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Greenery method for Synthesis of some alkali and alkaline earth metallic nanoparticles and its antibacterial screening activity

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Abstract

In the presence study of science and technology has greater significance for the development of nanoparticles and its physicochemical properties. Alkali and alkaline earth metalic nanoparticle has synthesized by using various plant extract and metalic solution. However, biogenic reduction of metal precursors to produce corresponding metalic nanoparticle is eco-friendly, low cost, free of chemical contaminants for medical and biological applications. The synthesized Metallic nanoparticle is found to be more susceptible towards the bacterial strains.

Keywords: Tulsi; Turmeric; Bael and Castor leaf powder; Nano-particle; Bacterial activities

1. Introduction

Nano technology is an important field of modern research dealing with preparation, methods and manipulation of particle size ranging from 1 to 100nm, mention to as nanoparticles [1]. They are showing remarkable properties such as size and shape respectively[2].However, Colours of nanoparticle also depends on the particle size and shape. Many researchers and scientists have shown great interest in their unique features and found that numerous nanoparticle materials revealed toxicity at the nanoscale size. To overcome the problem of toxicity, nanotechnology and green chemistry merge to fabricate nature-friendly nanoparticles via plants, microbes, etc[3].Researchers have developed many synthetic routes for nanoparticle fabrication which wellness a notable benefit to nature & environment via clean, nontoxic, and environmentally adequate "green chemistry" methods which include organisms such as bacteria, fungi, plants[4].

For the study of Nano-particles following analysis had taken. These have FTIR, UV-VISIBLE, PSA, SEM & antimicrobial activity etc.These are fundamentals test analysis to the properties of Nano-particles[5-6. Greenery synthesis of metalic nanoparticles materials properties has varied from materials prepared by other methods. Synthesized metalic nanoparticles may emphasize the reduced toxicity, stability and implacability; also it has enhanced the potential range of shapes, compositions and sizes of synthesis of metalic nanoparticles convert into a broad domain and new nanomaterials applications due to coating of capping agents[7].

Nano technology are wide range of applications like food packaging, in medicine (Especially in cancer treatment) agriculture and in waste water treatment etc. Green synthesis of metallic Nano-particles can be synthesized by various routs and one of the most important routs is a biological, in this rout we have been plane synthesizing nanoparticle from any body part of plant materials like roots, flowers, fruits, leaves etc.

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2. Material and methods

2.1. Materials

Potassium nitrate, Sodium nitrate, Calcium nitrate (Sigma–Aldrich, USA) and all other reagents used in this study were of analytical grade. In this experiment was used doubled distilled water.

2.2. Plant Leaf Extraction Procedure

Collect the leaves of Turmeric, Bael and Castor from the farm area of raver and Yawal tahasil areas and washing the leaves two or three times with distilled water. Drying the leaves under the clear sunlight for one week. This dry leaves is grinding by mixer and convert into powder. Taking 10 gm of leaf powder (Tulsi, Turmeric, Bael and Castor) in 250 ml beaker then adding 200 ml of distilled water. Dissolve it and making homogeneous solution. Heat the mixture on magnetic stirrer at 60-70°C for 5-7 hours. Cool the reaction mixture at room temperature & settled down precipitate for 2-3 days then forming the two layers in beaker then separate out upper extract without any disturbing it. Centrifuge off The crude Tulsi leaf at centrifuge machine, formation of clear solution Collect the pure extract into the sample bottles and this extract is used for the preparation of metalic Nano-particles.

