്റങ്ങളെ ഉൾക്കൊള്ളുന്നതിന പലർക്കും സാധിച്ചില്ല. കഥയുടെ അവസാനഭാഗത്ത് പുതിയ കണ്ണട ലഭിക്കുന്നതോടെ പൊയ്പ്പോയ സന്തോഷമെല്ലാം തിരിച്ചു കിട്ടുന്ന കഥാനായകനെയാണ് നാം കാണുന്നത്. അതായത് പുതിയ സാമൂഹ്യ ക്രമവുമായി സമരസപ്പെടുന്നതിന നായകന കഴിഞ്ഞു. യുദ്ധത്തെ സംബന്ധിക്കുന്ന വാർത്തകൾ ഓരോന്നും അത്യുത്സാഹത്തോടെ വായിക്കുന്ന കഥാനായകന്റെ സന്തോഷം ഇരട്ടിപ്പിക്കുന്നത് ചൈന - വിയറ്റ്നാം യുദ്ധം തീർന്നുവെന്ന വാർത്ത വായിക്കുമ്പോഴാണ് മനസ്സിന ശാന്തത നൽകുന്ന വാർത്തയാണിത്. താൻ വിശ്വസിക്കുന്ന തത്വശാസ്ത്രങ്ങളുടെ തകർച്ചയാണ് കഥാനായകന്റെ മനസ്സിൽ വിഭ്രാന്തി സൃഷ്ടിച്ചത്. കഥാനായകന്റെ അതേ അനുഭവങ്ങളാണ് കഥാകൃത്തിനും പിൽക്കാല ജീവിതത്തിൽ സംഭവിച്ചത്. ഈ അനുഭവം അദ്ദേഹത്തിന്റെ ബോധമണ്ഡലത്തിൽ സൃഷ്ടിച്ച അനുരണനങ്ങളാണ് വെള്ളെഴുത്ത് എന്ന കഥയിലൂടെ പ്രകടമാകുന്നത്. വർത്തമാനകാലത്തും പ്രസ്ഥാനത്തിനും പ്രത്യയശാസ്ത്രത്തിനും സംഭവിച്ച അപചയങ്ങളെക്കുറിച്ചുള്ള വിലാപവും കേൾക്കാം.

ഒരു വിപ്ലവത്തിന്റെ വിജയഹേതു സാധാരണക്കാരായ ജനങ്ങളുടെ പിന്തുണയാണ്. വിപ്ലവം ജനകീയമായിരിക്കണം. ജനകീയമായ അടിത്തറയിൽ പടുത്തുയർത്തപ്പെടുന്ന സമരപോരാട്ടങ്ങൾക്കെ ലക്ഷ്യസാക്ഷാത്കാരം സാധ്യമാവുകയുള്ളൂ. വിപ്ലവകാരികൾ അവതരിപ്പിക്കുന്നത് എത്ര മഹത്തായ കാര്യമാണെങ്കിലും സമൂഹത്തിലെ അടിസ്ഥാന വർഗ്ഗത്തിന്റെ പിന്തുണ അതിനുണ്ടായിരിക്കണം. അല്ലാത്തവ

