



ST. THOMAS COLLEGE

Ranni, Pathanamthitta, Kerala - 689673

ACCREDITED BY NAAC WITH 'B' GRADE

3.3.1 : DIGITAL JOURNALS

CRITERION : 3

**RESEARCH, INNOVATIONS
AND EXTENSIONS**

ISSN: 0976-8165

Vol. 8, Issue-V (October 2017)

THE CRITERION

AN INTERNATIONAL JOURNAL IN ENGLISH

Bi-Monthly Refereed and Indexed Open Access eJournal

8th Year of Open Access

The Criterion 

Editor-In-Chief: Dr. Vishwanath Bite

www.the-criterion.com

About Us: <http://www.the-criterion.com/about/>

Archive: <http://www.the-criterion.com/archive/>

Contact Us: <http://www.the-criterion.com/contact/>

Editorial Board: <http://www.the-criterion.com/editorial-board/>

Submission: <http://www.the-criterion.com/submission/>

FAQ: <http://www.the-criterion.com/faq/>



Galaxy: International Multidisciplinary Research Journal
www.galaxyimrj.com

ISSN 2278-9529

SOCIAL CHANGES AMONG WOMEN- A STUDY OF PATHANAMTHITTA DISTRICT, KERALA

Deepa Roselin Joseph

Assistant Professor, Department of History, St. Thomas College, Ranny, Kerala, India

Received: 28 Mar 2018

Accepted: 17 Apr 2018

Published: 20 Apr 2018

ABSTRACT

This paper studies the changes in the social status of women in an agrarian district of Kerala. During the past three or four decades significant changes have taken place here which changed the economic conditions of the district which in a way changed the society too. Improvement in the status of women is a crucial factor in the development of a region. So the social changes among women in this district are analyzed using the four indicators, sex ratio, and access to education, health, and participation in the labour force.

KEYWORDS: Social Change, Sex Ratio, Life Expectancy, Work Participation Rate

INTRODUCTION

Change, which is the law of nature, simply means alterations in the underlying structure of an object or situation over a period of time. Human society is no exception as it is a part of nature. Social change which occupies a dominant place in the consciousness of humanity is a general term, which refers to changes in social structure: nature, the social institutions, the social behavior or the social relations of a society, a community of people, and so on.

Women have been an integral part of the social structure not only because of their importance in the reproduction and caring of the human race, but also by virtue of their significant contribution to socio-economic progress. Gender analysis views women and men in terms of the roles they play in society, roles that change as societies change. Improvement in the status of women is a crucial factor in the development of a region. The study of social changes among women is important because it forms one of the most trustworthy and reliable indices of the state of society and indicates the nature and direction of social change.¹

The socio-economic status of women in Kerala related to that of men reveals that the position of feminine folk in the State is much advanced than that in other states of the country. Laudable achievements are there in the socio-demographic realms, such as a favourable sex ratio, high levels of literacy, high health standards unseen in other parts of the country.² Thus, it has become a commonplace in development studies literature that the agency of women has contributed significantly to the high social development in Malayalee society.

¹ Abha Chaudhan, *Tribal Women and Social Change in India*, (Bombay: A.C. Brothers, 1990) 34.

² Robin Jeffrey, *Politics, Women and Well-being: How Kerala became a Model* (New Delhi: Macmillan, 1993) 11.



BACKGROUND CAUSES OF HUMAN CATARACT IN THE THREE COASTAL DISTRICTS OF KERALA

Aleyamma Kuruvilla* and Issac Thomas

Department of Zoology, St. Thomas College, Ranni-689673 Pathanamthitta, Kerala, India

ARTICLE INFO

Article History:

Received 7th April, 2018

Received in revised form 16th

May, 2018 Accepted 3rd June, 2018

Published online 28th July, 2018

Key words:

Cataract, prevalence, districts, coastal, Thiruvananthapuram, Kollam, Alappuzha, background causes

ABSTRACT

Introduction: - Cataract is considered as a condition and not a disease, they develops due to multiple reasons.

