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Editorial

ACADEMIA, a multi disciplinary research journal, is an initiative of Nehru Arts and Science College Kanhangad for highlighting original research work of teachers and students. The journal features articles pertaining to current relevant areas of research. It aims at exploring and exhibiting the potentials of stakeholders of our college. NAS college is proud to publish this journal during the golden jubilee year. I would like to thank everyone for their contributions that have enriched the third volume of ACADEMIA.

Dr. Naseema. K

Table of Contents

Studies on the Structural and Optical Properties of Copper Sulphide Nanoparticles Prepared By Chemical Precipitation Method

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Abstract

Cu_xS nanoparticles were synthesized using chemical precipitation method. The structural and optical studies were done by using X-ray diffraction and UV-Visible-NIR spectroscopy respectively. The XRD result shows high intensity major peaks at 2θ values 27.103^o, 29.25^o, 34.99^o with h k l planes (100), (102), and (104) respectively. The crystallite size of the particles was calculated using Debye Sherrer formula and it was found to be 1.55nm. The as-synthesized particles show low absorbance and high transparency in the visible region. Considerable absorbance in the near infrared region and the increased optical band gap makes the synthesized nanoparticle a good candidate for photovoltaic and optoelectronic applications.

Key words: XRD, UV-Visible-NIR, Cu_xS

1. INTRODUCTION

Rapid advancement in technology changes the world day by day by inventing new materials. Nano Science as a leading branch helps for the development of novel materials suitable for modern society. Due to their small size, nanoparticles exhibit good physical, magnetic, electronic and surface properties [1, 2]. They have wide range of applications such as film deposition, coating, nano fluid as coolant and medicinal applications like cancer treatment, pharmaceutical applications etc.[3]. Nowadays the synthesis of metal chalcogenide nanoparticles gained more attraction due to their unique nano scale properties that makes them an ideal candidate for photovoltaic applications [4]. Among the semiconducting materials, metal sulphides are more attractive because of their characteristic band gap, high extinction coefficient and suitability for solar cell applications such as light absorbers [5]. Copper sulphides are the simplest metal chalcogenide which fall in the binary semiconductor category. The Cu_xS, which is a P-type semiconductor with the x varies between 1 and 2 are Cu_2S (Chalcocite), CuS (Covellite), $Cu_{1.96}S$ (djurleite), $Cu_{1.8}S$ (digenite) and $Cu_{1.75}S$ (anilite) [6-7]. Various methods for the synthesis of copper sulphide nanoparticles are high temperature solution phase method, low temperature solution route, colloidal route, micro emulsion method, sonochemical route, thermolysis route, chemical precipitation route etc. The present work reports the chemical precipitation synthesis of copper sulphide nano

particles. The crystal nature of the particle was studied by X-ray diffraction method and the optical properties were analyzed using UV- visible NIR spectroscopy technique.

2. EXPERIMENTAL DETAILS

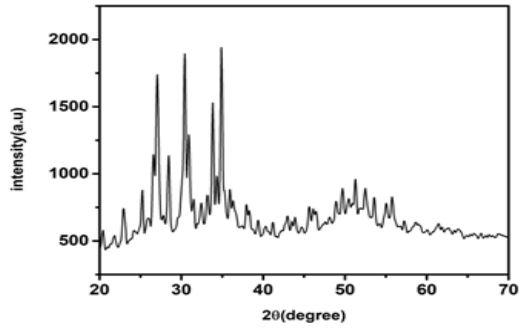
Cu_xS nanoparticles were synthesized using simple, low cost chemical precipitation method. For the synthesis first of all, solutions of 0.4M copper chloride $[CuCl_2.2H_2O]$ and 0.4M thiourea $[CH_4N_2S]$ were prepared in 100 ml deionized water separately. Both the prepared solutions were stirred well for half an hour using a magnetic stirrer at 750 rpm. Then thiourea solution was added with copper chloride solution. Finally white colour precipitate was collected from the solution. To remove the last traces of adhered impurities, the precipitate was washed several times using deionized water and acetone. Then the washed particles were dried at 100^{o}C and allowed to cool at room temperature. Finally the particles were grinded using a mortar to obtain fine powder. As obtained Cu_xS nano particles were characterized using X-ray diffraction and UV-Vis NIR spectroscopy analysis.

3. RESULTS AND DISCUSSIONS

3.1. X-ray diffraction analysis

The structural studies of prepared nanoparticles were carried out by using X-ray diffractometer with $Cu - K\alpha$ radiation of wavelength 1.5405 A^o over the diffraction angle 2θ between 20^o and 70^o. Fig 1 shows the XRD spectrum of as prepared copper sulphide nanoparticles.

Figure 1: XRD pattern of Cu_xS nanoparticles



The XRD result shows high intensity major peaks at 2θ values 27.103^o, 29.25^o, 34.99^o with hkl planes (100), (102), and (104) respectively. The peak at 33.8^o shows the presence of $Cu_{1.97}S$, orthorhombic djurleite (JCPDS-20-0365). This confirms the formation of copper sulphide nanoparticles. Crystallite size of the particles was calculated using Debye-Scherrer formula (Eqn 1) [8]

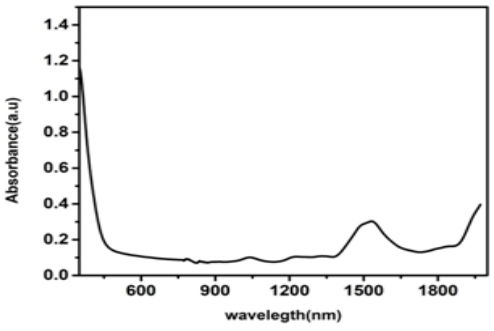
$$D = \frac{k\lambda}{\beta cos\theta} \tag{1}$$

Where D is the Crystallite size, k is a crystallite shape factor which takes the value of 0.9, λ is the wavelength of X ray which is $1.5405A^o$ for $Cu-K\alpha$ and β is the full width at half maximum(FWHM) in radians and θ is the Bragg's diffraction angle. The calculated crystallite size is found to be 1.55 nm.

3.2. UV-Visible spectroscopy analysis

The optical properties of the as prepared nanoparticles were studied using UV-Visible NIR spectroscopy analysis. The absorption spectrum of as prepared nanoparticles is shown in Fig. 2.

Figure 2: Absorption spectrum of Cu_xS nano particles

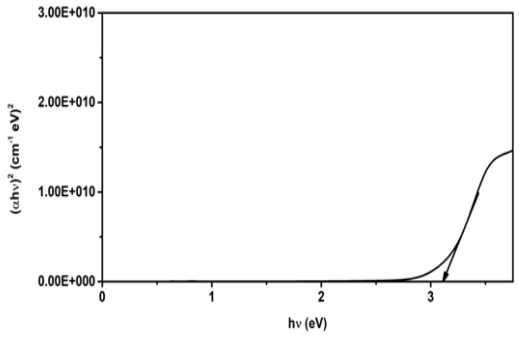


From the graph it is clear that the particles show low absorption over the visible region and is highly transparent in nature. It shows considerable absorbance in the near infrared region there by making it ideal for solar cell applications [9]. Optical band gap of the nanoparticles was calculated using the Tauc relation (Eqn 2) [9].

$$(\alpha hv)^2 = A(hv - E_g) \quad (2)$$

Where A is the absorption coefficient, E_g is optical band gap of the sample and hv is the photon energy. The plot of $(\alpha hv)^2$ versus hv for the Cu_xS nanoparticles is shown in Fig.3. The intersection of the slope to curve at x axis gives the optical band gap of the Cu_xS nanoparticles. Obtained band gap is $3.11eV$ which is higher than the bulk ($1.2eV$) [10].

Figure 3: Tauc plot of Cu_xS nanoparticle



4. CONCLUSION

Cu_xS nanoparticles were synthesized using chemical precipitation method. The crystallite size of the particle was found to be 1.55nm. The optical band gap is increased compared to the bulk. Absorption peak in the near infrared region makes the particle a good candidate for photovoltaic applications.

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Hailsham as a Gilded Cage–Tracing Dystopian Elements in Kazhuo Ishiguro's *Never Let me Go*

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The word Utopia comes from the Greek for utopia meaning "no place", and eutopia, meaning "good place", the word itself is a pun referring to a nonexistent good place. Dystopias are the opposite of utopias; they are horrific places, usually characterized by degenerate or oppressive societies. Dystopia has its origin from the Greek for "bad place", the opposite of a utopia. Accounts of dystopias inevitably conclude by depicting unpleasant, disastrous, or otherwise terrifying consequences for the protagonist as well as for humanity as a whole. Although the term "dystopia" would not be recognized until the last quarter of the twentieth century, it was coined almost a hundred years earlier as a humorous way of referring to the opposite of "utopia"

There have been many Utopias and Dystopias in the literature. Soon after the advent of Thomas More's *Utopia* many more Utopias came into literature. They included *The City Of The Sun*(1623) by Rabelais, *The Commonwealth of Oceana* (1656) by Harrington, Johnson's *Rasselas* (1787) and B F Shinner's *Walden Two* (1945). All these Utopias incorporate man's longing for a good life by projecting wishful fantasies of individual authors.Then came the dystopian turn in literature with a number of dystopian novels including *Nineteen Eighty Four* by George Orwell, The *Handmaid's Tale* by Margaret Atwood, *Divergent* by Veronica Roth, *The Giver* by Lois Lowry, *Never Let Me Go* by Kazuo Ishiguro and the list goes on. These dystopian novels had good audience and thus this kind of writing was promoted and encouraged during all time in the literature.

Both dystopian criticism and modern cultural criticism thus seem to respond in the air of crisis that had pervaded much of the twentieth century thought. Mark Hillegashas commended that the "flood" of dystopian works by writers like Zamyatin, Huxley and Orwell provide "one of the most revealing indexes to the anxieties of our world". Mainly there are two ideas, which are intimately connected which fed dystopian discourse. They are the idea of totalitarianism and on the other hand, the idea of scientific and technological progress which, instead of impelling humanity to prosper, has sometimes been instrumental in the establishment of dictatorships. Dystopia describes a futuristic society in which technology, corporation, and a totalitarian government exerts absolute control over its people. Dystopian Fiction includes a "worst- case scenario" that asks readers to consider the implications of human behavior, including how we treat others.

Kazuo Ishiguro is a Nobel Prize winning British Novelist, screenwriter, and short-story writer who has written many novels including *A Pale View of Hills* (1982) , *The Buried Giant* and *The Remains of the Day* (1989) for which he received the Booker Prize for Fiction. In Kazuo Ishiguro's *Never Let Me Go* we can see an oppressive government or

superior head which treats people or the citizens differently. The main problems faced by the people of that area is lack of freedom. In both the novels the people are under strong surveillance and they do not even have the liberty to enjoy their life in all means.The golden cage (or what is called a "gilded cage") is one that suggests living in luxury but without freedom. Hailsham appears to be a very dystopian experiment to raise children who have been cloned for use of their organs.

The novel Never Let me Go is all about Kathy and her friends Ruth and Tommy who grew up at Hailsham. This place seems to be an idyllic boarding school in England. The novel talks about an individual who is proudly giving the picture of her career as a carer to the readers. Kathy is too proud about her profession as a carer. It is only later revealed that children cared for at Hailsham are actually clones who were created for the purpose of donating their organs when they reach their adulthood. When Kathy and Tommy grow up and meet their former Head Mistress, they discover that Hailsham was created as an experiment, providing humane treatment to cloned students in contrast to conditions at other institutions.The dystopian fiction typically portrays a setting that is at odds with the author's ethos. The society of Hailsham in *Never Let Me Go* does not see cloned beings as fully human. Even though these cloned people are doing something good for the society they are neglected by the rest. The theme of the novel explores the power of art to reveal humanity. The guardians (teachers) of Hailsham encourage the children to produce art, which is displayed in exhibitions. This is a part of the effort to show the rest of the society that clones are as humans as anyone else.

Dystopian fiction often serves as a warning of the dangers of dehumanizing the 'other', any group of people seen as different or inferior.The novel is the story of Kathy H, a clone who relates what it was like to grow up in an institution established under this program and how she and a fellow inmate eventually confronted an official whose efforts to make the program more humane had failed. *Never Let Me Go* speculates about a use to which technology might be put in the future. It is the story of an entire society that, in the name of public health, requires one class of people to surrender their lives for the benefit of others.