2.3. Dry leaves and their powders

Figure 1 Dry leaves and their powder

2.4. General method of green synthesis of metalic nano-particles

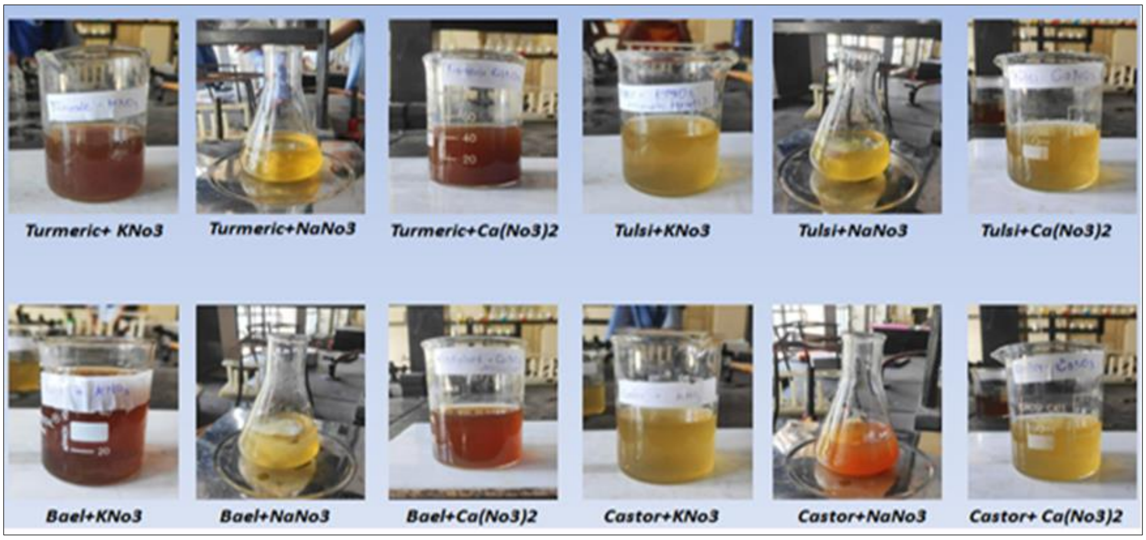


Figure 2 Formation of metalic nanoparticles

Taking 45 ml of leaf extract (Tulsi, Turmeric, Bael and Castor) and add 5 ml of 0.5 M metal solution ($NaNo_3$, KNo_3, $Ca(No_3)_2$) with constant stiring in a Conical flask orbeaker. Heat the mixture on a magnetic stirrer at 70-80°C for 40 min. After 30-40 minutessolution colour was changed as shown in fig.no.2 and we concluded that metalic nanopartical were formed.

2.5. Characterisation techniques of synthesized metalic nanoparticals

The formation of metalic nanoparticals was evaluated by visual assessment of the colour changes of the solutions. The reduction of metalic Nano partical was measured periodically at a wavelength range between 185–800 nm using an ultraviolet–visible (UV-2600 Type Series) spectrophotometer.

The DLS and zeta potential techniques were using the estimate the average particle size and the potential stability of the metalic nanoparticles formed in the solution [15].The DLS indicate of synthesized various metalic nanoparticles are illustrated in Graph-2 The shape and morphology of the nanoparticles were determined using scanning electron microscopy (SEM) [16-17]. This is showing in figure 5. And the synthesized metallic nanoparticle shows antibacterial activity against bacteria E-coli by agar well diffusion method as shown in figure 6**.**

3. Results and Discussions

The uses of environmentally eco-friendly sustainable solvent water systems and metals are reduces in to their elemental state are observed the most important criteria for green chemistry approach for the synthesis of metalic nanoparticles [8].

3.1. UV-Visible Study

The formation of light to dark brown or pale yellow color of various metalic nanoparticles shows which are an indicative of the reduction of metal ions (M^+ to M^0 where, M= Na, K & Ca)in elemental form and were examined by maximum absorption peak observed range between 185 and 800 nm which indicating the crystalline nature. (Graph-1)(1 second time intervals & light source change wavelength at 323nm) at room temperature [9-12].

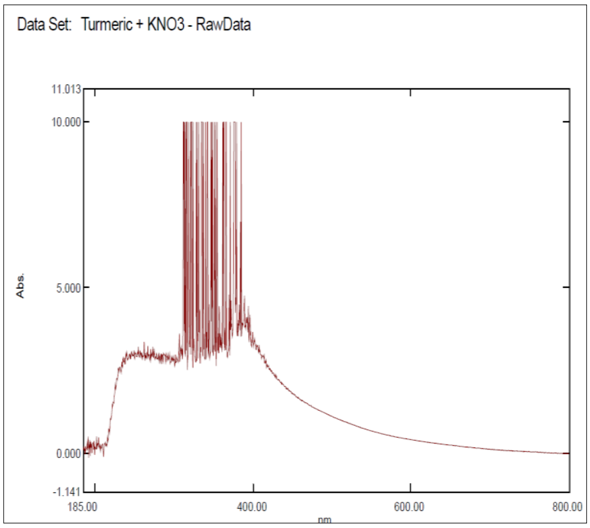
Many researchers were investigating the change of the optical properties of colloidal solution of metalic nanoparticles and they found Light irradiation reduction of metals, when the various metalic solutions were changed which can be related to the shape and size of the reduced different metalic nanoparticles [13]. For the higher absorption depends upon the change in particle size [14-16].

3.2. DLS study

DLS is the study of the Dynamic light scattering (DLS) technique in which the study of the potential stability of metalic nanoparticles and the average particle size formed in different metalic nanoparticles solution[17-18].The DLS has been estimating of synthesized metals nanoparticles for various metals and leaves extract nanoparticles in liquid phase are illustrated in Graph-2. So, this is also called as photo correlation spectroscopy [19]. The zeta potential of nanoparticles implies the valuable principal key of stability of metalic nanoparticles and surface charge present on it. Large magnitude of zeta potential designate and high electrical charge on the surface of the nanoparticles can cause strong repulsive force among particles to form clusters. [20]. in the others words by using DLS techniques were emphasized the negative magnitude of zeta potential of metalic nanoparticles ($\xi = -5.16$to-20.5 mV) showing longer time stability of these metalic nanoparticles solution. Solution indicating the dissemination of metalic nanoparticles because, off their presents between the negative–negative repulsive forces in the metalic nanoparticles solution.