Methodology:- A structural questionnaire was distributed among the patients in the hospitals, as well as in the houses in the three coastal districts directly or through the nurses to identify the background causes of three southern coastal districts (Thiruvananthapuram, Kollam, Alappuzha) of Kerala state.

Result:- Among the peoples participated in the questionnaire method, prevalence were highest among rural than urban or coastal, females than males, unilateral cataract blindness than bilateral cataract blindness, rice used as staple food than wheat and non-vegetarians than vegetarians in all the districts.

Discussion:- It is thus concluded that cataract is a major public health problem in Kerala, many factors including aging, female gender, rural residence, history of other diseases and other drug taken, non-vegetarian food, rice used as staple food and firewood as cooking fuel operating in its causation. The above risk factors are of concern not only for cataract prevention but also for public health at large. The success of public health programs is dependent on a healthy partnership between the government and nongovernmental organizations, and also private sectors.

Copyright©2018 Aleyamma Kuruvilla and Issac Thomas. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

Cataract is considered as a condition and not a disease, they develops due to multiple reasons. Secondary cataracts develop from procedures performed to correct other vision problems such as glaucoma. Traumatic cataracts develop from injury to the eye lens or the eye as a whole. Congenital cataracts are genetic and are found in babies and sometimes develop in childhood. There are also radiation cataracts that develop after some kinds of exposure such as excessive sunlight, ultraviolet or infra-red light. It has been shown that cataracts can develop from long term use of certain steroids as well as some lifestyle habits.

Exposure to even low-level UVB radiation from sunlight increases the risk for cataracts. Neale *et al.*, (2003), provided new evidence supporting the link between sun exposure and nuclear cataracts. The risk was highest among those who had significant sun exposure at a young age.

Vegetables have so much to offer and yet we choose more of non-vegetarian. But the consequences are pretty clear when a person goes to old age.

Obesity and muscle weakness leading to arthritis, low bone density and cataract are very few problems to deal with non-vegetarian food liker's are more in this world than the vegetarian food liking people. It is solely for the reason that non vegetarian is tastier and looks delicious. But the more a person eats non vegetarian, the more he is prone to complex diseases. On the other hand, non vegetarian food, makes the body immune system and health (Bukisa, 2012). Ramakrishnan *et al.*, (1995) favors the idea that cadmium accumulating in the lens directly causes the damage. They have the cadmium data to support that hypothesis, but other components of tobacco smoke and their products in blood may play a role. The interactions of cadmium with various components of the lens have yet to be explored. Plasma membranes, structural proteins, channels, enzymes, receptors, etc are obvious candidates for study. If cadmium is playing a major role in the link between smoking and cataract then workers exposed to high cadmium levels in the cadmium plated steel industry, or those consuming cadmium enriched food - for example, rice in some parts of Japan, might have an increased risk of cataract (Harding, 1995).

PATIENTS & METHODOLOGY

A structural questionnaire was distributed among the patients in the hospitals, as well as in the houses in the three coastal districts (Thiruvananthapuram, Kollam & Alappuzha) of southern Kerala, directly or through the nurses to identify the background causes such as information in the current as prior

*Corresponding author: Aleyamma Kuruvilla

Department of Zoology, St. Thomas College, Ranni-689673 Pathanamthitta, Kerala, India

RELIGION AND LIFE, SOME NEW TRENDS, A STUDY ON THE PILGRIM HEAD QUARTERS OF KERALA

Derpa Roselin Joseph

*Assistant Professor, Department of History, St. Thomas College,
Pazhavanagody, Ranny, Pathanamthitta, Kerala, India*

ABSTRACT

Religion is an important characteristic of the people in any country. This paper studies the changes in the religious trends of a hilly district of Kerala, Pathanamthitta, which is regarded as the pilgrim headquarters of Kerala. As far as religion is concerned, Pathanamthitta district is special in many ways. Belief in God is like breathing air to this pilgrim district of the State. Due to this reason, even the river sand bed of the district is rich with a religious color. Besides the traditional religious groups, the district is witnessing the growth of new sects probably in need of upward mobility. This is also because almost every other aspect of life here is deeply related to religion.