In Hailsham the Exchange Sales occur at the school ground during which Kathy buys a cassette tape from a woman named Judy Bridgewater, which contains the song entitled "Never Let Me Go". This particular song evokes strong feelings in Kathy and in her dorm she dances slowly to the music, holding an imaginary child in her arms. Kathy notices that this dancing cause Madame Geraldine to cry and she is initially confused by these incidents. Later Kathy realizes that she cannot have children and that is what made Madame and other people feel sorry for her and the other students. These clones die, or "complete," by the time their fourth organ is removed in their twenties or early thirties. Even more shocking than the novel's premise is its depiction of the coercive power of social conditioning. These clones do nothing to resist their fate. Though they are physically identical to humans conceived naturally, they do not attempt to flee or hide among those they consider "normal people". Their greatest hope which turns out to be nothing but a rumor is that they may earn a few years of deferral if they can prove that they are in love.

The character Kathy H in *Never Let Me Go* becomes part of the gilded Hailsham and she lives with the memory of the dystopian land Hailsham which she thinks as a perfect place for her to live. She is aware about the bad future waiting for her, but she still chooses and feels proud about it. When some literature boasts about the advancements in the field of technology and science they knowingly avoid or discard the problems of these inventions. Ishiguro in this novel questions the ethics and morals of the rapid progress in technology and specifically humans cloning humans. Even though we think that all these advancements are for human life there lays possibilities of danger during these so called progress. These cloning processes implemented for the better life of people may become a curse sometimes. In the case of Hailsham, the students live there with a lot of hope and dreams for the future. Kathy, Tommy and Ruth enjoy their life in Hailsham without knowing the drastic changes that will affect them. The shadowy backdrop in *Never Let Me Go*

is Genetic Engineering and associated technologies.

Dystopian fiction presents a vision of society in which authorities have attempted to fix problems in the world using methods and practices that create complicated consequences. The case of Hailsham shows that the authorities had created a group of human clones' in order to treat or satisfy the needs of the other people. By doing good for a group of people through Eugenics, they are creating a dystopic world to the remaining people.

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Effectiveness of M-Wallets in the Cashless Economy - A Study with Special Reference to Kanhangad Muncipality

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1. INTRODUCTION

The government of India and Reserve Bank of India has started working towards making India a cashless economy and to bring in accountability and transparency in each financial transaction. Recently Union Cabinet cleared the implementation of a few short and long-term measures to promote digital and card-based payments to curb cash use in the system. Some of the measures include withdrawal of surcharge, service charge, or convenience fee on card and other digital transactions.

The rise of the Smartphone as a payment tool is reflected in the brisk growth of mobile wallet transactions in the country. According to RBI data , the trend is only expected to grow with the introduction of unified payment interface and payment banks. M-WALLETS have emerged as the most significant contributor in pushing cashless and electronic payments. A bunch of youngsters has kick-started a movement by launching mobile wallets app which is avirtual wallet where a registered customer can pre-load a certain amount of money with any service provider, which can be used for various bill payments and recharges. There are currently about 25 mobile wallet payment gateways in India out of which few payment systems are licensed by RBI as payment bank.

The advantage of completing an online transaction through mobile wallet is, it does not charge any amount of money on every transaction and saves the customer from the hassle of entering card details and pin number for each and every transaction. it is easy and convenient for the users, as the user needs to sign in the account and make payment. On the other hand, it focuses on online merchants and offline merchants i, e the M-wallet providers act as intermediary between the merchants and the wallet users.

The current scenario is witnessing a new payment methodology called the mobile wallet which has revolutionized the payment system on a single tap. Therefore, the perception of customer is changing from "bank first to payment first". Players like Paytm, Mobikwik, Free charge, Citrus etc. have taken charge towards the payment system. Many studies have been conducted to analyse the adoption of m-wallets. Demonetization also paved the growth of m-wallets.This study looks into the effectiveness of m-wallets in promoting cashless economy with special reference to Kanhangad municipality, which helps to know how much people lies within this digital era and how much people are out of the purview of this wallets and cashless payments. It also analyses demographic characteristics which affect m-wallets usage and also the refraining factors also.

2. STATEMENT OF PROBLEM

Today India is on the path to become cashless economy. Lots of cashless initiatives are taken by

the govt. and RBI. As a way to going cashless society, it is relevant to pay attention towards M-Wallets.
The study attempts to analyse the effectiveness of m-wallets in the cashless economy. The study is named as "effectiveness of m-wallets in the cashless economy".
Making payments through these M-wallets is surely the best way to get rid of this present crisis and the platforms like Paytm and Mobikwik are some of the best platforms for it.A secure E-wallet can manage all our finances with one click, and we can even make it more secure than our banks. It gives all types of facilities to settle all our amounts online as well as an offline transaction with ease, and we can even pay our bills, taxi rides, bus drives and recharges through online services.

3. SCOPE OF THE STUDY

It is the era of digitalization. Cashless transactions are growing day by day as a result of increase in the users of smart phones and the impact of telecom sectors. various policy initiatives are taken by government to promote cashless transactions in both urban and rural areas. This study aims to analyse the impact of digital wallets in the Kanhangad municipality to know the extent of cashless society and digitalization.

4. OBJECTIVES OF THE STUDY

The main objectives of the study are;

1. To study the effectiveness of M-Wallets in the cashless economy
2. To study the awareness and preference towards the usage of M-Wallets
3. To find out the impact of various demographic variables on the usage of m- wallets and the factors refraining the use of wallet.

5. SIGNIFICANCE OF THE STUDY

The significance of the study is to understand the effectiveness of m-wallets in promoting cashless transactions. It will help the m-wallet service providers to know the reach of their services and also will benefited to government to initiate policy measures to bring the uneducated and rural people in the stream of cashless economy.

6. RESEARCH METHODOLOGY

The current study is based on primary data collected from sample of respondents from the Kanhangad municipality. The sample of 60 respondents taken for the study comprised of students, bankers, retailer's serviceman, businessman, casual workers and home makers selected on the basis of convenience. The questionnaire comprised questions covering the awareness and perception, usage and factors encouraging and discouraging the adoption of M-Wallets.

- Primary data
  Primary data was collected through questionnaire.
- Secondary data
  Secondary data was collected through the books, journals, internet, newspapers. for thestudy.
- Sampling
  A sample is a set or group selected from population for study. A sample of 60 respondents from the different locations of Kanhangad municipality is chosen byusing convenience sampling technique.
- Analysis of data
  For the purpose of analyzing the data, mainly two types of tools.ie. Analysis tools and presentation tools. Tables and diagrams are used as presentation tools and percentage and chi-square test are used as analysis tool.

Taking into account the foreseen technological evolutions the strategies announced by the banks and by the card issuer companies as well as the increased needs of the buyer merchandisers regarding the security and flexibility of the transactions the future of the electronic payment systems will be based on the following defining elements: -the mobile environment and devices, the electronic wallets and standards meant to increase the flexibility of the transactions. **(International Research**

Journal of Engineering and Technology (IRJET) December2015 e- issn 2395-0056.
Dr Hem shewetaRathore ,Assistant Professor Bharathi Vidyapeeth's Institute of Management studies and Research , Navi Mumbai (BVIMSR'S) journal of management research April 2016 studied in his paper "Adoption of Digital Wallet by consumers"- in order to understand how consumers perceive new technological service ie digital wallet. His analysis suggests that moving the wallets to a mobile device offers more than portability. In addition growth basic functions like payments and identifications mobile wallet create interactive shopping experience. The 3 major factors which play an important role in consumer adoption are convenience in buying products online , brand loyalty and usefulness of digital wallet.
Jiangpingwan ,Mingzeng, Lianyu liang- School of Business Administration,South China University of Technology, Guangzhou China, Institute of Emerging Industrialization Development, South China University of Technology, Guangzhou, chine-(August 42013)explored "empirical study on usability impact factors of electronic wallet – ine card solution within college students, behavior habits within using the electronic wallet.
Poonam painuly and shalurathi(2016) in their research paper "mobile wallet: an upcoming mode of business transaction" have analysed that ease of transaction, secured profile and convenience in handling application put forth the benefits of wallet money and also concluded that business sectors like banking, retail, hospitality etc. are making use of wallet money and mobile payment instruments including contactless and remote payment in the customers to customer areas.

7. FINDINGS

- The study focuses on effectiveness of m-wallets in the cashless economy with special reference to Kanhangad Municipality. A sample of 60 respondents were selected on the basis of convenience. From the samples collected 34 respondents are non-aware about m-wallets. Only26 respondents aware about m-wallets. The demographic characteristics which affects the usage of m-wallets are gender Which means that majority of the m-wallet users are male. Youngsters are more attracted to this type of digital wallets according to the age group. Educated people use m-wallets for cashless transactions having degree / diploma and post-graduation qualification. It also reveals that occupation wise students are more attracted to m-wallets and as per my study business people doesn't know about the usage ofm-wallets.
- Majority of the respondents are unaware about the functionality of m-wallets
- As per the result of chi square test there is no association between gender of the users of m-wallets and their usage
- Social media is the main source from which information about m-wallets arrived.
- Most of the respondents sometimes uses the m-wallets and for executing financial transaction they sometimes opt m-wallets.
- The study shows that Paytm is the leading m-wallet service provider in india followed by Mobikwik,free charge, oxygen.
- M-wallets is mostly preferred because it is a time saving method of payment. Certain people prefer because it act as a alternative choice and because of its ease ofuse.
- Most of the users of m-wallets use it for recharging their mobile phones and for online shopping. But money transfer are rarely conducted through m-wallets.
- Education as a prerequisite for the usage of m-wallets, most of the respondents have a neutral opinion. It means that they neither agree nor disagree with this statement.
- The half of the respondents says that implementation of KYC norms will reduce the number of users of m-wallets and at the same time half percentage says that it will never reduce the customers.
- M-wallets cannot be act as an alternative for banking services
- Most of the users are satisfied with their m-wallets. There is no user who are dissatisfied with their m-wallets.

		Users of M-Wallets		Non users of M-Wallets	
	Categories	Count	Percentage	Count	Percentage
Gender	Male	17	28.333	20	33.333
	Female	9	15	14	23.33
Age	Below 20	1	1.67	0	0
	20-30	22	36.67	12	20
	30-40	2	3.33	6	10
	40-50	0	0	9	15
	Above 50	1	1.67	7	11.67
Educational qualification	Below SSLC	0	0	6	10
	SSLC	1	1.67	9	15
	Higher secondary	2	3.33	3	5
	Degree /Diploma	13	21.67	12	20
	Post graduation/ higher	10	16.67	4	6.67
Occupation	Student	12	20	10	16.67
	Government employee	3	5	5	8.33
	Private employee	4	6.67	3	5
	Self employed	1	1.67	1	1.67
	Daily wage worker	2	3.33	5	8.33
	Home maker	0	0	3	5
	Business	0	0	3	5
	Retired	0	0	2	3.33
	Any other	4	6.67	2	3.33

- Customers are motivated by premium offers, cashback offer and available discount offered by the m-wallet service providers.
- Purchase of movie tickets, mobile recharge and DTH is the most preferred products and services using m-wallets. it is followed by books & clothes, railway or bus reservation,electronic products.
- The study reveals that lessor usage of m-wallets in the rural areas will act as a hindrance for the growth of cashless economy.
- Of course, m-wallets promote cashless payments to the next level by act as convenient mode of digital payment system.
- Majority of the respondents do not face any obstacles while using m-wallet. But certain respondents shared problems and the major issue is connected with security.
- Most of the users recommend the m-wallets to the non-users.
- Lack of smart phone is not the major reason for the non-use of m-wallets.
- Majority of the non-users of m-wallets have bank accounts, but still certain people doesn't have bank accounts.
- From the study it is clear that certain respondents don't know even the term m- wallets. They only know about Paytm service provider. Major reason behind the non-awareness is that respondents are not interested in such digital wallets. Another reason behind the non-awareness is that lack of education, no government measures.