3.3. SEM Study

The morphology of metalic nanoparticles had studied by SEM. In the present work only study some of the metalic nanoparticles (Tulsi, Turmeric, Bael and Castor of $NaNo_3$) showing different shapes. The shapes of metalic nanoparticles depends on concentration of plant extract, part of the plant used, rate of mixing metal ions solution and plant extract, time required for reaction and temperature etc. [21]. The reduction of metal ions to fabricate metals nanoparticles by using tea extract, reducing agent and stabilizer, led to the formation of spherical metalic nanoparticles [22-23]. SEM images of various metalic nanoparticles as showing [24-28]. in figure 5


Data Set: Turmeric + KNO3 - RawData
11.013
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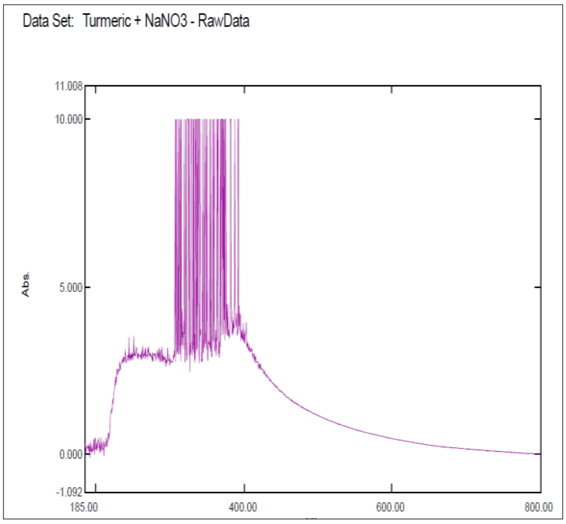
800.00