KEYWORDS: Religion, Pathanamthitta, Witnessing

Article History

Received: 21 Aug 2018 | Revised: 06 Sep 2018 | Accepted: 15 Sep 2018

INTRODUCTION

Religion is an important characteristic of the people in any country. Pathanamthitta district of Kerala is well known as the headquarters of pilgrim worship in Kerala. Historically, from the beginning of the Christian era, the district has been able to house new religions and religious sects. When the Brahmins from the other parts of the country established 32 settlements in Kerala, some of them like Aranmula Thiruvalla, Venmani were also in this district. Some other settlements are close to the district on the banks of river Pamba. This had geographical factors behind. The rich and fertile river valleys in the district made it best suitable for wetland agriculture and thus the Brahmins chose to settle down there. One of the most popular pilgrim centers of India, Sabarimala is located in this district. Recently, a number of new sects and new religious formations have either originated or come to prevalence in the district. The trend of emergence of new sects is seen mainly in Christianity and Hinduism. The geography, history, and economy of the district along with migration and such factors influence the religious profile of the district and the change in it over the course of years.

Population by Religion

The major religious groups in the district are Hindus, Christians, and Muslims. The other religious communities like Sikhs, Jains, and Buddhists are insignificant as their percentage to total population is very negligible.

Demographically speaking Hindus constitute more than half of the population in the district in the three censuses which is in accordance with the all Kerala pattern. Regarding the Muslim population, Pathanamthitta is the district with the

EMPOWERMENT THROUGH EDUCATION: THE CONTRIBUTIONS OF CHAVARA KURIAKOSE ELIAS

DR. DEEPA ROSELIN JOSEPH

Assistant Professor, Thomas College, Puthayangudy P.O, Ranni, Kerala, India

ABSTRACT

St. Chavara Kuriakose Elias, a luminary among the topmost social reformers of India, was the leader of Syrian Catholics in Kerala, India. He can be considered as the morning star of social reformers, and he was such great revolutionary who came before the time. The general trend of stagnation during his time was surpassed by his luminous vision, vibrant actions and educational and literary assignments. Along with the duty as a priest in the church, he could render a great service to the general public of Kerala irrespective of caste, creed and colour. The Catholic Church raised him to the status of a saint on 23rd Nov 2014. This study aims at describing the contributions of Chavara in the educational upliftment of his fellowmen, in a caste ridden society, where their conditions were deplorable.

KEYWORDS: Down-trodden, Education, Empowerment, Society & Women

Received: May 09, 2020; Accepted: May 29, 2020; Published: Aug 04, 2020; Paper Id: IJHRDEC20202

1. INTRODUCTION

The British and Indian administrators, who were actuated by liberal impulses introduced even in the early decades of the 19th century, a series of administrative and social reforms with a view to modernize the administration and society of Kerala. By the 19th century, Kerala witnessed a new era of peace and progress, which resulted in a renaissance of its own. The progress of social change in Kerala society during the 19th century has been interpreted as the output of the interplay of several internal and external factors like introduction of Western education, work of Christian missionaries and the progressive works done by the rulers of that time.

The role played by Saint Kuriakose Elias Chavara (1805-1971), a spiritual colossal figure in this regard cannot be confined into a water tight compartment. Saint Chavara was a radical and total transformer, not merely a saint confined to the Church and the Christian community, but who shed light and paved new paths for the wider humanity in general. He was an integral transformer, who contributed immensely to the overall growth of the 19th century Kerala. He is remembered for his various contributions to the socio-cultural development of Kerala. He was endowed with exceptional creative and leadership qualities.