8. SUGGESTIONS

The dream of becoming a cashless economyis still in the pursuing stage in India. India is making several efforts to become a cashless economy. Digital wallets have made cashless transactions extremely convenient and hassle free. As a result, more and more people adopting the digital wallet system for accepting and making payment. After demonetization, even the small street vendors like fruit and vegetable sellers have started using digital wallet likePaytm. But according to my study in the area of Kanhangad there is no much popularity for mobile wallets. Only the young and employed people aware about m-wallets. Even business people don't know about m-wallets. so, in order to materialize the dream of cashless economy following suggestions are recommended based on the study;

- Majority of the users of m-wallets are male, young and educated and people. So, action should be taken to bring female and male users having different age group and occupation by giving information about the functionality of m-wallets.
- People are only aware about the name of the m-wallets service provider . They don't know

the term m-wallets. So awareness should be created about M-wallets.

- Conduct education and awareness programmes to provide information about the need for a cashless economy and growing importance of m-wallets.
- As most of respondents are concerned about the security of mobile payments, the security system should be strengthened so that people won't scare about their money and transactions.
- The usage of m-wallets is still at nascent stage only. Therefore, the companies should promote the same through their marketing and advertising campaign.
- Payments business especially m-wallets will have to expand their revenue streams ahead of the full-fledged roll out of government Unified Payment Interface (UPI), which envisages seamless digital money transfers across bank and their customers.
- As per the study male users are more for m-wallets and even educated people always resort to cash transactions. So, government should take adequate steps to change the attitude of all types of people whether men or women, employed or unemployed etc.
- Government should take active participation in promoting m-wallets by offering high security and promote the usage of m-wallets for all types of transactions and make it a habitual experience.
- Mobile wallets should be reshaped in such a manner even uneducated people can easily transact through m-wallets.
- Still there are people who does not have bank accounts.so, action should be taken to ensure bank account for all people and bring them into digitalization.

9. CONCLUSION

The study has provided an insight into the effectiveness of m-wallets in the cashless economy in Kanhangad area. It reveals that adoption of m-wallets is only at the beginning stage. Young, educated and employed people adopt digital wallets for recharging mobile phones, shopping, ticket reservation etc. Huge transactions involving high amounts were not conducted through m-wallets as its security becomes an issue. Moreover, large part of the respondents are unaware about the functionality of m-wallets as they are not interested in such technology and always resort to cash transaction. Demonetization doesn't make huge changes because as per the study business people always do transaction using money and they use net banking services. Some of the respondents recommend that wallets should be issued by government. Many of them lack the knowledge that wallets can be issued only with the permission of RBI. The growth of m-wallets in this area is low as compared to other cities.
To conclude adoption of m-wallets is low, so education and awareness programmes should be conducted to bring the rural and uneducated people into the stream of cashless economy. Government should take adequate steps to ensure the security of payments through m-wallets and try to achieve the dream of cashless economy.

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"You Are A Question to Yourself": The Quest for Identity and Political Legitimacy in Nuruddin Farah's *Maps*

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Nuruddin Farah is one of the best contemporary African novelists and the sole Somali author whose works have achieved international awards and fames. Farah has received acclaim as one of the greatest contemporary in the world through the publication of many short stories, novels and essays. The mother country Somalia and its cultural differences, historical perspectives and political narratives are the centre core of his writings.He also points towards customs,folktales,geographical issues, linguistics differences and all other areas including clans,caste and identity.Farah is a keen observer who concentrates exclusively on the lives and fates of the Somali characters through his novels. This is rightly established in Elba in From a *Crooked Rib* and Koschin in *A Naked Needle*, through the families of Loyaan, Medina and Deeriya in the novels *Sweet and Sour Milk*,*Sardiness* and *Close Sesame* to Askar and Duniya in *Maps* and Nonno in *Secrets*. All the actions take place within Somalia in these eight novels and a few non-Somali Figures do appear in these novels such as the British fiancée Nancy in *A Naked Needle*, Margaritta in *Sweet and Sour Milk*, the African –American peace corp worker Kathy in *Secrets*. These three characters have only minimaleffect on the Somali Protagonists. Misra, the surrogate mother to Askar in Maps is the exception among such non-Somalis.She plays a very effective role in the development and identity formation of her adoptive son,Askar.

Most of the novels of Nuruddin Farah especially first two trilogies are organized on the basis of political and historical themes. Farah titled the first trilogy as *Variations on the Theme of African Dictatorship* and it includes three novels namely *Sweet and Sour Milk*,*Sardiness* and *Close Sesame*. These three novels published in quick succession, appearing between 1979 and 1983. The second trilogy Blood in the Sun moves away from the dictatorship and focuses on the issues of identity and Somalian culture. The trilogy includes *Maps* (1986) *Gifts* (1992) and *Secrets* (1998).

Somalia, officially the Federal Republic of Somalia is a country located in the Horn of Africa.It is bordered by Ethiopia to the west, Djibouti to the northwest, the Gulf of Aden to the north, the Indian Ocean to the east, and Kenya to the southwest. Somali and Arabic are the official languages of Somalia. The culture of Somalia is an amalgamation of traditions in Somalia that were developed independently and through interaction with neighbouring and far away civilizations, including other parts of the North East Africa, the Arabian Peninsula, India and South East Asia. Somali literature refers to the literary tradition of Somalia.It ranges from Islamic poetry and prose produced by the region's scholars and sheikhs of centuries past to works of fiction from contemporary writers.

Somali scholars have for centuries produced many notable examples of Islamic literatures ranging from poetry to fiction. With the adoption of modified Latin script developed by the Somali linguist Shire Jama Ahmed in 1972 as the nation's stan-

dard orthography, numerous contemporary Somali authors have also released novels, some of which have gone to receive worldwide acclaim. Nurrudin Farah is probably the most celebrated Somali writers in this modern period. His most famous novel, *Maps* (1986), the first part of his *Blood in the Sun* trilogy, is set during the Ogaden conflict of 1977 and employs the innovative technique of second-person narration for exploring questions of cultural identity in a post independent world.

Maps first appeared in Britian and the United Statesin 1986 and takes place in the embattled Ogaden. It is a delicate and mystical evocation of bonds of mother to son and son to mother-country. Askar a Somali orphan recounts his life with his 'mother' Misra, an Ethiopian woman, through fragmented and almost hallucinating memories and dreams.He is raised in the warmth of Misra's instinctive love, sleeping curled with her every night, crying scornfully when she is far away. Eventually he imagines his body is an extension of hers, a third leg. From an age he becomes acutely aware of her menstrual cycle, which he believes he experiences too. Blood- whether flowing from a wound, imagined in one of Askar's dreams of rivers and wars, or 'read' byMisra as a means of telling future is the tie that connects mother and child, although they share no biological bond. Askar's love loyalty are tested when Misra is accused of betraying the location of a pro-Somali group that is fighting to capture the Ogaden. Askar is pulled between loyalty to Misra and obedience to Somalia as he lives with his uncle in Mogadishu and about to join in Somali fight. This is the moment when Askar is pulled between loyalty to Misra and obedience to Somalia.

Farah's trilogies are always occupied by a single metaphorical figure. In the first trilogy, *Variation on the Theme of African Dictatorship*, the figure is the dictator,the General, who represents the patriarchichal tyranny that weakens individual freedom at every political level from the family to the nation. In the second trilogy the centre figure is an orphanwith a quite different stature and power. In *Maps* Askar is left parentless at birth and adopted by Misra, who was herself rejected and kidnapped as a child. In *Gifts* Duniya takes in an abandoned body whom she calls ' the nameless one' . In *Secrets* Kalaman learns that he is the product of a gang rape that is his paternity is therefore unknown and his parents are not married.

The question of identity and orphan figure is there at the heart of Farah's each work. " The first and most important question that all human being asks themselves" , he said in an interview in 1989, are " who am I ?", " Why am I ?" , "what is my place in this world ?" and to answer these questions, he went on to say that " I have been writing, coming from different angles using different characters" (184). The figure of orphan foregrounds these questions, because for orphans answers are not always available. As an orphan one's to take responsibility for defining one's self for choosing one's root. Askar reflects: " You are a question to yourself. It is true. You have become a question to all those who meet you, those who know you, those who have any dealings with you".

In order to determine his identity and to find answers to those questions, Askar has to inquire into his relationship with both Misra, the non-Somali foster mother to whom he owes his survival, and Somalia his mother country. These questions of identity are fundamentally political questions, whether they are raised in the sphere of public events and institutions, as in the Dictatorship trilogy, or in the sphere of the domestic and the interpersonal as in Farah's earliest novels *From a Crooked Rib* and *A Naked Needle* or again in the second trilogy.

In *Maps* Farah deals with personal theme, which is the story of an orphan boy named Askar. Askar is searching for himself and the political theme which is the Somali identity in the war with Ethiopia. First, the theme of identity is more related to Askar. In the beginning the theme is not much reflected, because Askar is young, he is raised by Misra. She was like his real mother,and she gives him all affection and love. As Askar grows up, Misra talks to him about his parents and the occasion of their death. Askar though he is young,became aware about the realities around him. His normal and peaceful life with Misra is soon disturbed and his attitude towards Misra has changed. He became greedy of her and thinks of killing her. In a conversation with Misra he says, "One day I might kill you"(95). Here Askar's dilemma begins; he begins thinking about himself, about who he is especially in that period of tormented Ogaden. The question of "who am I ?" is repeated in the novel a lot of times. As Askar grows he becomes leader among the boys of his age, a po-

sition he was interested to gain.
After the years of his life with Misra in Kallafo, Askar goes to Mogadishu to live with his uncle Hilaal and his wife Salaado to continue his studies. Even though uncle Hilaal and Salaado fulfill all his needs, his life with them is totally different from his life with Misra. Askar is still lost and still in search forwho he is.This reflects his moral confusion. His life with Hilaal leads Askar to anew outlook of life, the idea of nationalism was growing inside him. He plans to join in the liberation movement. At the end what *Maps* records is the world as "Askar told it to himself". All the narrative voices are his, and Misra's voice has been absorbed into his own, turned into his purposes. It is the story constructed out of the materials of nationalism, which Askar finds ready to hand and puts to use to redefine him.
By the end, the search for identity is still the dominant theme in the African works, this theme which comes as a result of the colonial regime and its tyranny. In *Maps* Farah tried to deal with this theme through the life of Askar and relation to his country. *Maps* deals with two types of conflicts, the first one is political and the second one is the internal conflict between the different parts of the self. In *Maps* Farah also examine the war between Somalia and Ethiopia, a war in which people shed their blood in an effort to determine their national and individual identity. Somali people view this war as legitimate which robbed them of their territory and falsified the national identity of their people.

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Effect of Wood Flour on Swelling of Gelatin/Polyvinyl Pyrrolidone Blend Composites in Aqueous Medium

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Abstract

Blend composites composed of two polymers, namely gelatin and Poly(vinyl pyrrolidone) have been made in aqueous medium using glutaraldehyde as the crosslinking agent. The conditions for the synthesis of various composites with regard to the polymer composition and the amount of crosslinking agent have been optimised. The effect of wood flour as a filler have been studied on the swelling behaviour of the composites in aqueous medium.

Key words: Composites, crosslinking, swelling, wood flour

1. INTRODUCTION

Composite materials are solid multiphase materials formed through the combination of materials with different structural, physical and chemical properties. This makes composites different from the other multi component systems such as blends and alloys. Composite materials often demand a unique combination of properties, including high thermal and oxidative stability, toughness, solvent resistance and low dielectric constant. Composites are widely used in such diverse as transportation, construction and consumer products[1,2]. Gelatin is a substantially pure protein food ingredient, obtained by the thermal denaturation of collagen, which is the structural mainstay and most common protein in the animal kingdom. Gelatin is a high molecular weight polypeptide and an important hydrocolloid, which has proved popular with the general public and finds its uses in a wide range of food products largely because of its gelling and thickening properties[3]. Polyvinyl pyrrolidone (PVP) is a linear nonionic polymer that is widely used in hair care formulations around the world. Its unique combination of extraordinary physical and chemical properties made it suitable as a biomaterial in numerous significant medical and non medical applications.Its good electrical properties opened the path for PVP in various uses in electrical and optical applications, such as screens, printed circuit boards, cathode ray tubes, energy storage devices, solar cells, etc[4,5] In the present study Gelatin/PVP based green composite is prepared by wood flour is taking as the green filler. The effect of wood flour on the swelling of composites in aqueous medium was studied.