ഉപരിതല സ്പർശിയായി കടന്നുപോകും. അറുപതുകളിലും എഴുപതുകളിലും വസന്തത്തിന്റെ ഇടിമുഴക്കം എന്ന് വിശേഷിക്കപ്പെട്ട തീവ്രവാദരാഷ്ട്രീയ പ്രസ്ഥാനത്തിനും സംഭവിച്ചത് ജനപിന്തുണയില്ലായ്മയാണ്. തൂക്കുമരങ്ങൾ ഞങ്ങൾക്ക് എന്ന കഥ വിപ്ലവത്തിന ജനപിന്തുണയില്ലാതെ വരുമ്പോഴുണ്ടാകുന്ന പ്രശ്നങ്ങളെയാണ് ചർച്ച ചെയ്യുന്നത്. ഉറുമ്പുകളെപ്പോലും വേദനിപ്പിക്കുവാൻ ആഗ്രഹിക്കാത്ത പരമസാത്വികനായ, ത്യാഗിയായ, അന്യന്റെ ദുഃഖത്തിൽ ദുഃഖിതനും അവന്റെ മോചനത്തിനു വേണ്ടി പ്രവർത്തിക്കുന്നവനുമായ കഥാനായകന പലവിധത്തിലും ശിക്ഷകൾ ഏറ്റുവാങ്ങേണ്ടിവന്നു. ശിക്ഷയ്ക്ക് കാരണമായ തെറ്റുകളാകട്ടെ, യുവതിയെ ബലാത്സംഗത്തിൽ നിന്നും, കൃഷിക്കാരെ വിശപ്പിൽ നിന്നും രക്ഷിച്ചതാണ്. ന്യായാധിപന്റെ മുമ്പിൽ സാക്ഷി പറയുവാൻ പലരും തയ്യാറായി. ജന്മിമാരെ ദൈവത്തിന തുല്യം ആരാധിച്ചിരുന്ന ഒരു കാലഘട്ടത്തിൽ ജന്മിമാർക്കെതിരെ പൊരുതുവാനുള്ള കഥാനായകന്റെ ആഹ്വാനം വേണ്ടത്ര പ്രയോജനം ചെയ്യാതെ പോയി. കർഷകരെ ജന്മിമാർക്കെതിരെ സംഘടിപ്പിക്കുന്നതിൽ അദ്ദേഹത്തിന്റെ ആഹ്വാനം വിജയിച്ചില്ല. 'നിങ്ങൾ വിശന്ന് പൊരിയുന്നവർ! അത്താഴം കഴിക്കാതെ വിളഞ്ഞ വയലുകൾക്ക് കാവൽ നിൽക്കുന്നവർ! വിതയ്ക്കാത്തവരുടെ മുറ്റത്ത് ധാന്യങ്ങൾ എത്തുംമുമ്പ് വിതച്ചവരേ, നിങ്ങൾ ഈ രാത്രിയിൽ മുഴുവൻ ധാന്യങ്ങളും കൊയ്തെടുക്കുക.' കഥാനായകന്റെ ഈയൊരു ആഹ്വാനത്തെ ചെവിക്കൊള്ളുന്നതിന മർദ്ദിത വിഭാഗം തയ്യാറായില്ല. ഈയൊരവസ്ഥ സൂചിപ്പിക്കുന്നത് ജന്മിമാരെ ദൈവത്തിന തുല്യം കണ്ടിരുന്ന അടിയാള വിഭാഗത്തിന ആദ്യകാലങ്ങളിൽ ജന്മിമാർക്കെതിരെ പ്രവർത്തിക്കുവാൻ കഴിഞ്ഞില്ലയെന്നാണ്. കർഷകരെ സംഘടിപ്പിച്ചതിന നായകന ലഭിച്ച ശിക്ഷ കടൽക്കരയിലെ തൂക്കുമരത്തിൽ മരിക്കുന്നവരെ തൂക്കിലിടാനാണ്. പക്ഷേ ആ വിധി നിറവേറ്റുവാൻ നിയോഗിക്കപ്പെട്ടവനാകട്ടെ ആർത്തിരമ്പുന്ന കടൽപ്പരപ്പിലേക്ക് അവനെ എറിയുകയാണുണ്ടായത്. ഒപ്പം നീന്തി രക്ഷപ്പെടുക എന്ന ഉപദേശവും നൽകി. നടുക്കടലിൽ അകപ്പെട്ട മനുഷ്യന്റെ അവസ്ഥയാണ് ജനപിന്തുണയില്ലാത്ത വിപ്ലവ പ്രസ്ഥാനത്തിന്റെതും പ്രവർത്തകരുടേതുമെന്ന് ഇവിടെ സുകുമാരൻ വെളിപ്പെടുത്തുന്നു. തന്റെ കൺമുമ്പിലൂടെ കടന്നുപോകുന്ന യാഥാർത്ഥ്യങ്ങളെ സാക്ഷിനിർത്തികൊണ്ടാണ് കഥാകൃത്ത് വിപ്ലവത്തിന്റെ ജനപിന്തുണയെക്കുറിച്ച് സംസാരിക്കുന്നത്. വിപ്ലവകാരികൾ ആരുടെ