2. OBJECTIVES AND METHODOLOGY

The general objective is to identify the role played by Chavara Kuriakose Elias for the empowerment of Kerala society, using education as the medium. The specific objectives are

- To identify the status of Kerala society in the 18th and 19th centuries.
- To analyze the socio economic status of the marginalized sessions in Kerala, during the 19th century



ORIGINAL ARTICLE

Excellent protection of mild steel in sodium chloride solution for a substantial period of time using a hybrid nanocoating of poly vinyl alcohol and Titania



P.K. Jaseela^a, Mathew Kuruvilla^b, Linda Williams^a, Chinju Jacob^b,
K.O. Shamsheera^a, Abraham Joseph^{a,*}

^a Department of Chemistry, University of Calicut, Calicut University P.O., India

^b Department of Chemistry, St Thomas College, Ramani, Pathanamthitta, India

Received 29 April 2020; accepted 2 July 2020

Available online 9 July 2020

KEYWORDS

Nanocomposite;
Hybrid material;
TiO₂;
PVA;
Corrosion inhibition

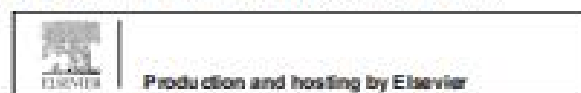
Abstract The production of eco-friendly hybrid sol-gel coatings for long term protection of metallic substrates from aggressive environments was one of the emerging areas, competing with conventional chromate and phosphate coatings. Herein, a nanocomposite has been synthesized from TiO₂ and PVA through a novel sol-gel route and the structure and morphology of the same was characterized using X-ray diffraction, FTIR, UV-Vis spectroscopy, FESEM with EDAX, and AFM studies. The flower-like structured composite offers excellent corrosion protection properties in NaCl solution of sea water salinity. Impedance and polarization studies were carried out to monitor the anticorrosion performance of the materials coating. This coating on mild steel offers 98% inhibition efficiency in NaCl. The influence of loading PVA on TiO₂ and its effect on corrosion efficiency have also been investigated. It is found that an optimum weight of 20 wt% PVA is required in the composite for beneficial corrosion resistance. 92% inhibition efficiency is registered by the coated MS in NaCl solution after 40 days of exposure and is quite encouraging compared to many of the recent reports. The Ti–O–Ti, and Fe–Ti–O linkage along with compactness and adherence of the material together contribute to better blocking of steel corrosion.

© 2020 The Author(s). Published by Elsevier B.V. on behalf of King Saud University. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

* Corresponding author.

E-mail address: abrahamjoseph@uoc.ac.in (A. Joseph).

Peer review under responsibility of King Saud University.



Production and hosting by Elsevier

1. Introduction

The design and fabrication of flexible nontoxic hybrid materials in simple and viable methods are needed to meet the demands of industry for various purposes including the protection of metals/materials from aggressive environments. Mild steel is a common material used in industries due to low cost,



Service quality of state bank of India in Kottayam district

Ravi Jain Raja

Assistant Professor, Post Graduate, Department of Commerce, St Thomas College Ranny, Pathanamthitta, Kerala, India

Abstract

The banking and financial service sector in India is in a stage of rapid transformation. In order to withstand in this competitive era, bank marketers need to be attentive about the service dimensions that are used by customers in selecting banks. If the bankers are successful in understanding this service dimensions, then the bankers can make the gap between the expectation and perception to minimum. In the present study, for measuring the service quality, SERVQUAL Model is used to analyze the difference between service quality expectation and service quality perception of dimensions like assurance, tangibility, reliability, responsiveness and empathy. The present study measures the service quality of State Bank of India in Kottayam District. The study period covered four months starting from October 2020 to January 2021. The study revealed that customers of State Bank of India has higher gap with empathy dimension and lower gap with tangibility dimension.

Keywords: expectation, perception, service quality, SERVQUAL

Introduction

The banking industry has been undergoing through revolutionary changes. In today's intensely competitive economy, providing excellent customer service plays a vital role in the success of banking industry. For that banks are giving greater emphasis on delivering quality services to the customers. Customers who experienced discontent with the quality of service will automatically switch over to the competitors. Increased competition, highly educated customers and increased standard of living are forcing the banks to give greater emphasis on quality. When banking business gives greater emphasis on quality dimensions, then they can retain existing customers and also acquire new ones and also such banks can differentiate itself from its competitors. Hence Banks need to provide consistent service quality to maintain their market share and it is deemed as the crucial success factor that influence the existence of any organization particularly banks.