2. EXPERIMENTAL DETAILS

2.1. ***Preparation of Gelatin/ Polyvinylpyrrolidone/Wood flour composites***

The following method was used in the preparation of the Gelatin/Polyvinylpyrrolidone/Wood

flour composites. 10% (w/v) aqueous solution of Gelatin and 15 % aqueous solution of PVP were made separately by stirring at a temperature of 45°C. These two solutions were mixed and stirred for 4 hours to make homogeneous. To the resulting solution varying amounts of wood flour was added and again stirred for 2 hours. Then added 5% glutaraldehyde as the crosslinking agent. The crosslinking was cariedout in beakers suspended in water bath at 60°C for a period of 4 hours. After that, the crosslinked composites were taken out and washed with distilled water to remove the adhering salt solution. The composites thus obtained were dried at 40^0 and stored. The details of the preparation conditions and the codes used for the designation of the composites are compiled in Table 1.

Table 1: Preparation of Gelatin/ Polyvinylpyrrolidone/Wood flour composites

Gel Code	GLTN(%)	PVP(%)	GLA(%)	WF(%)
GPGW1	10	15	5	0.00
GPGW2	10	15	5	0.25
GPGW3	10	15	5	0.50
GPGW4	10	15	5	2.50
GPGW5	10	15	5	5.00

2.2. ***Swelling Studies***

The swelling behaviour of the composites was investigated by swelling measurements carried out in aqueous solution. Pre-weighed dry composites were immersed in excess of the aqueous medium at room temperature. After specific intervals of time, the gels were removed from the medium, the surface adhered liquid drops were wiped by blotting and the increase in weight of the composites were measured using an electronic balance with an accuracy of ±0.1 mg. The measurements were continued till the weight of the swollen films attained a constant value. The percentage of swelling (S%) at the given time 't' was calculated using the following expression[6],

$$\text{Swelling } (S)\% \ = \left[\frac{(W_t - W_o)}{W_0}\right] \times 100$$

where W_t & W_o are the mass of the swollen gel at time t and the dry gel respectively

3. RESULTS AND DISCUSSIONS

3.1. ***Swelling Studies***

The swelling data collected as a function of time in the medium of distilled water are displayed in Table 2-7. The data clearly indicates the influence of wood flour, on the swelling behaviour of the composites. The nature of the swelling data indicates that amount of water absorbed into the composite increases with time at a faster rate in the beginning and after a certain period, the rate slows down and the gels gradually reach their equilibrium swelling level. On the addition of wood flour swelling first decreases from 317 to 303. This is due to the fact that as the filler particles occupy the space where water molecules are occupied, the amount of water hold by the composites decreases. But with a small increase in the amount of wood flour the polymer chains become flexible and due to that swelling slightly increases. But again with increase in the amount of wood flour swelling decreases due to the unavailability of the space for water molecules to occupy. Moreover the system becomes compact.

Table 2: Swelling studies of GPGW1

Time (min.)	Wt (g)	S	S %
0	0.1199	0	0
5	0.1628	0.357798	35.77982
15	0.1906	0.589658	58.9658
30	0.2401	1.002502	100.2502
60	0.2827	1.357798	135.7798
120	0.3307	1.758132	175.8132
240	0.5006	3.175146	317.5146

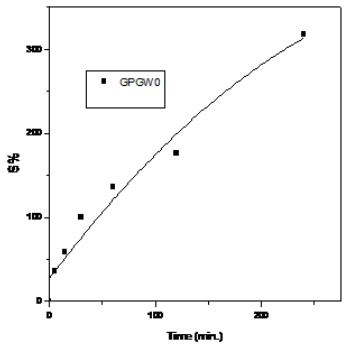

Figure 1: Swelling curve of GPGW1

Table 3: Swelling studies of GPGW2

Time (min.)	Wt (g)	S	S %
0	0.097	0	0
5	0.1772	0.826804	82.68041
15	0.1997	1.058763	105.8763
30	0.2311	1.382474	138.2474
60	0.2953	2.04433	204.433
120	0.3642	2.754639	275.4639
240	0.3916	3.037113	303.7113

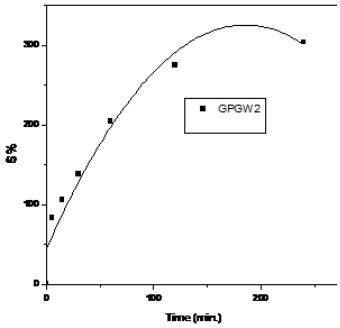

Figure 2: Swelling curve of GPGW2

Table 4: Swelling studies of GPGW3

Time (min.)	Wt (g)	S	S %
0	0.0871	0	0
5	0.1317	0.512055	51.20551
15	0.1576	0.809414	80.94145
30	0.1735	0.991963	99.19633
60	0.1958	1.247991	124.7991
120	0.2335	1.680827	168.0827
240	0.3716	3.266361	326.6361

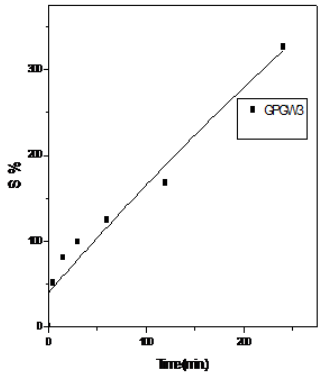

Figure 3: Swelling curve of GPGW3

Table 5: Swelling studies of GPGW4

Time (min.)	Wt (g)	S	S %
0	0.1373	0	0
5	0.2054	0.495994	49.59942
15	0.2199	0.601602	60.16023
30	0.2646	0.927167	92.71668
60	0.3187	1.321194	132.1194
120	0.3791	1.761107	176.1107
240	0.497	2.619811	261.9811

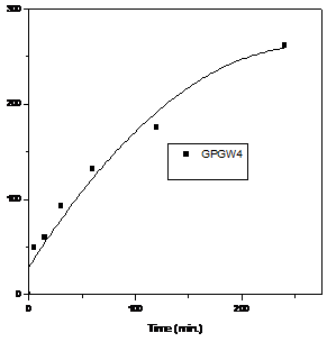

Figure 4: Swelling curve of GPGW4

Table 6: Swelling studies of GPGW5

Time (min.)	Wt (g)	S	S %
0	0.1457	0	0
5	0.2134	0.464653	46.46534
15	0.2609	0.790666	79.06658
30	0.2726	0.870968	87.09677
60	0.3173	1.177763	117.7763
120	0.4	1.745367	174.5367
240	0.443	2.040494	204.0494

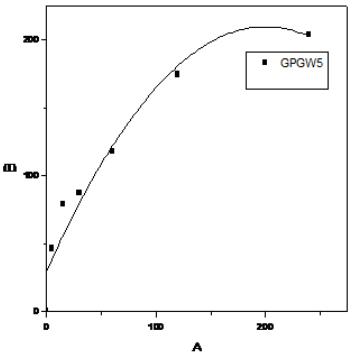

Figure 5: Swelling curve of GPGW5

Table 7: Equilibrium swelling of various composites

CODE	S%
GPGW1	317.51
GPGW2	303.7113
GPGW3	326.6361
GPGW4	261.9811
GPGW5	204.0494

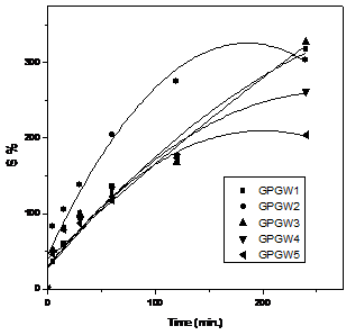

Figure 6: Swelling curve of GPGW composites

4. CONCLUSIONS

Gelatin / Polyvinylpyrrolidone/ Wood flour composites have been made in the presence of gluteraldehyde as the crosslinker. The swelling capacity of the composites and the rate of swelling were observed to be influenced by composite composition and the preparation conditions. As the amount of wood flour increases the % swelling initially decreases and then increases and again decreases. The decrease in swelling with increase in wood flour is due to the unavailability of the space for water molecules to occupy.

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A Comparative Analysis of Finger Print Patterns in Man in Relation with Finger Dominance and Attached Earlobes

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Abstract

Dermatoglyphics (Gk.*derma* = skin; *glyph* = carving Penrose) is the scientific study of fingerprints. Fingerprint ridge pattern can be separated into three major types, arches, loops and whorls. Fingerprint patterns are unique for people. In this basic study, we are trying to find out whether there is any correlation between fingerprint patterns and some genetic traits such as finger dominance and attached earlobes. Detailed studies are needed for more clarifications.

Key words: Fingerprint patterns, genetic traits, finger dominance, attached ear lobes etc

1. Introduction

Dermatoglyphics (Gk.*derma* = skin; *glyph* = carving Penrose) is the scientific study of fingerprints that started in 1892 when one of the most original biologists of his time, Sir Francis Galton, a cousin of Charles Darwin, published his new classic work on fingerprints. The study was later termed dermatoglyphics by Dr. Harold Cummins, the father of American fingerprint analysis.

Ridged skin occurs on the volar surfaces of the palms and soles of all primates (Cummins and Midlo, 1943). Fingerprint is unique for an individual because epidermal ridges are genetically determined and their pattern remains constant throughout life (Crawford, 1992).

Dermal ridges begin to form around the 13^{th} week of intrauterine life and development is completed by the end of the 21^{st} week and then remains invariable. They follow a polygenic pattern of inheritance (Schaumann and Alter, 1976; Manoj and Hemlata, 2012; Bhat et al., 2014 for reviews). The fingerprints are permanent and are not the same even in homozygotic twins (Abilash et al., 2012). The ridge pattern can be affected by certain abnormalities of early development including genetic disorders, such as Down syndrome and skeleton malformation, such as polydactyly (Bhat et al., 2014 for reviews).

Several methods for making a permanent record of dermatoglyphic patterns have been outlined by numerous authors (Walker, 1957; Miller and Giroux, 1966; Uchida and Soltan, 1969). A similar pattern is seen in the toe (Gray, 2008).

In this project, we have taken the impression of papillary ridges of fingertips of 150 students in the age group 17-24 years for analysis and we attempt to find out if there is any correlation between the finger print patterns and some selected genetic characteristics in the selected group.

Fingerprint patterns:

Arches (A): These are parallel ridges that traverse the pattern area and form a curve that is concave proximally. The arch pattern is subdivided into two types:

(a) Simple arch or plain arch composed of ridges that cross the fingertip from one side to the other without recurving.

(b) Tented arch (TA) composed of ridges that meet at a point.

Loops (L): A series of ridges enter the pattern area on one side of the digit, recurve abruptly, and leave the pattern area on the same side. If the ridge opens on the ulnar side, resulting loop is termed as ulnar loop (UL). If the ridge opens toward the radial margin, it is a radial loop (RL).
Whorls (W): Whorls are configurations having ridges that actually encircle a core. If ridges spiral around the core in either a clockwise or a counter-clockwise direction, it is known as double or a spiral whorl. A central pocket loop/whorl contains a loop within which a smaller whorl is located. Complex patterns, which cannot be classified as one of the above patterns, are called accidentals.

2. MATERIAL AND METHODS

In this study, the finger prints of all the fingers of the left hands of 150 students of Nehru Arts and Science College Kanhangad was taken using ink pad method (Galton, 1892). 75 males and 75 females in the age group 17 – 24 years, were selected and fingerprint patterns of five fingers of the left hand were collected by rolling on an ink pad in a steady pace and with light pressure. Then the evenly stained fingers were rolled on A4 sheet papers before getting dried up. The papers were dried and subjected for fingerprint pattern analysis. Close observation was done by using hand lens. The data thus obtained was tabulated and graphically explained.

3. RESULTS AND DISCUSSION

Correlation studies of genetic disorders and fingerprint patterns have been studied earlier by many authors (Bhat et al., 2014). In this study, an attempt is made to study the relation between the fingerprint patterns of thumb and index finger of males and females and a few genetic characteristics (finger dominance and attached ear lobes). The percentage of different patterns of fingerprints in different fingers in the selected group of 150 students (in the age group 17-24 years) is shown in Table 1. UL is the most dominantly observed one and W is the next dominant pattern. It has been observed in an earlier study from our laboratory (Amrutha et al., 2016). TA is totally absent in the thumbs of males and females. The observation also shows that, M is the least observed one with only below 5% occurrence (Table 1).