മോചനത്തിനു വേണ്ടിയാണോ പുറപ്പെട്ടത്, ഭരണകൂടം അവരുടെ പിന്തുണയോടുകൂടി വിപ്ലവപ്രസ്ഥാനത്തെയും പ്രവർത്തകരെയും ഇല്ലാതാക്കുന്നതിന തയ്യാറാകുന്നു. ആയിരത്തി തൊള്ളായിരത്തി അറു പതുകളിലെയും എഴുപതുകളിലെയും തീവ്രവിപ്ലവ പ്രസ്ഥാനത്തിന സംഭവിച്ചത് ഇതാണ്.

വർത്തമാനകാലത്ത് ഇടതുപക്ഷ പ്രസ്ഥാനങ്ങൾ നേരിടുന്ന അപ ചയത്തിലേക്ക് വിരൽചൂണ്ടുന്നതാണ് കുറ്റപത്രത്തിന മറുപടി. രാഷ്ട്രീയ നേതാക്കളുടെയും ഉദ്യോഗസ്ഥ മേധാവികളുടെയും അവിശുദ്ധ കൂട്ടുകെട്ട് വിപ്ലവ പ്രസ്ഥാനങ്ങളെ എങ്ങനെ ബാധിക്കുന്നു വെന്നതിന്റെ നേർചിത്രമാണീ കഥ. സത്യസ്വരൂപനെന്ന ശിപായിയുടെ സസ്പെൻഷനെ മുൻനിർത്തിയാണ് സുകുമാരൻ ആശയത്തെ അവതരിപ്പിക്കുന്നത്. വർത്തമാനകാലത്ത് കേരളത്തിലെ ട്രേഡ് യൂണിയൻ പ്രസ്ഥാനങ്ങളിൽ വളർന്നുവരുന്ന അനാശാസ്യ സഖ്യങ്ങളെ കഥാകൃത്ത് കാണുന്നുണ്ട്. തൊഴിലാളി നേതാക്കളും ഭരണാധികാരികളും സൃഷ്ടിച്ചെടുക്കുന്ന സഖ്യത്തിന്റെ മുമ്പിൽ അധ്വാനിക്കുന്ന ജനവിഭാഗം പലപ്പോഴും നിസ്സഹായരായി മാറുന്നു. ഒരു കാലഘട്ടത്തിൽ തൊഴിലാളികളിൽ അവകാശബോധവും വർഗ്ഗബോധവും സൃഷ്ടിക്കുന്നതിനാണ് പ്രസ്ഥാനങ്ങൾ ശ്രമിച്ചിരുന്നതെങ്കിൽ ഇന്ന് അധികാരമെന്ന ഒറ്റ ലക്ഷ്യത്തെ മുൻനിർത്തിയാണ് പ്രവർത്തിക്കുന്നത്. ഇത് പ്രസ്ഥാനത്തിന സംഭവിച്ച അപചയത്തെയാണ് കാണിക്കുന്നത്. അപചയത്തിന്റെ ഒരു രക്തസാക്ഷിയായി സത്യരൂപനേയും കാണാം. തൊഴിലാളികളുടെ അവകാശങ്ങൾ സംരക്ഷിക്കുന്നതിന വേണ്ടി പ്രക്ഷോഭപരിപാടികളിൽ പങ്കെടുക്കുകയും ആലപ്പുഴ ലോക്കപ്പിൽ ധീരരക്തസാക്ഷിത്വം വരിക്കുകയും ചെയ്ത അച്ഛന്റെ മകനാണ് സത്യസ്വരൂപൻ. അച്ഛന്റെയും മകന്റെയും കാലഘട്ടത്തെ അവതരിപ്പിച്ച് രണ്ട് കാലഘട്ടങ്ങൾ തമ്മിലുള്ള അന്തരവും കഥാകൃത്ത് ഇവിടെ വിവരിക്കുന്നു. ഈ മാറ്റം ഭയാനകമാണ് ഏതൊക്കെ ലക്ഷ്യങ്ങളെ മുൻനിർത്തിയാണോ കമ്മ്യൂണിസ്റ്റ് പ്രസ്ഥാനം അതിന്റെ ആദ്യ കാലഘട്ടങ്ങളിൽ പ്രവർത്തിച്ചത് അതിൽ നിന്നെല്ലാം പ്രസ്ഥാനം ഇന്ന് അകന്നിരിക്കുന്നു. ഈയൊരു അവസ്ഥാവിശേഷവുമായി പൊരുത്തപ്പെട്ട് പോകുന്നതിന പല പ്രവർത്തകർക്കും കഴിയാതെ വന്നു. ഇത്തരമൊരു സാഹചര്യമാണ ഇവിടെ തീവ്രവിപ്ലവ പ്രസ്ഥാനം ഉടലെടുക്കുന്നതിന കാരണമായത്. അതുകൊണ്ട് കുറ്റപത്രത്തിന മറുപടി എന്ന കഥ