Data Set: Turmeric + NaNO3 - RawData
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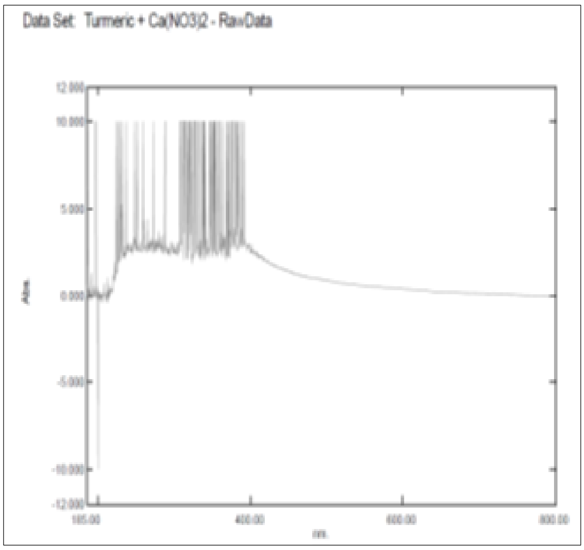
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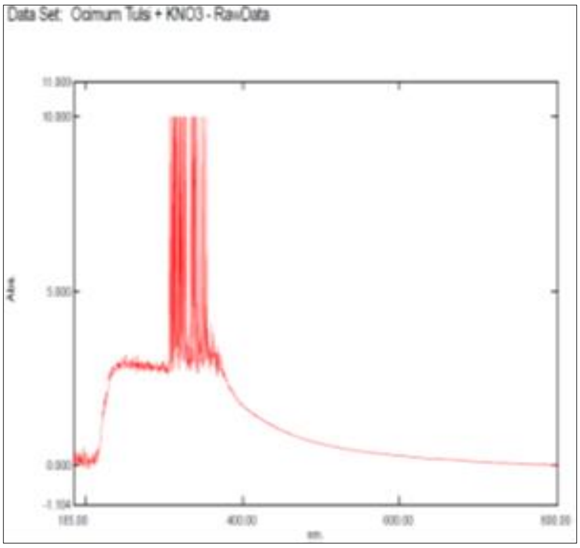
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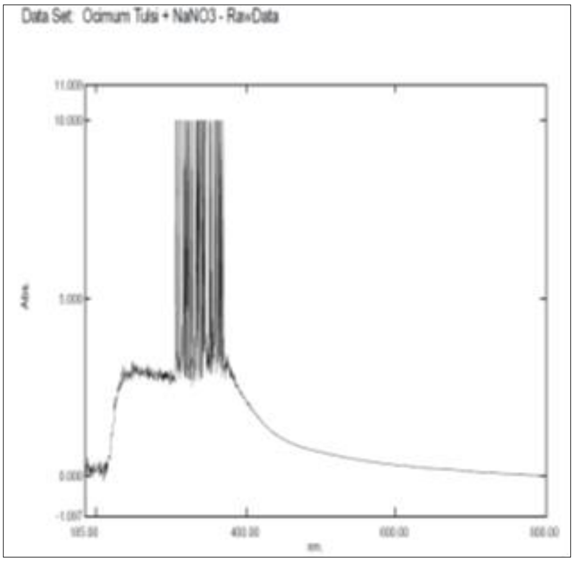
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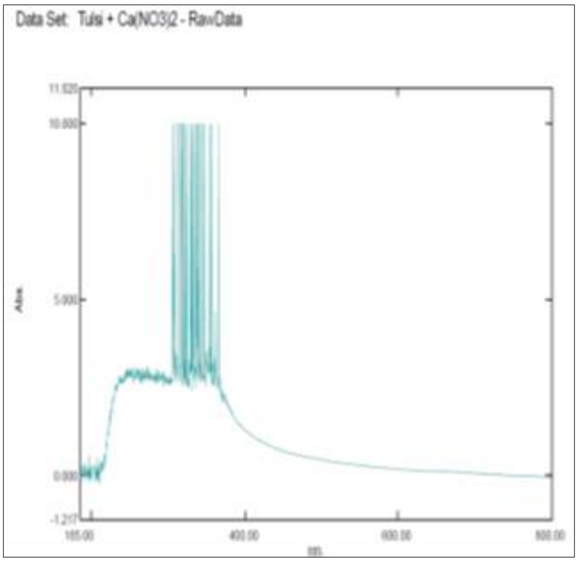
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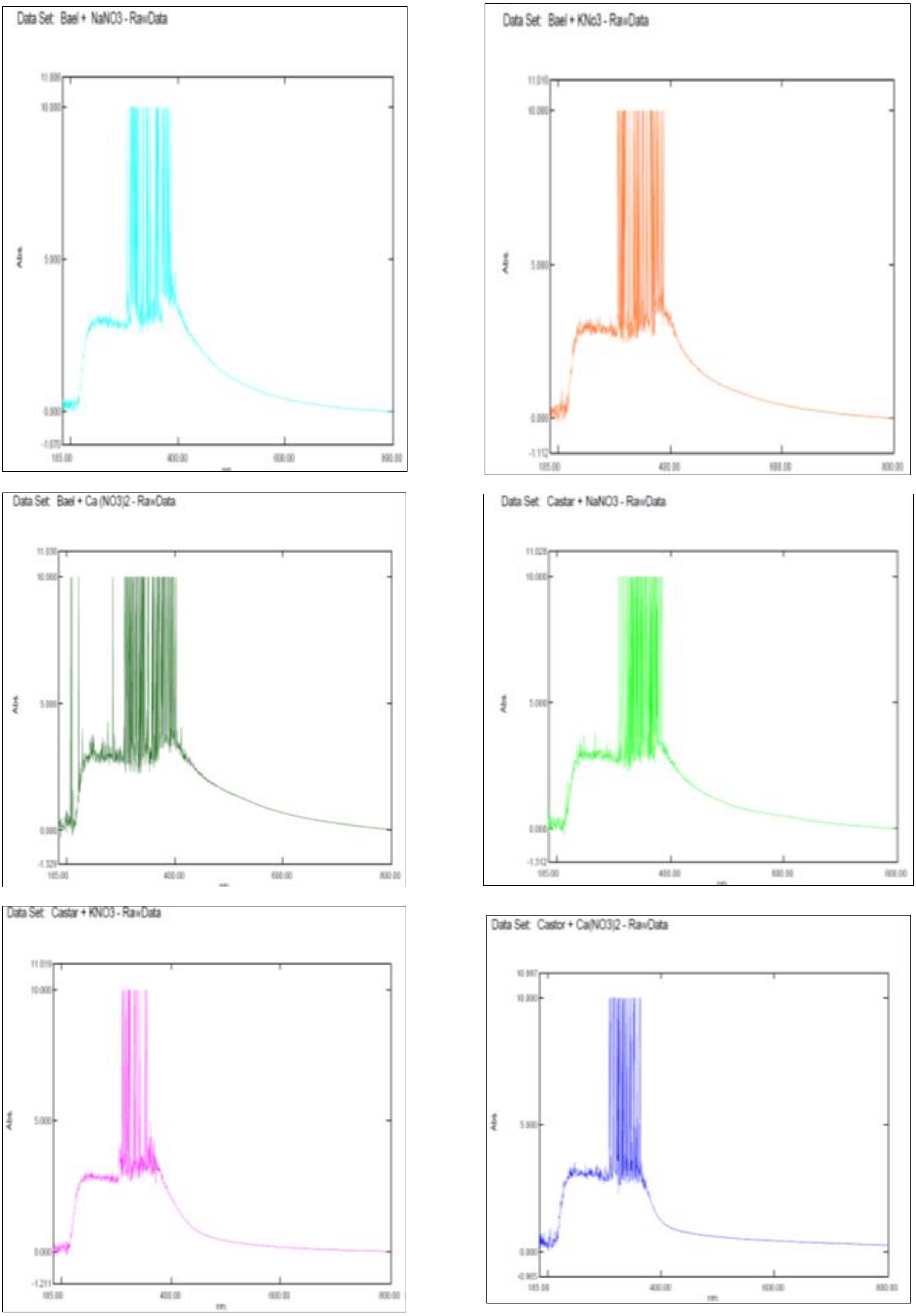
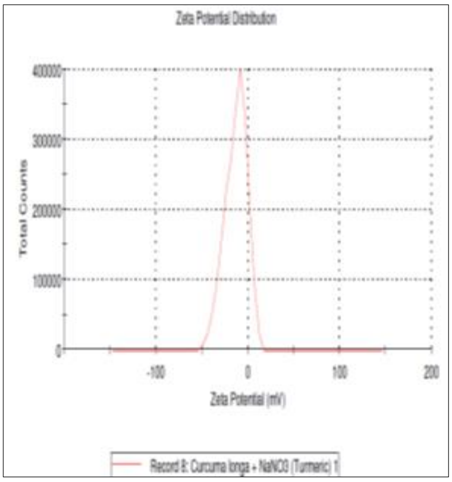
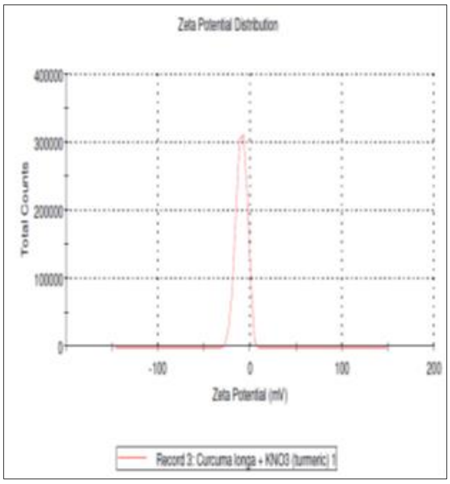
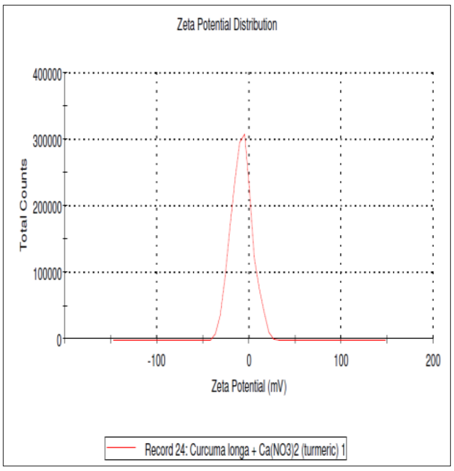
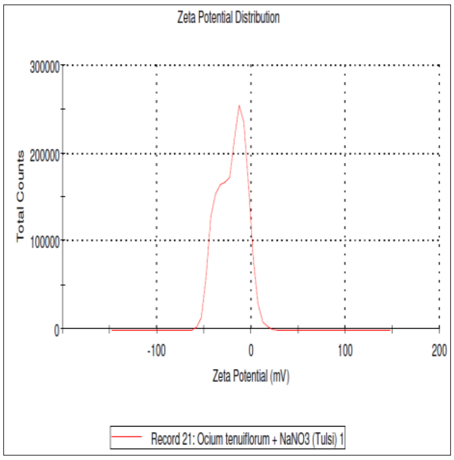