Correlation between the fingerprint patterns of thumb and index finger, with the occurrence of finger dominance and attached ear lobes in males and females:

50% of males in the selected group shows UL pattern in their thumb (Table 1; Fig. 1). Among them, 50% shows index finger dominance and rest of the 50% shows ring finger dominance. At the same time, TA pattern of finger prints is totally absent in thumbs of males. The males with PL pattern shows 100% index finger dominance and those with A and RL shows ring finger dominance. Attached earlobes are totally absent in those with A, M and PL patterns. Dominace of UL pattern in fingers are already reported (Slatis et al., 1976). The dominance of W pattern in males, when compared to the females has already been reported (Bhanu et al., 1972).
40% of the females in the selected group show W pattern and 36% shows UL pattern in their thumbs (Table 1; Fig. 1). At the same time, TA is totally absent as in the case of males. Females with PL shows index finger dominance and RL and M pattern do not show ring finger dominance. Attached earlobes are totaly absent in females with DL pattern in their thumb (Table 3; Fig. 3).
Around 30% of the males in the selected group show UL and W patterns in their index finger (Table 1; Fig. 1). None of the observed patterns is totally absent. Most of the males with DL pattern (66%) show index finger dominance. All the males with M pattern (4%) in the index finger show ring finger dominance. Here, attached earlobes are totally absent in males with A pattern in their index finger. Most of the males with DL and M pattern (66.6%)

Figure 1: % of occurrence of different patterns of fingerprints in males and females:

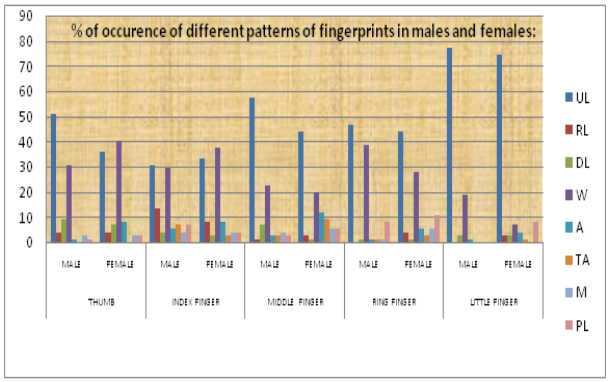
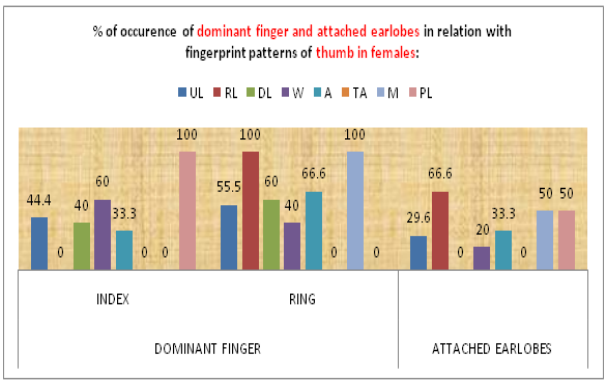


Figure 2: % of occurrence of dominant finger and attached earlobes in relation with fingerprint patterns of thumb in females:



show attached ear lobes (Table 4; Fig. 4).
Around 35% of the females in the selected group show UL and W patterns in their index finger (Table 1; Fig. 1). None of the observed patterns is totally absent. Females with RL and M (66%) show index finger dominance. At the same time, females with TA pattern in their index finger show 100% ring finger dominance and those with A and PL patterns show 66.6% ring finger dominance, attached earlobes are totally absent in females with M pattern in their index finger. About 50% of the females with DL and TA in their index finger show attached earlobes (Table 5; Fig.5).
The correlation studies of fingerprint patterns and genetic characteristics are very meagre. We have made an observation on some basic fingerprint patterns and its relationship with a few selected genetic characteristics. Many interesting relationships are observed in these preliminary observations and further studies are needed for getting more results.

Figure 3: % of occurrence of dominant finger and attached earlobes in relation with fingerprint patterns of index finger in males:

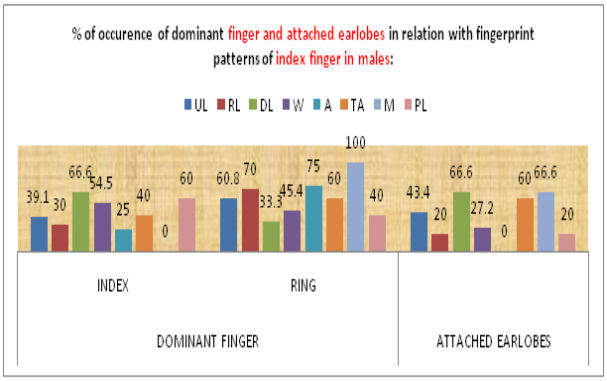


Figure 4: % of occurrence of dominant finger and attached earlobes in relation with fingerprint patterns of index finger in females:

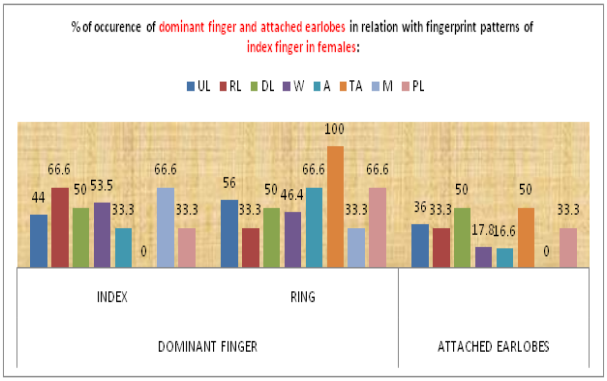


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Table 1: Occurrence of different patterns of fingerprints in males and females (in %)

TYPES OF FINGER PRINTS	THUMB		INDEX FINGER		MIDDLE FINGER		RING FINGER		LITTLE FINGER	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
UL	50.7	36	30.7	33.3	57.3	44	46.7	44	77.3	74.7
RL	4	4	13.3	8	1.3	2.7	0	4	0	2.7
DL	9.3	6.7	4	2.7	6.7	1.3	1.3	1.3	2.7	2.7
W	30.7	40	29.3	37.3	22.7	20	38.7	28	18.7	6.7
A	1.3	8	5.3	8	2.7	12	1.3	5.3	1.3	4
TA	0	0	6.7	2.7	2.7	9.3	1.3	2.7	0	1.3
M	2.7	2.7	4	4	4	5.3	1.3	5.3	0	0
PL	1.3	2.7	6.7	4	2.7	5.3	8	10.7	0	8

Table 2: Occurrence of dominant finger and attached earlobes in relation with fingerprint patterns of thumb in males (in %)

TYPES OF FINGER PRINTS	MALE	DOMINANT FINGER		ATTACHED EARLOBES
		INDEX	RING	
UL	50.6	50	50	39.4
DL	9.3	100	0	28.5
W	30.6	47.8	52.1	34.7
A	1.3	0	100	0
TA	0	0	0	0
M	2.6	50	50	0
PL	1.3	100	0	0
RL	4	0	100	33.3

Table 3: Occurrence of dominant finger and attached earlobes in relation with fingerprint patterns of thumb in females (in %)

TYPES OF FINGER PRINTS	FEMALE	DOMINANT FINGER		ATTACHED EARLOBES
		INDEX	RING	
UL	36	44.4	55.5	29.6
RL	4	0	100	66.6
DL	6.6	40	60	0
W	40	60	40	20
A	8	33.3	66.6	33.3
TA	0	0	0	0
M	2.6	0	100	50
PL	2.6	100	0	50

Table 4: Occurrence of dominant finger and attached earlobes in relation with fingerprint patterns of index in males (in %)

TYPES OF FINGER PRINTS	MALE	DOMINANT FINGER		ATTACHED EARLOBES
		INDEX	RING	
UL	30.6	39.1	60.8	
RL	13.3	30	70	20
DL	4	66.6	33.3	66.6
W	29.3	54.5	45.4	27.2
A	5.3	25	75	0
TA	6.6	40	60	60
M	4	0	100	66.6
PL	6.6	60	40	20

Table 5: Occurrence of dominant finger and attached earlobes in relation with fingerprint patterns of index finger in females (in %)

TYPES OF FINGER PRINTS	FEMALE	DOMINANT FINGER		ATTACHED EARLOBES
		INDEX	RING	
UL	33.3	44	56	36
RL	8	66.6	33.3	33.3
DL	2.6	50	50	50
W	37.3	53.5	46.4	17.8
A	8	33.3	66.6	16.6
TA	2.6	0	100	50
M	4	66.6	33.3	0
PL	4	33.3	66.6	33.3

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Fruit Peel Extract Mediated Green Synthesis of Copper Nanoparticles

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Abstract

Copper nanoparticles preparation via green synthesis using different fruit peel extracts as reducing agents is discussed in the present work. Copper sulphate solution was used as a source of the copper ions, while Citrus sinensis (orange), Musa acuminata (banana) contributed their peels for extracts. The fruit peel shows the properties of both reducing and stabilizing agent. The usage of peels from the fruit takes full advantage of unwanted waste material which is economically friendly, efficient and safe. The synthesized copper nanoparticles have the potential to be applied in biomedical and other applications where nontoxicity is crucial.

Key words: Copper nanoparticles, green synthesis, nontoxicity

1. INTRODUCTION

Nano science and nanotechnology are the study and application of nano materials and can be used across all the other science fields, such as chemistry, biology, physics, materials science, and engineering. Nanotechnology may be able to create many new materials and devices with a vast range of applications, such as in nanomedicine, nanoelectronics, biomaterial energy production, and consumer products. On the other hand, nanotechnology raises many of the same issues as any new technology, including concerns about the toxicity and environmental impact of nano materials, and their potential effects on global economics, as well as speculation about various doomsday scenarios[1−3]. The goal of any synthetic method for nano materials is to yield a material that exhibits properties those are results of their characteristic length scale being in the nanometer range. Accordingly, the synthetic method should exhibit control of size in this range so that one property or another can be attained. Copper nanoparticles show unique characteristics including catalytic and antifungal or anti-bacterial activities that are not observed in commercial copper[4]. They demonstrate a very strong catalytic activity, a property that can be attributed to their large catalytic surface area. With the small size and great porosity, the nanoparticle is able to achieve a higher reaction yield and a shorter reaction time when utilized as reagents in organic and organometallic synthesis. The antimicrobial activity is induced by their close interaction with microbial membranes and the metal ions released in solutions. Copper nanoparticles with great catalytic activities can be applied to biosensors and electrochemical sensors[5]. Researchers are currently investigating the environmentally friendly green production of copper nanoparticles using flavanoids. Flavonoids are a large group of polyphenolic compounds that comprise several classes: anthocyanins, isoflavonoids,

flavonols, chalcones, flavones, and flavanones, which can actively chelate and reduce metal ions into nanoparticles[6]. Flavonoids contain various functional groups capable of nanoparticle formation. It has been postulated that the tautomeric transformations of flavonoids from the enol-form to the keto-form may release a reactive hydrogen atom that can reduce metal ions to form nanoparticles[7–9]. The presence of such mechanisms may indeed explain the ability of flavonoids to be adsorbed onto the surface of a nascent nanoparticle[10,11]. This probably means that they are involved in the stages of initiation of nanoparticle formation (nucleation) and further aggregation, in addition to the bio reduction stage[12]. Moreover, isolated flavonoids and flavonoid glycosides have the ability to induce the formation of metal nanoparticles. Some reducing compounds are used along with stabilizer molecules to solve the purpose of reducing and capping simultaneously[13]. In some cases (during metal nanoparticles synthesis), reducing agent with specially appointed structure can act as the capping agent too. The capping agent has a promising role in the stabilization of nanoparticles as it protects agglomeration of nanoparticles from combining themselves. These also play an essential role in controlling the morphology of nanostructures because of their soft - template effect and their ability to modify the chemical kinetics[14–17]. The present work reports the green synthesis of copper nano particles using flavanoids derived from different fruit's peels.

2. EXPERIMENTAL

2.1. ***Materials and Methods***

All the chemical reagents used in this experiment were of analytical grade purchased from Loba chemicals. The oranges and bananas were collected from local market, Nileshwar, Kasaragod. The orange peel and banana peels were thoroughly washed, dried and powdered. Standard copper sulphate solutions were prepared by dissolving $CuSO_4.5H_2O$ in 100 mL standard flask.