Service quality is considered as researchable area in all service oriented industries such as banking, tourism, hospital etc. In the service industry particularly banks, the concept of service quality leads to focus on meeting customer needs and requirements and to find out how well the service delivered meets their expectations. For that purpose, the banking organizations must first identify what it is that constitutes quality to those whom it serves. Quality is defined as the discrepancy between perception and expectations of customers. It is the key factor that influences the formation of perception, expectations and level of satisfaction of the customer with regard to any product and service.

Service quality is the degree and direction between customer service expectations and perceptions. Perceived service quality is defined as the evaluation of the service across the episodes when compared to some explicit or implicit standard.

Further, it can be seen as how well a service satisfies the expectations of customers. Thus service quality is considered as the difference between customer expectations of service and perceived service. If expectations are greater than performance, then perceived quality is less than satisfactory and hence customer dissatisfaction occurs. The organizations particularly banks must try to lower the service quality gap. When there is lower gap, it implies that the experience of customers regarding various service attributes meet the expectation of customers and vice versa. Hence the bank must take adequate steps to lower the service quality gap.

Various researchers have developed different models for measuring the service quality. They are: Gronroos Model of Technical and Functional quality, GAP Model by Parasuraman, Zeithaml, Berry, Haywood Farmers Attribute Service Quality Model, SERVQUAL Model of Service Quality, Synthesized Model of Service Quality, SERVPERF Model of Service Quality, Attitude Service quality Model, The P-C-P service attribute Model of Philip and Harlin, BSQ Model, BANSQUAL Model and so on. In the present study the researcher has employed SERVQUAL model for measuring service quality.

Rationale of the paper

Service quality is one among the foremost attractive and researchable areas for researchers over the last decade in the banking sector. As India is moving towards greater economic liberalization, causing customer expectation in all areas relating to customer service has been of prime importance for the banking sector in India. As a result of significant growth of banks in India, customers in the banking sector have strong bargaining position. Hence banks should be very vigilant while providing services because of this can their competitors within the banking industry.

1

To exist in the competitive era, banks must identify and implement new strategies which will satisfy and delight their customer. Thus customer satisfaction as well as customer delightment are viewed as the essence of success of any service organization. High customer satisfaction is pre requisite for having a loyal customer base. Hence both the concepts customer satisfaction and customer delightment can be attained by rendering quality services to its customers. Thus, customer satisfaction is the outcome of service quality. Banking sector in India has made phenomenal development since independence. It has witnessed a major transformation from class banking to mass banking. The banking revolution which are key for providing effective customer service at lowest possible costs have been undergone through drastic development in innovation and information technology. IT based services such as Automated Teller Machines (ATM), EFT, anywhere-anytime banking, smart cards, net banking, mobile banking and swift etc are no longer alien concepts to Indian banking customers. The banks have had to respond with an array of digitization and innovation initiatives. These initiatives employ cutting edge technologies to ensure a customer centric perspectives rather than traditional focus on products. The various technologies are Augmented reality, Block chain, Robotic process automation, Quantum computing, Artificial intelligence, API platform, Prescriptive security, Hybrid cloud, instant payments and smart machines. This all technologies have forced Indian banking institution to enter the trade-off between winning new customers and retain old ones.

In order to sustain and grow in the face of stiff competition, issues concerning with maintaining service quality in India banking sectors have to be studied extensively and widely. The successful banker must have the ability to anticipate and

State Bank of Hyderabad, State Bank of Travancore and State Bank of Patiala and with the Bharatiya Mahila Bank, which had been considered as the bank exclusively for women. State Bank of India is regarded as one of the responsible and trustworthy bankers by the general public of India. It is the need of the hour that State Bank of India should give prime importance for delivering services to its customers. Against such a backdrop, the scope for studying the service quality of State Bank of India has its own significance.