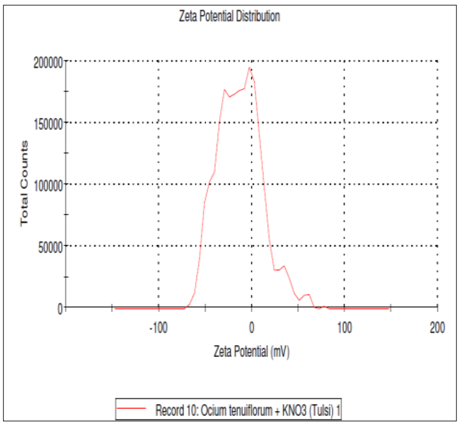
Figure 3 UV Spectra

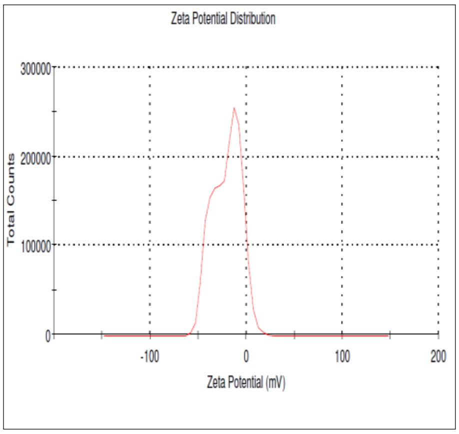

Zeta Potential Distribution
Total Counts
Zeta Potential (mV)
Record 8: Curcuma longa + NaNO3 (Turmeric) 1