2.2. ***Synthesis of Cu nanoparticles using fruit's peel***

For the Cu nanoparticles synthesis, 1 mg of orange peel powder was added to 20 ml of 10 mM aqueous $CuSO_4.5H_2O$ solution in a 250 ml Erlenmeyer flask. The flask was then stirred overnight at room temperature. The Cu nanoparticles solution thus obtained was purified by filtration. The experiment was repeated with 30 mM and 40 mM solution using orange peel powder. The experiments were repeated with Banana peel powder too.

3. RESULTS AND DISCUSSION

Citrus sinensis (orange), Musa acuminata (banana) peel extracts act as both the reducing and stabilizing agent and $CuSO_4.5H_2O$ (10, 30 and 40 mM) acts as the copper precursor . The reduction of copper nanoparticle was confirmed by using colorimetry. The fruit peel shows the properties of both reducing and stabilizing agent. The usage of peels from the plant takes full advantage of unwanted waste material which is economical friendly, efficient and safe. The synthesised copper nanoparticles are potential to be applied in biomedical and other applications where nontoxicity is crucial.

4. CONCLUSION

Banana and Orange peel extracts were used in the synthesis of Cu nanoparticles. It is an ecofriendly route for the synthesis of Cu nanoparticles. The merits of this method over other reported methods are easily available and inexpensive starting materials, easy procedure to carry out in laboratory and pollution free method due to the usage of non toxic reagents. The fruits' peel extract demonstrates the properties of both reducing and stabilizing agent. The usage of peels from the plant takes full advantage of unwanted waste material which is economically friendly, efficient and safe. The synthesized copper nanoparticles are potential to be applied in biomedical and other applications where nontoxicity is crucial.

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Fitness Capsule for Prevention of Hypo Kinetic Disease

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1. INTRODUCTION

Approximately 3.2 million people die globally each year due to lack of sufficient physical activity. The more we enjoy the "good life" the greater is the increase in chronic diseases. We need to increase physical activity for better health and quality of life.

Nowadays people are suffering from hypo kinetic diseases. It can be defined as "A disease or condition that is related to or caused by chronic physical inactivity and poor fitness".Fitness is defined" as the quality ofbeing suitable to perform a particular task". The term fitness increased in western vernacular by a factor of ten. Fitness is described in modern times as a person or machine's ability to perform a specific function or a holistic definition of human adaptability to cope with various situations. This has led to an interrelation of human fitness and attractiveness which has mobilized global fitness and fitness equipment industries. Regarding specific function, fitness is attributed to personnel who possess significant aerobic or anaerobicability, i.e. strength or endurance.
A holistic definition of fitness is described by Greg Glassman in the Cross Fit journal as an increased work capacity across broad times and modal domains; mastery of several attributes of fitness including strength, endurance, power, speed, balance coordination and being able to improve the amount of work done in a given time with any of these domains. A well rounded fitness program will improve a person in all aspects of fitness, rather than one, such as only cardio/respiratory endurance or only weight training. It is proved that physical fitness results in positive effects on the body's blood pressure, because staying active and exercising regularly builds up a stronger heart.
A healthy diet is a diet which contains a balanced amount of nutrients, varied food such as fruits and vegetables, proteins primarily from fish, dairy products, and nuts. Minimal amounts of caffeine, sugar, fat, salt, and alcohol. Healthy eating is identical to a healthy diet, in that it relates to the practice of food intake for healthy living. Governments often use this term to refer to the ideal diet which the average person requires to remain healthy.

2. OBJECTIVE OF THE STUDY

- Importance of fitness to prevent hypo kinetic disease.
- Prevention is better than cure

3. MAIN BODY OF THE PAPER

Lifestyle is defined as a sum total of individuals' ways of life. Individual lifestyle constitutes what he / she eats, drinks, smokes, physical activity or in activity, participation in unprotected sexual behavior and drug habits. The above mentioned indices are called lifestyle factors. The effect of this lifestyle factors are responsible for degenerative and chronic diseases that afflict human beings in recent times. Such degenerative diseases are hypertension, diabetics, cancer, stroke and liver diseases including

the spread of HIV/AIDS. Lifestyles are patterns of behavioral choices made from the alternative that are available to people according to their socioeconomic circumstances and to the ease with which they are able to choose certain ones over others. Lifestyles are the "behavior of choice" which affect ones fitness and health status.

Physical fitness is having sound strength and endurances which promotes a healthy mind. Fitness was commonly defined as the capacity to carry out day's activities without undue fatigue. However, as automation increased leisure time, changes in lifestyles following the industrial revolution, rendered the definition insufficient. In current contexts, physical fitness is considered as a measure of the body's ability to function efficiently and effectively in work and leisure activities, to resist hypokinetic diseases, and to meet emergency situations. Hypo-kinetics are conditions related to inactivity or low levels of habitual i.e. obesity, excess body weight and diabetes.

Physical fitness is defined as a state of well-being with low risk of premature health problems and possessions of reserved energy. 30 minutes of moderate physical activity in most of the weeks are recommended by various organizations in the United States to maintain a healthy weight, lose weight, promote good health; including prevention of hypokinetic diseases. This level of activity might include walking, jogging, running, gardening, and yard work or swimming, sedentary behavior patterns and excessive fat in the diet. Sedentary lifestyles are defined in relation to the numbers of hours that an individual spends sitting down in a typical day or the number of hours spent in walking or in either specific activities. Another definition of sedentary lifestyle refers to those individuals who did not practice any physical activity during their leisure time and in addition spent long time sitting down (Friedman and Thieibar, 1972). Majority of the University staff (Academic and non- academic staff) walk about with pot-belly and hearty hips buttocks occasioned by sedentary behavior adopted in their work places.

What Is Diabetes?

Diabetes is a defect in the body's ability to convert glucose (sugar) to energy. Glucose is the main source of fuel for our body. When food is digested it is changed into fats, protein, or carbohydrates. Foods that affect blood sugars are called carbohydrates. Diabetes develops when the pancreas fail to produce sufficient quantities of insulin – Type 1 diabetes or the insulin produced is defective and cannot move glucose into the cells – Type 2 diabetes. Either insulin is not produced in sufficient quantities or the insulin produced is defective and cannot move the glucose into the cells.

Normal Diabetes	**Normal**	**Diabetes**
Fasting blood sugar	80-99 mg/dl	126 mg/dl and above
Random blood sugar	80-139 mg/dl	200 mg/dl and above
2 hour glucose tolerance test	80-139 mg/dl	200 mg/dl and above

Exercise for Prevention Of Diabetics

- Sit-up: normal, sideways
- Using body twister machine
- Vakrasana
- Malsyasana
- Dhanurasana
- Savasana
- Strengthening exercise

What Is Hyper Tension?

Blood pressure is the force of blood pushing against blood vessel walls.High blood pressure (HBP) means the pressure in the arteries is higher than itshould be. Another name for high blood pressure is hypertension.

Normal blood pressure is below 120/80 mm Hg. If you're an adult and your systolic pressure is 120 to 139, or your diastolic pressure is 80 to 89 (or both), you have "prehypertension." High blood pressure is a pressure of 140 systolic or higher and/or 90 diastolic or higher that stays high over time.

Exercise for Prevention Of Hyper Tension

- Weekly once Endurance run
- Step –up

- Meditation
- Strengthening exercise
- Sheersasana
- Sarvangasana
- Savasanaa

4. CONCLUSION

- Fitness gives more energy and strength.
- Lowers cholesterol.
- Improves circulation.
- It helps to manage weight.
- Strengthens muscles, bones and joints.
- Decreases stress.
- Improves posture, balance and independent living.
- Improves well-being.
- May help to sleep better.
- Reach and maintain a healthy weight.

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Predictive Modeling for Hardness in Ground Water

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Abstract

In this article we describe a scientific method to predict one of the most significant water quality characteristic-the hardness using advanced stochastic modeling techniques. The study is based on data on about 21 variables on water quality and related soil and location characteristics. The data on some of the variables are directly measured, while the others are measured through the laboratory analysis of the soil and water samples collected from 300 locations selected at random in the district of Kasaragod. We use multiple regression model to predict the level of hardness in ground water in terms of soil and water source location characteristics. The significant feature of the model is that it enables to predict the hardness of water in a location based on a set of soil and location characteristics. One of the important use of the model is that it helps in fixing the locations for waste dump area, septic tank, digging well etc. in town planning, designing residential layouts, industrial layouts, hospital/hostel construction etc.

Key words: Hardness, Generalized Linear Model, Multiple Regression Model, Prediction, Stochastic Model, Water Quality.

1. Introduction

The quality of water is described in terms of about a dozen characteristics identifiable by means of lab tests of water samples. As per WHO standard the quality of water is described in three categories *microbial, physical and chemical*. The microbial parameters include *Escherichia coli (E. coli) and coliform organisms*, physical parameters include *temperature, smell, taste, colour and turbidity* and chemical parameters include *pH, dissolved oxygen(DO), biological oxygen demand (BOD), total dissolved solids (TDS), total hardness (TH), chlorides (Cl), sulphates (SO_4), fluorides (F), nitrates (NO_3), calcium(Ca), magnesium(Mg), iron (Fe)*, etc. Each of these water quality characteristics has different impact on water quality. In this paper we consider estimation of hardness in water that would be available in a location in terms of several related soil and location characteristics. Water hardness is commonly defined as the sum of the polyvalent cations such as calcium and magnesium dissolved in the water. Although other cations, e.g. barium, iron, manganese, strontium and zinc, also contribute to total hardness in water.

Providing adequate safe drinking water to all persons in a country like India is undoubtedly a great challenge for the Government. Recognizing the importance of safe drinking water several organizations across the country has done several studies to assess the quality of drinking water. Most of the studies indicate that the status of drinking water quality of the country is not in an

appreciable stage. Each of the physical, chemical and microbiological contaminants is higher than the tolerance level. As per a recent report of Khurana et al. [2009] of WaterAid , (WaterAid is an international non-profit organization transforming lives by improving access to safe water, hygiene and sanitation. *www.wateraid.org*) "it is estimated that around 37.7 million Indians are affected by waterborne diseases annually, 1.5 million children are estimated to die of diarrhea alone and 73 million working days are lost due to waterborne disease each year". In a study conducted by Prasad et al.[2009], attempt was made for predicting water quality using regression techniques based on water quality characteristics. In this study they have developed linear regression models between each correlated pairs of water quality characteristics and used the model to predict the level of one of the water quality characteristic using the known value of the other. A study on drinking water quality was conducted by Kumar et al.[2010] to identify the drinking water quality in the state Uttar Pradesh using a similar simple regression model. They used the model to estimate and compare the level of various water quality characteristics with the WHO standards which revealed that drinking water is polluted with reference to all the characteristics studied and water quality management is urgently needed in the study area. Behera et al.[2012] conducted a study to understand the ground water pollution due to iron content and water quality in and around, Jagdalpur, Bastar district of Chattisgarh. Their study revealed that the hardness of the water is very high and level of contamination is more than the tolerance level.

Related studies in Kerala indicate that the rivers, ponds, wells, tanks and streams of Kerala have been increasingly polluted from the industrial and domestic waste and from the pesticides and fertilizers (Disaster, Risk and Vulnerability Conference 2011, School of Environmental Sciences, Mahatma Gandhi University, India, in association with the Applied Geoinformatics for Society and Environment, Germany - March 12-14, 2011). Karthick et al.[2012] conducted a study to analyze the drinking water quality in all districts of Kerala using the Statistical Techniques, correlation analysis and cluster analysis. In their study they found that among 98 water samples physical-chemical and biological characteristics of only nine sample's Attathodu, Pampa Valley, Athikayam, Vadaserikara, Pandalam (Pathinamthita district), Kandiyoor (Alapuzha), Kattachal (Kollam), Pazhayidam (Kottayam) and Nedumangadu (Thiruvananthapuram) were within desirable limit as per Bureau of Indian Standards (BIS). This means 91% of the study cases have pollutants higher than the tolerance level.

Several studies were conducted across the world to assess drinking water quality over the years. As per WHO the quality of drinking water reduces in each year. According to WHO World Health Report, 1998, over 1 billion people do not have an adequate and safe water supply of which 800 million are in rural areas. Even affluent nations including Japan, Sweden, Canada, the U.S., the U.K., and Australia have experienced many outbreaks of waterborne disease in recent decades.