Objectives of the study

1. To measure the Service Quality Gap with respect to tangibility, assurance, reliability, responsiveness and empathy dimensions of customers of State Bank of India.
2. To give suggestions on the basis of findings of the study.

Literature review

The present study is an attempt to study the service State Bank of India. The studies pertaining to it are reviewed in this section. The sources are in relevant scholarly research studies, journals, books.

Nitin Seth and S.G. Dhanasekhar (2015) ⁽¹⁾ attempt, various service quality models covering the gap, conventional services to web interacted services. The study concluded that service quality outcome and measurement is dependent on type of service setting, situation, time, need etc. In addition, even the customer's expectations towards particular services are also changing with respect to factors like time, increase in the number of customers with a particular service, competitive environment, etc.

Manita Brahmabhatt and Dharmendra Pawalia (2008) ⁽²⁾




Cite this: *RSC Adv.*, 2022, 12, 14328

The co-adsorption of thymohydroquinone dimethyl ether (THQ) and coumarin present in the aqueous extract of *Ayapana triplinervis* on mild steel and its protection in hydrochloric acid up to 323 K: computational and physicochemical studies

Jeeja Rani AT,^a Asha Thomas,^a Mathew Kuruvilla,^b Muhammed Arshad^a and Abraham Joseph^{a*}

This study evaluates the corrosion inhibition property of the aqueous and alcoholic leaf extracts of the medicinal plant *Ayapana triplinervis*. The major components in the extracts are thymohydroquinone dimethyl ether (THQ) and coumarin. It is clear from the weight-loss studies that the water extract of the leaves (AYW) is superior to the alcoholic extract (AYA) in terms of offering corrosion inhibition. The 96% efficiency of 4% (v/v) AYW in 0.5 N HCl at room temperature changes to 84.62% at 323 K. The mixed-type inhibition behaviour of AYW shows slight dominance in the anodic direction. Studies suggest the multilayer adsorption of phytochemicals on the metal surface and that the adsorption follows the Temkin model. Theoretical studies using DFT and BIOVIA Materials Studio investigations establish THQ as a good inhibitor with high adsorption characteristics. Even though the concentration of coumarin in the extract is low, its presence in the extract facilitates the adsorption of THQ on the metal surface, which is evident from the MD simulation study. The changes in the surface topography and elemental composition of the metal specimen in the inhibited and uninhibited solution are monitored by SEM and EDX spectral studies. XPS data support the presence of both THQ and coumarin on the metal surface and the existence of co-ordinate bonding between the metals d orbital and the O atoms of THQ. Theoretical and experimental studies support the mixed mode of adsorption of THQ as physisorption followed by chemisorption.

Received 1st April 2022
Accepted 22nd April 2022

DOI: 10.1039/d2ra02109a

rsc.li/rsc-advances

1 Introduction

Corrosion, though undesirable, is an unavoidable natural process leading to the destruction of metals and alloys. This material deterioration leads to environmental pollution to different extents including loss of resources, maintenance problems, serious damage to the entire ecosystem, and economic recession. In this context, researchers and scientists all over the world are in search of better and viable remedies to resolve these problems.^{1,2} The use of eco-friendly inhibitors is one of the accepted strategies for managing material dissolution in aggressive environments. In the early days, we used synthetic organic and inorganic compounds as corrosion inhibitors. However, recent environmental issues have made scientists and researchers focus on these issues before applying different chemicals as corrosion inhibitors. Hence, research in the area of corrosion inhibitors is targeted at environmentally