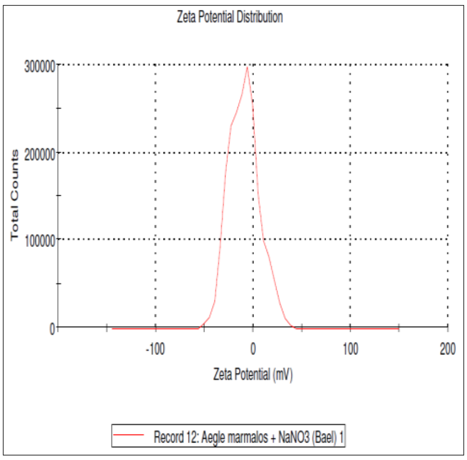

Zeta Potential Distribution
Total Counts
Zeta Potential (mV)
Record 3: Curcuma longa + KNO3 (turmeric) 1

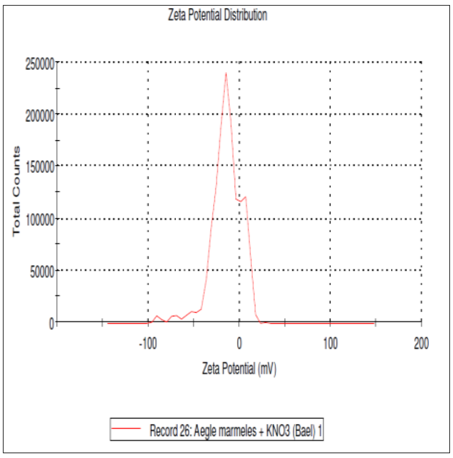

Zeta Potential Distribution
Total Counts
Zeta Potential (mV)
Record 24: Curcuma longa + Ca(NO3)2 (turmeric) 1


Zeta Potential Distribution
Total Counts
Zeta Potential (mV)
Record 21: Ocium tenuiflorum + NaNO3 (Tulsi) 1


Zeta Potential Distribution
Total Counts
Zeta Potential (mV)
Record 10: Ocium tenuiflorum + KNO3 (Tulsi) 1


Zeta Potential Distribution
Total Counts
Zeta Potential (mV)


Zeta Potential Distribution
Total Counts
Zeta Potential (mV)
Record 12: Aegle marmalos + NaNO3 (Bael) 1


Zeta Potential Distribution
Total Counts
Zeta Potential (mV)
Record 26: Aegle marmeles + KNO3 (Bael) 1

