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ECO FRIENDLY SYNTHESIS OF OXALATE AND OXIDE NANOPARTICLES COPPER USING AVERRHOABILIMBI L:- A RENEWABLE SOURCE OF OXALIC ACID

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ABSTRACT

Metal carboxylates have been widely investigated and have been used as precursors in the production of metal oxide nanomaterials. Generally, these metal carboxylates are thermally decomposed at relatively low temperatures into the corresponding metal oxide nanomaterials. Afacile and green approach for the synthesis of metal oxalates and their subsequent thermal decomposition to the oxide nanoparticles. This approach is based on mixing the metal ion solution and the fruit juice extract without the use of hazardous organic compounds or surfactants.

KEYWORDS:- Averrhoabilimbi L, photovoltaic devices, gas sensors, micro-electronics.[1-6]

INTRODUCTION

The precursors are usually obtained when the metal salt reacts with the free acid or any of its labile carboxylates. The reactants are generally synthetic, but many of these carboxylates are readily available in our environment (mostly in plants) and need only to be harnessed. They include, amongst others, citric acid, tartaric acid, and oxalic acid. The latter is known to be one of the major acids in many plants (e.g. Rhubarb and Averrhoabilimbi L.). Averrhoabilimbi L, known as bilimbi. Metal-oxides are emerging as technically important materials because of the wide variety of physical properties they possess, which make them attractive for applications such as photovoltaic devices, gas sensors, micro-electronics and corrosion protection devices.[7] However, the production of high quality metal oxide films with a desired chemical composition has been costly and challenging. The synthesis of metal oxalate and metal oxide nanoparticles has attracted considerable attention in physical, chemical, biological, medical, optical, mechanical and engineering sciences where novel techniques are being developed to probe and manipulate single atoms and molecules.This paper gives a facile and green approach for the synthesis of metal oxalates and their subsequent thermal decomposition to the oxide nanoparticles. Our approach is based on mixing the metal ion solution and the fruit juice extract without the use of hazardous organic compounds or surfactants. In this preliminary study, divalent 3d metal ion (Cu^{2+}) is used for the proof of concept. The prepared compounds and their various thermal decomposition products have been characterized by FTIR, and SE.

EXPERIMENTAL SECTION

Copper Oxide is prepared by Hydrothermal Method in two stages.

Stage 1: Preparation of the Precursor Copper Oxalate

Equimolar proportions say0.25g of CuSO4.5H2O dissolved in minimum volume of water and bilimbi, fruit extract of 20 cm^3 is stirredfor15 minutes on a magnetic stirrer. A blue colored precipitate for Copper Oxalate is obtained at pH 6. The precipitate is washed with water and finally dried with acetone. The precipitate separated using micro centrifuge with 4000 rpm then dried at 104°C for four hours.

$CuSO_4.7H_2O$

↓

bilimbi, fruit extract

↓

Added with Stirring for 30 minutes on a magnetic stirrer

Copper oxalate (CuC_2O_4)

Stage 2: Preparation of Copper Oxide Nanoparticles

The prepared metal oxalate precursors are mixed with polyvinyl alcohol in the weight ratio 1:5, powdered in a mortar, mixed in a crucible and ignited in an electric furnace. The temperature should not exceed 300°CThe CuO dried samples were separated and powdered CuC_2O_4(white).

Polyvinyl alcohol (weight ratio is 1:5)

↓

Powdered in a mortar, ignited in an electric

furnace not more than 300°C

blue CuO

Fig. 1: Preparation of copper oxalate nanoparticle with bilimbi, fruit extract.