തീവ്രവാദ രാഷ്ട്രീയ പ്രസ്ഥാനത്തിന്റെ ഒരു പശ്ചാത്തല കഥയായി വിലയിരുത്താം.

ഭരണവർഗ്ഗത്തിന എവിടെയും എല്ലാക്കാലത്തും ഒരേ മുഖം തന്നെയാണ്. കാലാനുസൃതമായി ഭരണാധികാരികൾക്ക് മാറ്റമുണ്ടാകുമെങ്കിലും അവരുടെ ഭരണ നയങ്ങളിലോ പ്രവർത്തനങ്ങളിലോ ജനങ്ങളോടുള്ള മനോഭാവത്തിലോ യാതൊരു മാറ്റവുമുണ്ടാകുന്നില്ല. ബ്രിട്ടീഷ് ഇന്ത്യയിലും ജനാധിപത്യ ഇന്ത്യയിലും ഭരണാധികാരികൾ ഒരുപോലെയാണെന്ന ആശയം സിംഹാസനത്തിൽ തുരുമ്പ് എന്ന കഥ മുന്നോട്ട് വയ്ക്കുന്നു. പുതിയ മേയർ നഗരത്തിന്റെ ഭരണം ഏറ്റെടുത്തപ്പോൾ ജനങ്ങൾ സന്തോഷിച്ചെങ്കിലും പഴയ മേയറെപ്പോലെ തന്നെ ജനങ്ങളെ അടിച്ചമർത്തുന്ന നയം തന്നെയാണ് പുതിയതെന്നും താമസിയാതെ ബോധ്യപ്പെട്ടു. അവസാനത്തെ വൈസ്രോയിയായ മൗണ്ട്ബാറ്റൺ തന്നെയാണ് പഴയ മേയർ. പുതിയ മേയറാകട്ടെ നെഹറുവും. മൗണ്ട് ബാറ്റനെന്നോ നെഹറുവെന്നോ പേര് കഥാകൃത്ത് സൂചിപ്പിക്കുന്നില്ല. പക്ഷേ കഥയിൽ നിന്ന് തന്നെ ഇവരെയാണ് സൂചിപ്പിക്കുന്നതെന്ന് വ്യക്തമാകുന്നുണ്ട്. അതിന തെളിവ് പുതിയ മേയർ തന്റെ മാറത്ത് വെളുത്ത പുഷ്പവും ധരിച്ചു കൊണ്ടാണ് ജനങ്ങളുടെ മുമ്പിൽ പ്രത്യക്ഷപ്പെടുന്നത്. ബ്രിട്ടീഷ് ഭരണവും നെഹറു ഭരണവും കഥാകൃത്ത് ഇവിടെ താരതമ്യം ചെയ്യുന്നു. സുകുമാരന്റെ വീക്ഷണത്തിൽ കോളനി ഭരണകാലത്തും ജനാധിപത്യ ഭരണത്തിലും സമൂഹത്തിന്റെ താഴേതട്ടിലുള്ള അധ്വാനിക്കുന്ന ജനവിഭാഗങ്ങളുടെ ജീവിതരീതിക്ക് ഒരു മാറ്റവും സംഭവിക്കുന്നില്ല. ചൂഷണത്തിന എല്ലാകാലത്തും വിധേയരാകാനാണ് വിധി.