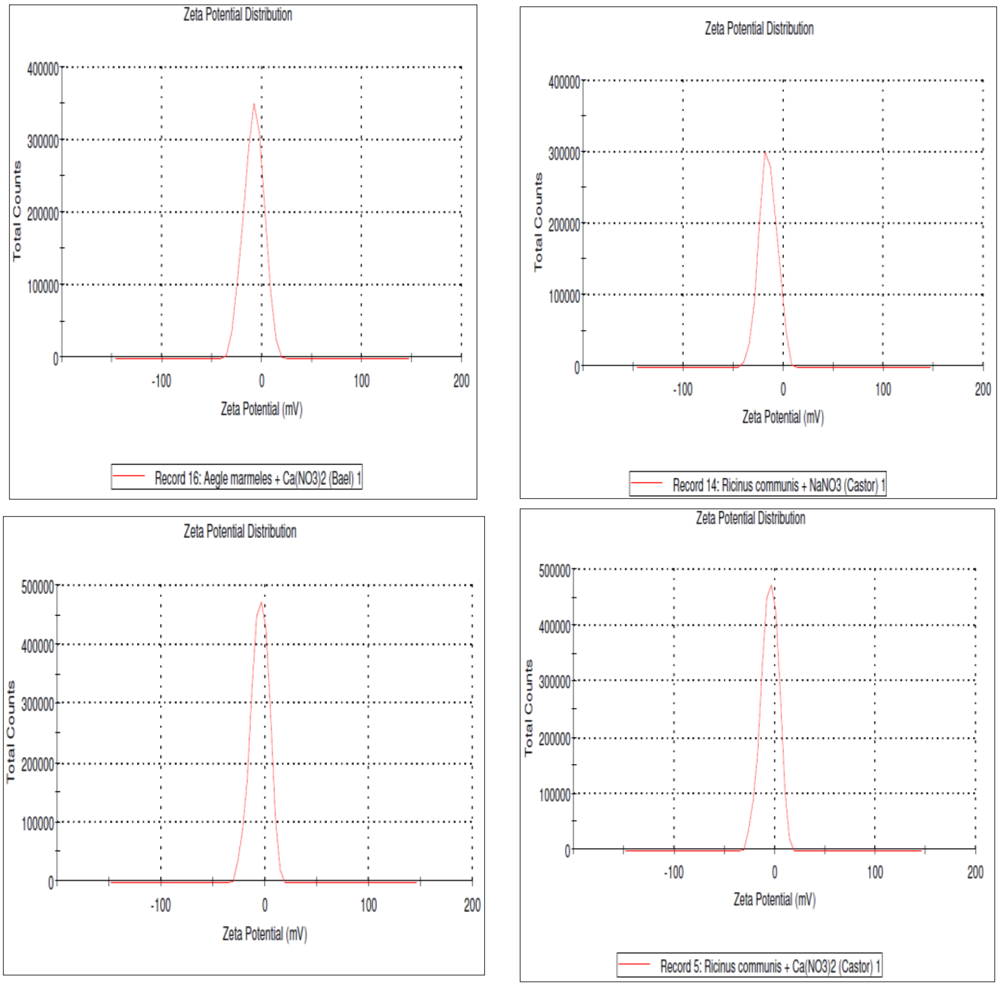


Figure 4 Dynamic light scattering (DLS)