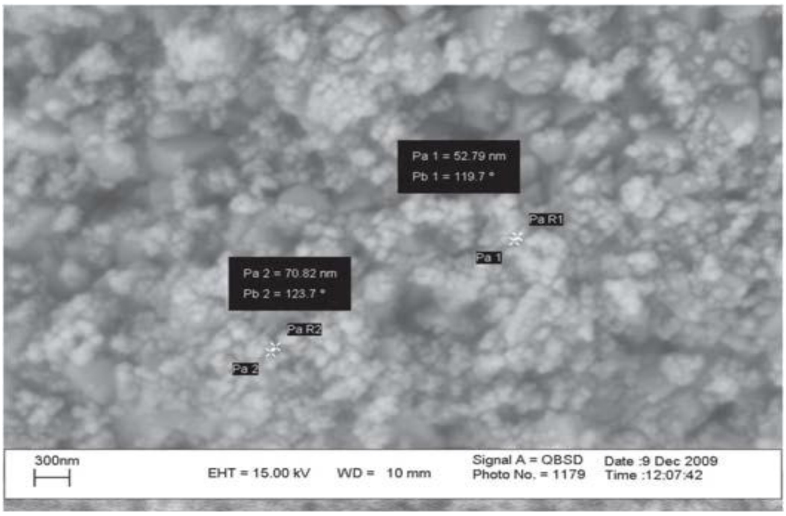
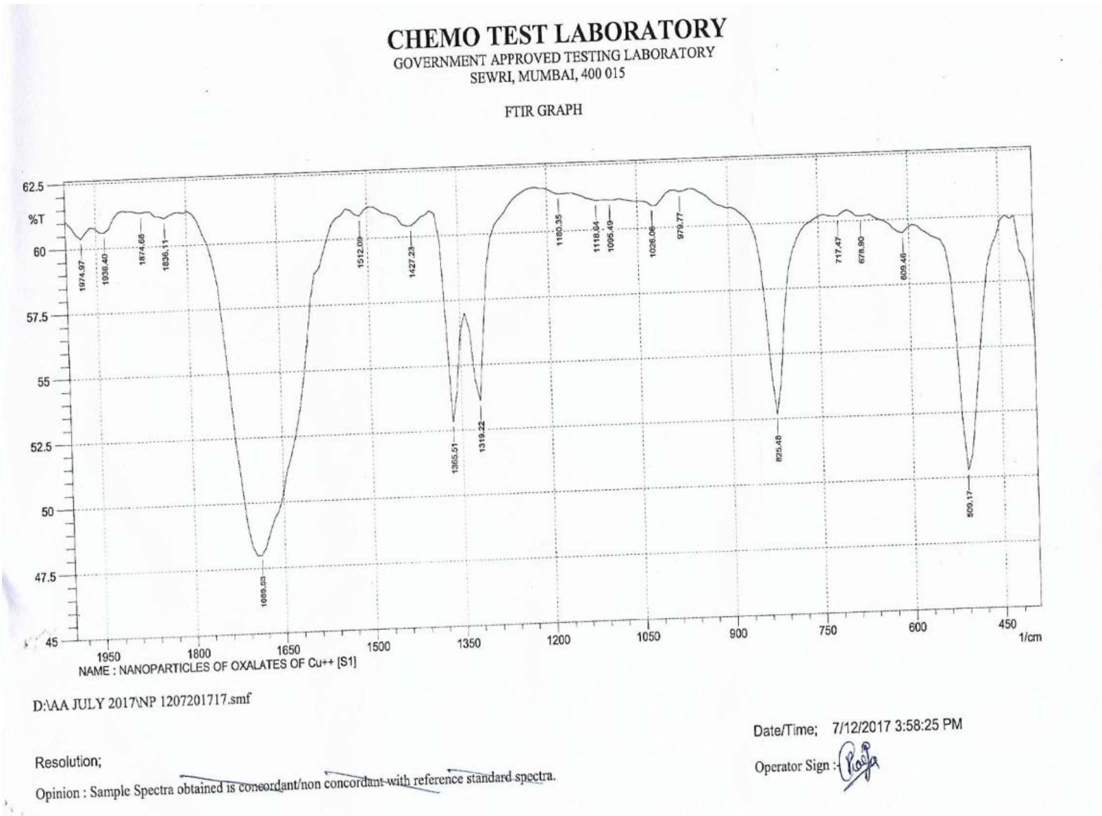


Fig. – 1: Sem Images of CuO.

The SEM images analysis

Fig. 1 shows the SEM images of Copper Oxide Nanoparticles. The SEM image shows morphology of the synthesized Copper Oxide nanoparticles and is found to be of spherical shaped size of CuO Nanoparticles 61nm seen. Other particles joined as group and form bigger particles. SEM images of nanoparticles were showed that Copper oxide, metal nano particles were exactly in the shape of spherical and clustered. Also SEM images were confirmed that all of nanoparticles were exactly pure.



Experimental PROTOCOL

- All chemical and solvents used were of A.R.grade. Further, remaining, pure reagents were purchased from S.D. Chemicals.
- I.R spectra of the synthesized nanoparticles were recorded on Shimadzu Fourier TranstormInfra Red Spectrophotometer (FTIR) 400-4000cm^{1} region in KBr disk.
- The SEM is carried out SAIF IIT Powai.

CONCLUSION

- ❖ We have been able to use Averrhoabilimbi L juice as source of oxalic acid for the synthesis of some divalent metal oxalates.
- ❖ The synthesis required no special treatment of the juice as the product was obtained by directly mixing the metal ion solution and the juice.
- ❖ The products were all identified as the expected metal oxalates. Both the oxalates and their decomposition products oxides were found to be nanomaterials with their crystallite size ranging from 14 to 91 nm.
- ❖ It can be concluded that synthesis of these nano particles require no expensive ingredients and complicated equipments. This method is less time consuming and flexible.
- ❖ Development of synthesis of nanomaterials over a range of sizes, shapes and chemical composition is an important aspect of nano technology.
- ❖ The size-development and physical-chemical properties of nanoparticles have fascinated and inspired research activities.
- ❖ CuO, synthesized characterization which and further studied may be done for studying its applications.

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