There are some studies undertaken to get a predictive model for water quality using Regression Techniques. Loucks et al.[2005] conducted a study to build a predictive model for water quality in River, Lake, Sea and Ocean based on some explanatory variable like velocity of water flow, algal density, temperature, chemical and microbiological contamination etc,. Clement et al.[2005] conducted a study funded by AWWA Research Foundation of U.S. for building a predictive model of water quality in distribution system based on the explanatory variables metals that are significantly related to the water quality, microbial contamination, water storage places, quality of distribution pipes, water flow paths, travel time etc,. Andrew et al.[2009] conducted a study to develop a predictive model for drinking water reservoirs based on taste and odor in Kansas, USA. Mannina et al.[2005] describe the behavior of water pollutants present in river waters in terms of physical, biological and chemical process, using the differential equation connecting the concentration of generic pollutant, time, longitudinal displacement, velocity of flow of water and the diffusion coefficient. Another important study was conducted by Mustapha et al.[2012] using multiple regression model and principal component analysis. This study also was on the water quality characteristics. Hynds et al.[2012] develop a model to predict

microbial contamination using local meteorological data and they found that local bedrock type, local subsoil type, groundwater vulnerability, septic tank setback distance, and 48 h antecedent precipitation were all significantly associated with thermotolerant coliform (TTC) presence. Francy et al.[2013] conducted a study to develop predictive Models for Escherichia coli (E. coli) concentrations at Inland Lake Beaches based on rainfall, wind direction and speed, turbidity and water temperature. Heydari et al.[2013] conducted a study on 'Correlation Study and Regression Analysis of Drinking Water Quality in Kashan City, Iran'. In this study they used simple correlation technique and developed simple linear regression models to express one water quality characteristic based on the other. Akoteyon et al.[2013] conducted a study to fit a regression model for predicting water quality using depth of water source. Using correlation analysis they found that depth of water is depending on water quality. Hall et al.[2014] conducted a study to fit a multiple regression model assessing the relationship between land use and water quality. Using canonical discriminant analysis they identified the association between Land use and water quality characteristics. Tabata et al.[2015] conducted a study to assess the water quality in the Ariake sea using principal component analysis and investigate the relationship between the environmental issues and water quality. They found that seasonal changes and organic pollutions are affecting the quality of water. A study was conducted by Camacho et al.[2015], to assess the water quality in different sites and different seasons using multivariate statistical techniques.

It is clear that water pollution due to hardness is mainly because of lack of scientific management of industrial and domestic waste, increased use of pesticides and chemical fertilizers in agriculture, poor sanitation facilities etc. Many factors can affect the quality of the water in an ecosystem including discharges of industrial and agricultural wastes, domestic and institutional wastes, contamination from leakages from septic tanks, proximity to garbage disposal sites etc. The existing practice for fixing the location for drinking water collection is mainly based on the surface distance of the water source location from the location of waste disposal. Field observations and soil testing allow us to assess the links between land use and its effects on water quality. Thus there is sufficient reason to suspect strong correlation between soil structure and water quality characteristics.

The hardness of water is due to the presence of calcium and magnesium minerals that are naturally present in the water. Mineral content is high in hard water. As per the WHO standard and National standard for drinking water quality the desirable level of water hardness is $< 200ppm$. Several studies were reported so far for finding the health issues due to hardness in water. Survey of literature indicates that no scientific studies were done so far for the estimation of hardness in ground water using advanced stochastic models based on location and soil characteristics.

This study is conducted in the district of Kasaragod belonging to the Kerala State. Data has been collected by the method of stratified random sampling by dividing the area into 6 strata namely Agricultural land (Pesticide using area), Costal area, Forest area, Hospital area, Market places, and Waste dump area depending on the levels of contamination of ground water. Since well and bore well water sources are the main source of drinking water in the district, we confined our study on well and bore well water sources. As many as 300 water sources were selected at random ranging 50 to 60 from the neighborhood of each stratum. Soil and water samples were collected from these locations. **distance of well from septic tank, slope of well from septic tank, number of septic tanks near to the well, distance of well from nearest stratum boundary, slope of well from nearest stratum boundary and depth of the well**. The soil characteristics measured are **porosity, pH, electrical conductivity, organic carbon , texture, iron, sulphur, phosphorus, calcium, magnesium, copper, zinc, manganese and potassium**. All these characteristics combined together we call as water source location characteristics. Hardness in water and soil characteristics are identified by testing water and soil samples in the laboratory.

In this article we describe the procedure of estimating hardness in ground water using multiple regression model. The model utilizes effectively the benefit of the relationship of hardness with water source location characteristics. The whole analysis were done using SPSS.

The remaining part of this article is organized as follows: section 2 describes briefly some of the

advanced statistical concepts based on which the study is made. Basic statistical characteristics of the data under study are presented in the first sub section of section 3 and the model building process and its features are discussed in the next sub section. The article closes with a conclusion, acknowledgment and the list of references.

2. Statistical/Mathematical Background

Following the terminology and convention in general linear modeling we regard the hardness in ground water as the response variable and water source location characteristics as the explanatory variables. First of all we identify the statistical properties satisfied by the response variable and explanatory variables so as to decide upon the kind of model and type of analysis to be performed. For this purpose descriptive statistical analysis (mean, standard deviation, skewness and kurtosis) were done. Constructing the correlation matrix between the response variable and set of explanatory variables we identify the highly correlated water source location characteristics. Since response variable is continuous scale variable, multiple regression model is appropriate in this case.

A multiple regression model is a model belonging to the class of general linear models. A detailed description of the model choice, fitting and the various features of models in general linear model are available in standard text books such as Yule and Kendall[1922], Koutsoyiannis[1973], Draper and Smith[1998], Hosmer and Lemeshow[2000], Montgomery, Peck and Vining[2003], etc,.

The functional form of a multiple regression model (general linear model) is,

$$Y = X'\beta + \epsilon, \tag{1}$$

where Y is the response variable, X is the column vector of explanatory variables, β is the column vector of the regression coefficients and ϵ is the random error.
For the validity of the multiple regression model the variables in the model are to satisfy the following assumptions:
The error ϵ must follow normal distribution with zero mean and constant variance (Gaussian and homoscedastic). Explanatory variables must be non correlated (no multicollinearity).

The regression coefficients are estimated using method of least squares. The least squares estimates are

$$\hat{\beta} = (X'X)^{-1}X'Y, \tag{2}$$

provided that $(X'X)^{-1}$ exists.
In (2), X denotes the observation matrix on explanatory variables and Y the column vector of observations on the response variable.

In fitting the above model one important element is selecting the explanatory variables for inclusion in the model. Normally all those explanatory variables that are highly correlated with the response variable are to be included. There are several statistical procedures for selecting variables for inclusion in the model such as stepwise regression, forward selection, backward elimination etc. Adequacy of the fitted model is assessed using Analysis of Variance (ANOVA) techniques which performs a F- test for the overall adequacy of the model and provides the coefficient of determination R^2 (higher the value of R^2 more appropriate the fitted model). The significance of each regression coefficients can also be tested using individual t -test provided the model assumptions are satisfied. Even after fitting the model as described above there are several techniques to verify the model adequacy as well as the extent to which the model assumptions are satisfied (post-hoc tests). Finally the model adequacy can be validated using about 10% of the real data Further details on estimates and their properties can be had from the standard references Montgomery et al.[2003].

3. Results and Discussion

3.1. Preliminary Analysis

Table (1) present the basic statistical characteristics of the hardness of water. In Table (1) the descriptives of hardness in well and bore well are given in different columns. From this table we can identify that the hardness is more in bore well water sources. Soil and location characteristics analysis reveals that in our data the distance from nearest stratum boundary is ranging from 0.5m to 500m.

Using the multiple regression model we can predict the total hardness in a water source which is more than 500m from the nearest stratum boundary. Slope from nearest stratum boundary is ranging from -86.5 degrees to 63.4 degrees. We know that positive slope of the location affect the water quality very much. While considering the depth of the water source negative slope also gets consideration. Soil potassium, manganese, iron, calcium and magnesium shows large variability and it shows the heterogeneity of the selected area.

Table 1: Hardness of Water in ppm

Descriptives	Overall	Well	Bore Well
Mean	87.28	69.05	113.84
Median	80	62	110
Variance	2768.95	1828.82	2923.54
Minimum	15	15	32
Maximum	280	280	240
Skewness	1	1.45	0.59
Kurtosis	0.84	3.77	-0.23

As per the WHO guidelines the water quality is good when hardness is less than 200ppm.
Table (2) gives the classification of wells in terms of WHO standard.

Table 2: Classification of Wells in Terms of WHO Standard

Hardness	Frequency	Percentage
≤ 200	283	94%
> 200	17	6%

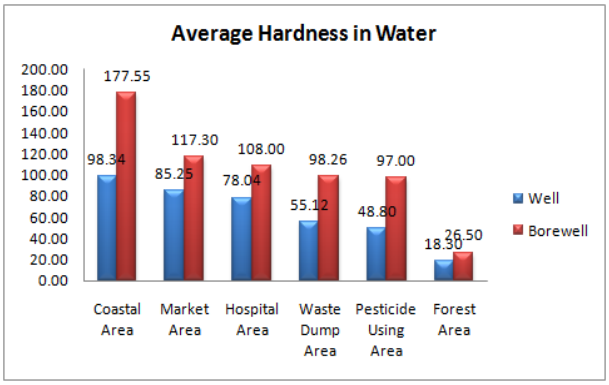
Thus from the Table (2) only 6% of the water sources in the study area are not in the permissible limit.

The average hardness level at each each stratum and their diagrammatic representations are give in Table (3) and Figure (1) respectively. The results indicate that hardness of water around the forest area is relatively low.

Table 3: Comparison of Mean Hardness in Various Locations

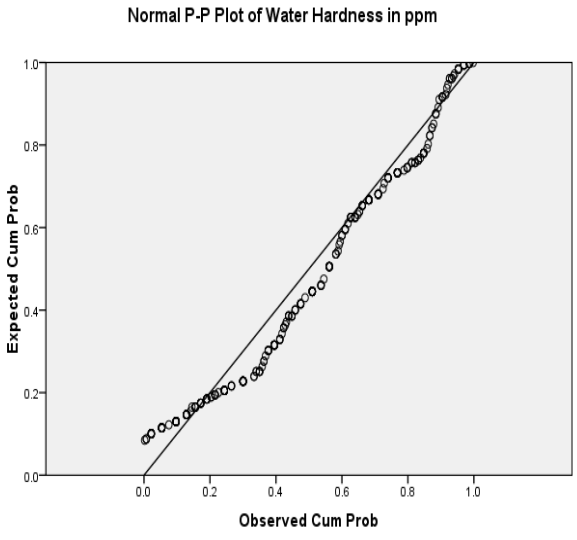
Location	Overall	Well	Bore well
Costal Area	135.55	98.34	177.55
Fish Market	98.98	85.25	117.30
Hospital	92.69	78.04	108.00
Waste Dump Area	73.75	55.12	98.26
Pesticide Using Area	53.22	48.80	97.00
Forest Area	22.40	18.30	26.50

Figure 1: Comparison of Mean Hardness in Various Locations



From this comparison we can observe that the average hardness in all stratum locations except forest area is relatively high. Thus it is important to study the ground water contamination due to hardness in all locations except forest area. For comparing average hardness in various stratum locations we used ANOVA technique. Before conducting the ANOVA we have to check the normality of hardness and this can be done using Normal P-P Plot.

Figure 2: Normal P-P Plot



From Figure (2), it is observed that hardness

data satisfies normality assumption and approximately so that ANOVA can be performed.

Table 4: Comparison the Mean Hardness in Various Strata

Source of Variation	SS	df	MS	F	P-Value.
Strata	191862.00	4	47965.50	24.43	0.00
Error	488979.46	249	1963.77		
Total	680841.47	253			

From Table (4) it is observed that the average hardness is significantly different in various locations.

From Table (2) we can identify that the hardness distribution is different in well and bore well water sources. Thus before going to the model based analysis we have to check the significant difference of mean hardness in well and bore well water sources. This test can be done using independent sample t-test. For this t-test we have to check the equality of variances in two samples (well and bore well samples) using Levene′s Test for Equality of Variances.

Table 5: Levene′s Test for Equality of Variances of well and bore well

Levene′s Test	F value	P-Value
Equal variances assumed	1.51	0.22

Since P-Value in last column of Table (5) is > 0.05 we accept the null hypothesis. Thus the variances of two samples are equal. Thus we have to use equal variance t-test for comparing means of well and bore well samples.