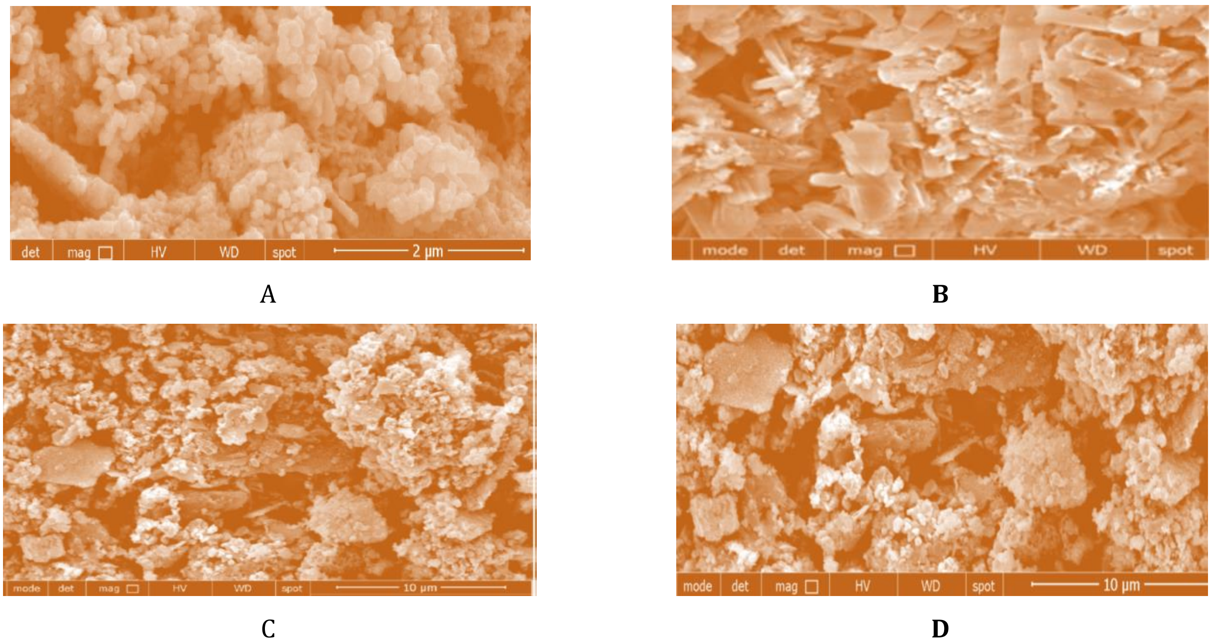


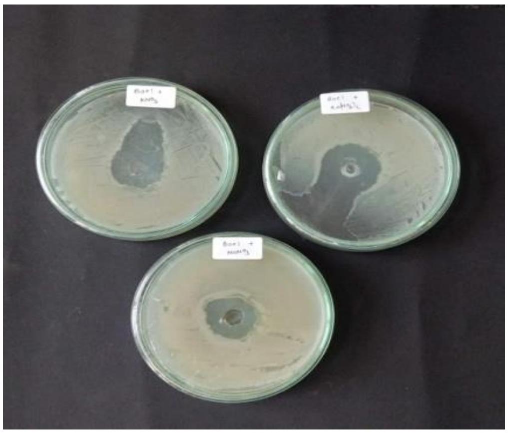
Figure 5 SEM

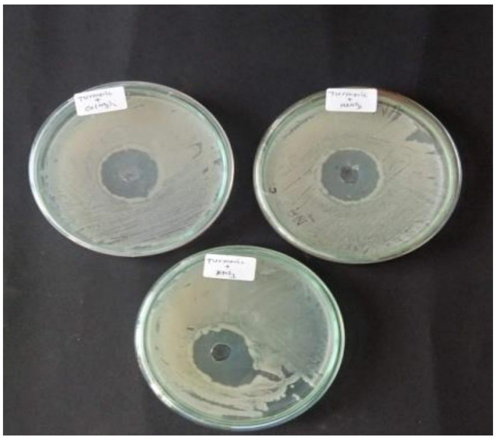
3.4. Antibacterial activity

We have reported here in vitro screening of wide range of metalic nanoparticles. They were screening of Gram-negative bacteria [29-33]. (E.coli NCIM 2065) and it's compared with ciprofloxacin. The synthesis metallic nanoparticle showed antibacterial activity of E-coli bacteria by agar well diffusion method [34-37]. From the following results of some alkali and alkaline earth metalic nanoparticles has enhanced the better potency of antibacterial activity of E-coli bacteria as showed in table no-1.

Table 1 Antibacterial activities of synthesized metalic nanoparticles

Sr.No.	Name of the Synthesized metalic nanoparticles	Zone of inhibition after 24 hours of incubation in (mm)
1.	Tulsi + KNO_3	22
2.	Tulsi + $NaNO_3$	21
3.	Tulsi + $Ca(NO_3)_2$	21
4.	Turmeric + KNO_3	25
5.	Turmeric + $NaNO_3$	22
6.	Turmeric + $Ca(NO_3)_2$	24
7.	Bael + KNO_3	19
8.	Bael + $NaNO_3$	20
9.	Bael + $Ca(NO_3)_2$	23
10.	Castor + KNO_3	16
11.	Castor + $NaNO_3$	14
12.	Castor + $Ca(NO_3)_2$	15





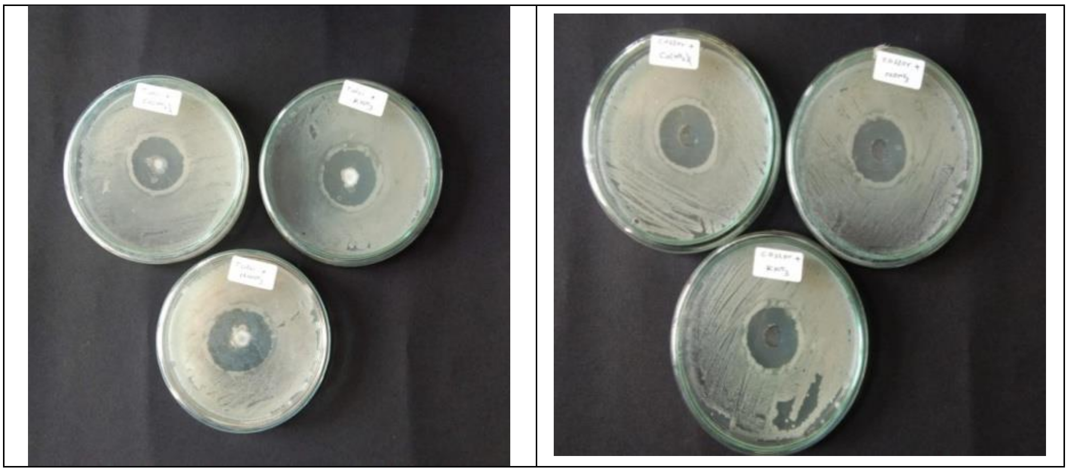


Figure 6 Antibacterial activities of synthesized metalic nanoparticles

4. Conclusion

The preparation of metallic nanoparticles from the different leaf extract in minimum time, low coast and also simple way. Only water is used as green solvent and its required minimum time to formation of nanoparticles. Also the prepared nanoparticle it exhibit good antibacterial activity. The metallic nanoparticle syntheses by plant extract are characterized by synthesized nanoparticles using uv-visible spectra, PSA, Zeta potential and SEM. The maximum absorbance of metallic nanoparticle by uv-visible spectra was found to be 185 and 800 nm and surface charge determine by Zeta potential. The synthesis metallic nanoparticle shows antibacterial activity against bacteria E-coli by agar well diffusion method. The synthesized Metallic nanoparticles are found to be more susceptible towards the bacterial strains.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

The authors agree no conflict of interest.

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