benign, economically viable, easily available, and more effective materials in terms of efficiency over synthetic ones.^{3,4} Most of these requirements could be met by the usage of plant extracts as corrosion inhibitors. Extracts can be made from leaves, stems, roots, bark, fruits, peels, seeds, flowers, and from the entire plant itself. The extracts serve as efficient inhibitors as all plant parts are 'reservoirs' of many phytochemicals that possess several heteroatoms, aromatic rings, electron-rich groups, and heterocyclic ring systems. These phytochemicals alone or their synergistic interaction make the plant extract an effective inhibitor for different metals in different environments. These organic inhibitors mitigate the corrosion rate mainly by getting adsorbed on the metal surface through their polar functional groups and multiple bonds, while inorganic inhibitors reduce the corrosion rate by influencing the anodic or cathodic processes of corrosion.⁵ Vashi *et al.* demonstrated *Bacopa monnieri* leaf extract as an efficient corrosion inhibitor for Al in HCl. This inhibitor shows a maximum efficiency of 91.89% at 1.2 g L⁻¹. El-Housseiny *et al.* investigated the inhibition ability of *Cassia* plant extract as a mixed-type inhibitor for Zn in 0.5 M sulphuric acid using electrochemical methods. Umaren

^aDepartment of Chemistry, University of Calicut, Kerala-673 635, India. E-mail: abrahamjoseph@uoc.ac.in

^bSt. Thomas College, Kanan, Pathanamthitta, Kerala, India


LETTER

Open Access



Efficacy in degradation of carcinogenic pollutant sulforhodamine B by green synthesized silver nanoparticles

Ramakrishnan Jayakrishnan^{1*}, Anju Joseph² and Vinoy Thomas²

Abstract

Colloidal Silver nano-particles were grown at room temperature using leaf extract of *Ocimum tenuiflorum*. The silver nanoparticles suspended in the solution were found to be stable for over a period of 2 months. Structural, optical and photo catalytic behavior of the suspended silver (Ag) nano-particles (NPs) was characterized. From TEM analysis the size of the silver nanoparticles was estimated to be 25–30 nm. Our findings suggest that the ratio between the molarity of AgNO₃ and the volume of leaf extract does not have any role in controlling the size of the Ag nano-particles. These green synthesized Ag nano-particles exhibit degradation of the carcinogenic organic pollutant sulforhodamine B in absence of light.

Keywords: Nano-fluids, Ag Nano-particles, Photo-catalysis

Introduction

The emergence of nanotechnology and nano-medicine has opened an arena for research on bio-compatible materials with therapeutic potential. Silver is widely used in anti-microbial medicines, and in anti-biotic coatings on surgical equipment [1]. Silver exhibits the highest thermal and electrical conductivity among all known metals. Biological activity of silver has been attributed to the Ag⁺ ion [2]. The advancements in the field of nano-science resulted in development of Silver nano-particles (Ag-NPs) which exhibit unique physical and chemical properties [3]. The chemical stability, ability to exhibit localized surface plasma resonance, photo-catalytic activity and high conductivity resulted in renewed research interest on this material [3–5]. With the advent of new research tools and techniques Ag-NPs have demonstrated their applications in opto-electronic devices, food industry, cosmetics and antifungal effects and have

eventually improved the tumor-killing properties of anti-cancer drugs [6–9].

Compared to physical and chemical methods that are trending the green route stands at advantage in being less dependent on requirements of solvents, capping agents and reducing agents [10–12]. *Ocimum tenuiflorum* also called the “Queen of the Herbs” is widely used in Indian Ayurveda for its diverse healing properties [11]. The leaves of *Ocimum tenuiflorum* contain a diversity of ingredients that have biological activity, including saponins, flavonoids, triterpenoids, and tannins [10–12]. It is well established that the biological activity of AgNPs is governed by factors like surface chemistry, size, size distribution, shape, particle morphology, particle composition, coating/capping, agglomeration and the type of reducing agents used for the synthesis of AgNPs [13–15]. The use of *Ocimum tenuiflorum* leaf extract for the production of Ag-NPs has not been reconnoitered extensively [16, 17]. The use of the medicinal plant extract also opens up the possibility of synthesizing bio-compatible Ag-NPs that may find diverse applications [18–20].

Sulforhodamine B is a carcinogenic dye which is used by scientists as a classical aromatic pollutant to study

*Correspondence: jk@keralauiversity.ac.in

¹Photochemical Research Laboratory, Department of Physics, University of Kerala, Karyavattom (60), Thiruvananthapuram, India

Full list of author information is available at the end of the article



© The Author(s) 2021. Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.