സുകുമാരന്റെ വ്യക്തി ജീവിതവും സാഹിത്യ ജീവിതവും ഭിന്നമല്ല. രണ്ടും പരസ്പര പൂരകങ്ങളാണ്. വ്യക്തിജീവിതത്തിൽ സുകുമാരൻ തീവ്രവിപ്ലവാഭിമുഖ്യം പ്രകടിപ്പിച്ചു എന്നാൽ സമത്വസുന്ദരമായ ലോകത്തെ സ്വപ്നം കണ്ടുകൊണ്ട് വിശ്വസിച്ചിരുന്ന പ്രസ്ഥാനങ്ങളും പ്രത്യയ ശാസ്ത്രങ്ങളും തകരുന്ന അവസ്ഥ അദ്ദേഹത്തിന കാണേണ്ടിവന്നു. അതുകൊണ്ടാണ് മലയാളത്തിലെ ഒരു പിടി നല്ല കഥകളുടെ രചയിതാവായ സുകുമാരൻ ഒരു വ്യാഴവട്ടം മൗനത്തിലാണ്ടത്. തന്റെ അവസാന കൃതിയായ പിതൃതർപ്പണം എന്ന നോവലറ്റിൽ വിപ്ലവകാരിയായ കഥാനായകൻ പ്രസ്ഥാനത്തിന്റെ അപചയം ഭയന്ന് ആത്മഹത്യ ചെയ്യുന്ന കാഴ്ചയുണ്ട്. ഈയൊരു അവസ്ഥാവിശേഷത്തെ

കഥാകൃത്തിന്റെ ജീവിതവുമായി കൂട്ടിച്ചേർത്ത് വായിക്കാവുന്നതാണ്. കടുത്ത നിരാശയിലാണ് തന്റെ അവസാനത്തെ കൃതി അദ്ദേഹം എഴുതിയത്. തുടർന്ന് അദ്ദേഹം മൗനത്തിന്റെ വാല്മീകത്തിൽ വാസമുറപ്പിക്കുകയും ചെയ്തു.

ഉപസംഹാരം

ആയിരത്തി തൊള്ളായിരത്തി അറുപതുകളിലും എഴുപതുകളിലും കേരളത്തിന്റെ സാമൂഹ്യമണ്ഡലത്തെയും വൈജ്ഞാനിക മേഖലയേയും ഏറെ സ്വാധീനിച്ച നക്സലൈറ്റ് പ്രസ്ഥാനത്തോട് ആഭിമുഖ്യം പുലർത്തിയിരുന്ന എഴുത്തുകാരനാണ് എം.സുകുമാരൻ. ഈ പ്രസ്ഥാനത്തിന്റെ വളർച്ചയും പ്രവർത്തന ശൈലിയും പിൽക്കാലത്തുണ്ടായ മൂല്യച്യുതിയുമെല്ലാം അദ്ദേഹം തന്നെ കഥയ്ക്ക് പ്രമേയമായി സ്വീകരിക്കുന്നു. വർഗ്ഗസമരത്തെ വിഭാവന ചെയ്ത കമ്മ്യൂണിസ്റ്റ് പ്രസ്ഥാനങ്ങൾ കേവലം വർണ്ണ സമരത്തിലേക്ക് അധഃപതിക്കുന്നതിന്റെ ചിത്രവും നമുക്ക് അദ്ദേഹത്തിന്റെ കഥകളിൽ കാണാം. കേരള ചരിത്രത്തിലെ സംഭവബഹുലമായ ഈ കാലഘട്ടത്തെ കലാപരമായി അനാവരണം ചെയ്യുകയാണ് എം. സുകുമാരൻ.

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