Table 6: Independent samples t-test for Equality of Means of well and bore well

t	df	P-Value (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference
9.27	245	0.00	53.42	5.76	(42.07 ,64.77)

Since P-Value in col. (3) of Table (6) is < 0.05 we reject the null hypothesis. Thus the average of hardness in well and bore well are significantly different. Thus different models required for well and bore well water sources for predicting hardness in water.

Advanced model based analysis are performed as described below.

3.2. Model Based Analysis

Let us first examine the simple correlations between hardness level and each of the explanatory variables under study.

Table 7: Correlation Matrix

Explanatory Variables	Overall	Well	Bore well
Distance of water source from nearest stratum boundary in meters (X_1)	-0.245**	-0.331**	-0.493**
Slope from nearest stratum boundary angle in degrees (X_2)	-0.103	-0.030	-0.100
Depth of water source in meters (X_3)	0.142*	-0.307**	-0.660**
Distance from nearest septic tank in meters (X_4)	-0.171**	-0.204*	-0.247*
Slope from nearest septic tank in degrees (X_5)	-0.114	-0.096	0.036
Number of septic tanks near to the water source (X_6)	0.281**	0.302**	0.264**
Distance from nearest flowing water body in meters (X_7)	-0.076	-0.059	-0.258*
Soil pH (X_8)	0.475**	0.389**	0.581**
Soil EC (X_9)	0.430**	0.448**	0.440**
Soil organic carbon (X_{10})	0.090	0.058	0.115
Soil Potassium (X_{11})	-0.187**	-0.145	-0.211*
Soil Sulphur (X_{12})	0.044	0.107	-0.085
Soil Phosphorus (X_{13})	0.411**	0.373**	0.528**
Soil Porosity (X_{14})	-0.451**	-0.338**	-0.530**
Soil Manganese (X_{15})	-0.036	0.069	-0.136
Soil Zinc (X_{16})	0.016	0.062	-0.087
Soil Copper (X_{17})	-0.192**	-0.158	-0.241*
Soil Iron (X_{18})	-0.035	-0.069	-0.041
Soil Calcium (X_{19})	0.180**	0.284**	-0.005
Soil Magnesium (X_{20})	0.043	0.029	0.005

** indicates significant correlation with hardness at 5% level of significance.
* indicates significant correlation with hardness at 1 % level of significance.

The Table (7) reveals that out of the 20 explanatory variables under study, 10 exhibit significant simple correlation with the response variable. This

provides justification to use a multiple regression model, however, it does not fix the explanatory variables to be included in the model. This is due to the fact that rather than the individual influence some the variables may have joint influence on the response. we describe below the appropriate model selection and its features.

3.2.1. Multiple Regression Model Fitting for well

Stepwise regression technique is used to develop the model for hardness as it allows a free choice for each variable for inclusion or exit from the model depending on the corresponding influence. 20 explanatory variables are used in this study. Out of which 7 are selected in the final model for predicting hardness. The fitted model information is presented in Table (8). Col.(1) of Table (8) contain the 7 explanatory variables finally included in the model, col.(2) the corresponding regression coefficients and their standard errors. col. (3) and (4) provide the t-test statistics and the corresponding p-values testing the significance of each regression coefficient. Note that the stepwise regression method retains only those variables with significant regression coefficient (p-value ¡.05), no matter whether the variable individually have significant correlation with the response or not. The entries in the last column is the variance inflation factor (VIF) which reflects the extent of multicollinearity present among the explanatory variables.

Table 8: Variables and Their Coefficients in the Regression Model for well

Variables	Coefficients		t	P-value	VIF
	β	Std. Error			
(Constant)	123.529	21.073	5.862	0.000	
X_1	-0.097	0.024	-3.975	0.000	1.211
X_2	-0.738	0.217	-3.407	0.001	1.110
X_3	-2.371	0.930	-2.549	0.012	1.293
X_9	0.756	0.430	1.758	0.081	1.812
X_{13}	0.276	0.086	3.198	0.002	1.153
X_{14}	-1.156	0.378	-3.058	0.003	1.552
X_{19}	0.002	0.001	2.055	0.042	1.286

where,
X_1 - Distance of water source from nearest stratum boundary in meters
X_2 - Slope from nearest stratum boundary angle in degrees
X_3 - Depth of water source in meters
X_9 - Soil EC in micro sements
X_{13} - Soil Phosphorus in kg/hector
X_{14} - Soil Porosity in %
X_{19} - Soil Calcium in kg/hector

Since VIF is less than 10 (very close to 1) there is probably no cause for Multicollinearity concern. Substituting the values of regression coefficients in equation (1) we will get the regression model as,

$$Y = 123.529 - 0.097X_1 - 0.738X_2 - 2.371X_3 + 0.756X_9 + 0.276X_{13} - 1.156X_{14} + 0.002X_{19} + \epsilon$$

where Y - Hardness in ppm

The model accuracy measure R^2 and the overall significance test results of the model are presented in Tables (9) and (10) respectively.

Table 9: Model Summary

R Square	Adjusted R Square	Std. Error of the Estimate
0.52	0.49	32.02

Table 10: ANOVA Table for Testing Overall Significance of Regression Model

Source of Variation	SS	df	MS	F	P-value
Regression	119329.22	7	17047.03	20.75	0.00
Residual	111752.59	136	821.71		
Total	231081.81	143			

The tables (8)-(10) together reveal that among the 20 explanatory variables used only the 7 included in the fitted model have significant influence on hardness and the included variables do not exhibit any serious multicollinearity. The fitted model is capable of explaining up to 52% of variation in hardness and the model is very highly significant. Table (11) presents the illustration of model validation. The relative percentage variation entries in the last column of this table are computed as,

$$RelativeVariation = \frac{|Actual\,Value - Predicted\,Value|}{Actual\,Value} * 100 \quad (3)$$

Table 11: Model Validation Using Randomly Selected Location Values for Well

Sl.No	X_1	X_2	X_3	X_9	X_{13}	X_{14}	X_{19}	Hardness		
								Actual	Predicted	Relative Variation
1	2	1.75	7	5.16	2.69	58.69	25.76	46	42.30	8.05%
2	20	-34.6	15	3.58	0.11	49.65	111.55	57	57.12	0.22%
3	250	-6.2	12	1.00	0.22	49.22	1237.6	24	21.80	9.16%
4	60	-10.6	12	12.00	66.86	36.95	5246	82	92.39	12.67%
5	15	-0.86	12	10.00	88.69	38.60	8456	100	98.58	1.42%
6	30	-3.4	5	28.00	42.78	20.24	1842	120	124.54	3.78%
7	30	-4.2	4	19.00	49.06	21.14	1842	125	121.38	2.90%
8	35	-3.2	5	16.00	52.25	20.71	2458	118	118.13	0.11%
9	140	3.5	10	23.00	57.68	28.57	22512	112	128.96	15.14%
10	30	22.4	20	104.00	38.53	51.95	3690.4	100	93.25	6.75%
11	120	-3.6	16	10.00	12.56	35.03	1864	54	50.87	5.79%
12	30	-4.6	4	39.00	42.78	21.67	1842.4	132	134.46	1.86%
13	6	-0.059	17	19.20	125.89	57.20	230.72	60	66.29	10.48%
14	60	-6.2	7	40.00	42.87	25.41	2542.4	150	123.48	17.68%
15	40	-8.54	9	3.50	4.93	60.10	71.456	41	39.29	4.18%

The relative variation in the last column of Table (11) reveals that except in 4 cases the value is less than 10% and 4 cases exceeding 10% have relative variation of magnitude 10.5%, 12.7%, 15.1% and 17.7% only. Admitting about 10% variation we can conclude that 11 out of 15 cases agree with the model as indicated in Table (12).

Table 12: Model Validation Using Relative Variation

Relative Variation (%)	Frequency	Percentage
$\leq 10\%$	11	73.33
$> 10\%$	4	26.67

3.2.2. Multiple Regression Model Fitting for bore well

The fitted model information is presented in Table (13). Columns are same as Table (8).

Table 13: Variables and Their Coefficients in the Regression Model for well

Variables	Coefficients		t	P-value	VIF
	β	Std. Error			
(Constant)	201.602	22.126	9.112	0.000	
X_1	-0.115	0.020	-5.791	0.000	1.179
X_2	-0.610	0.159	-3.826	0.000	1.146
X_3	-0.882	0.172	-5.115	0.000	1.861
X_9	1.554	0.328	4.741	0.000	1.848
X_{14}	-1.426	0.605	-2.358	0.021	1.860

where,
X_1 - Distance of water source from nearest stratum boundary in meters
X_2 - Slope from nearest stratum boundary angle in degrees
X_3 - Depth of water source in meters
X_9 - Soil EC in micro sements
X_{14} - Soil Porosity in %

Since VIF is less than 10 (very close to 1) there is probably no cause for Multicollinearity concern. Substituting the values of regression coefficients in equation (1) we will get the regression model as,

$$Y = 201.602 - 0.115X_1 - 0.610X_2 - 0.882X_3 + 1.554X_9 - 1.426X_{14} + \epsilon$$

where Y - Hardness in ppm
The model accuracy measure R^2 and the overall significance test results of the model are presented in Tables (14) and (15) respectively.

Table 14: Model Summary

R Square	Adjusted R Square	Std. Error of the Estimate
0.77	0.76	24.98

Table 15: ANOVA Table for Testing Overall Significance of Regression Model

Source of Variation	SS	df	MS	F	P-value
Regression	163492.88	5	32698.58	65.14	0.00
Residual	111752.59	97	501.94		
Total	231081.81	102			

The tables (13)-(15) together reveal that among the 20 explanatory variables used only the 5 included in the fitted model for bore well have significant influence on hardness and the included variables do not exhibit any serious multicollinearity. The fitted model is capable of explaining up to 77% of variation in hardness and the model is very highly significant. Table (17) presents the illustration of model validation.

Table 16: Model Validation Using Randomly Selected Location Values for Bore Well

Sl.No	X_1	X_2	X_3	X_9	X_{14}	Hardness		
						Actual	Predicted	Relative Variation
1	200	-82.50	80	5	38.87	104	111	6.45%
2	35	-8.40	76	9	41.77	88	90	2.38%
3	50	-5.40	8	48	23.43	220	233	6.03%
4	55	-4.90	8	60	24.61	240	249	3.90%
5	75	-4.30	20	35	26.27	220	195	11.41%
6	80	-4.60	20	28	26.27	200	184	8.19%
7	30	-4.30	6	38	20.00	240	226	5.83%
8	70	0.59	7	28	20.00	190	202	6.32%
9	55	-12.40	55	8	39.76	128	110	14.01%
10	500	-6.50	60	8	23.66	70	74	5.49%
11	100	-4.60	24	22	28.36	170	165	2.65%
12	150	-20.60	72	12	35.32	100	102	1.70%
13	200	-83.45	71	12	39.06	125	130	3.86%
14	10	-0.46	50	12	35.10	130	125	3.67%
15	500	-86.50	60	9	43.22	98	96	1.74%

The relative variation in the last column of Table (16) reveals that except in 2 cases the value is less than 10% and 2 cases exceeding 10% have relative variation of magnitude 11% and 14% only. Admitting about 10% variation we conclude that 13 out of 15 cases agree with the model as indicated in Table (17).

Table 17: Model Validation Using Relative Variation

Relative Variation (%)	Frequency	Percentage
$\leq 10\%$	15	86.67
$> 10\%$	2	13.33

4. Conclusion

Though everybody will admit that the water quality very much depends on the soil and location characteristics this is the first scientific study to highlight their actual impacts. Starting from 20 suspected soil and location characteristics we establish here the significant influence of 7 of them on hardness, one of the very significant determinant of water quality. The magnitudes of the regression coefficients in the fitted model reveal that among the 7 influential characteristics, electrical conductivity (EC) and phosphorus content in the soil have relatively major positive influence on hardness. While calcium content in the soil also have positive contribution, all other components, distance from stratum boundary (market place, hospital area, waste dump area, etc.), slope from stratum boundary, depth of water source and soil porosity have negative influence. The most significant feature of the model developed here is that using it one can determine the quality (in terms of hardness) of the water that would be available in a location by observing the set of 7 water source location characteristics. This knowledge can be used to fix the locations for digging wells, waste dumping, market places etc. while planning residential and industrial lay outs, town planning etc. Similar models can also be derived for several other important water quality characteristics.

5. Acknowledgement

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