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Green Synthesis of CuO Nanoparticles using Coffea Powder Extract

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Abstract*: Copper oxides nanoparticles have multifunctional properties and wide range of applications and can be prepared by many methods available today. In this work, CuO nanoparticles were prepared by Coffea powder extract. The green synthesised CuO nanoparticles was characterized by XRD. The results indicate that CuO nanoparticles synthesised by Coffea powder extract has an average particle size of 27nm-32nm.
Keywords: Green synthesis, Coffea powder extract, CuO nanoparticles.

I. INTRODUCTION

There is a rapid progress for the preparation of nanosized metal oxide particles mainly due the unusual size-dependent optical and electronic properties. Green Synthesis of metal oxides nanoparticles using plant extract is novel and it leads to green chemistry with less expense. Copper(II) oxide is a p-type semiconductor, having a energy gap of 1.2eV with a work function value of 5.3eV. They belong to monoclinic crystal system [1]. CuO has wide range of applications, antibacterial, anti-biotic, catalysis, sensors, dry cell batteries and so on [2]-[6]. CuO nanoparticles can be synthesised by both conventional and green synthesis method, but green synthesis of CuO nanoparticles is more eco-friendly, non-toxic, and low cost compared to the chemical or physical method available, as they produce toxicity and hazardous reactions and also reagents are expensive in conventional methods. In this work, CuO nanoparticles are synthesised using Coffea commonly known as coffee powder extract. The particle size, crystal and amorphous nature of materials of particles was studied using XRD characterization.

II. MATERIALS AND METHODS

The Coffea (or coffee) beans were purchased from the market, for the synthesis it was grinded into fine powder.
Cupric Nitrate and distilled water was purchased from Merck, India, and was used as purchased without any modification.

A. Green Synthesis Method

18g fine grounded Coffea powder was dissolved in 200 ml of distilled water and boiled for 2 hours in medium flame and cooled down to the room temperature. The extract obtained was then kept overnight. Copper Nitrate solution and Coffea extract was taken in 1:2 ratio and was slowly added to the extract under vigorous constant stirring at 250^0C for 3 hours which gives the brown precipitate. After cooling at room temperature, the extract was filtered using Whatman filter paper and was thoroughly washed with distilled water three times to remove any impurities present in it. The collected precipitate was dried in Hot Air Oven for 8 hours at 80^0C and then transferred to silica crucibles and kept in Muffle Furnace for 3 hours at 500^0C. The powder obtained was grinded into fine powder using mortar pestal.

B. Characterization

The CuO nanoparticles were send to SAIF, Kochi, for the XRD characterization. XRD was carried out with Bruker AXS D8 Advance model and Cu Wavelength 1.5406 A° was used with the temperature range of -170 °C to +450 °C.

III.RESULTS AND DISCUSSION

The XRD spectra of synthesised CuO nanoparticles was carried out and resulted 2Theta values ranging from 10^0 to 80^0. The 2Theta values at 32.53, 35.56, 3.77, 48.83, 61.61, 66.29 and 68.09 were observed as shown in Fig.1. The average crystalline size was found to be 27nm and 32nm. The peaks obtained with this method was matching with the JCPDS No.80-1268 data, which confirms the CuO nanoparticles presence.

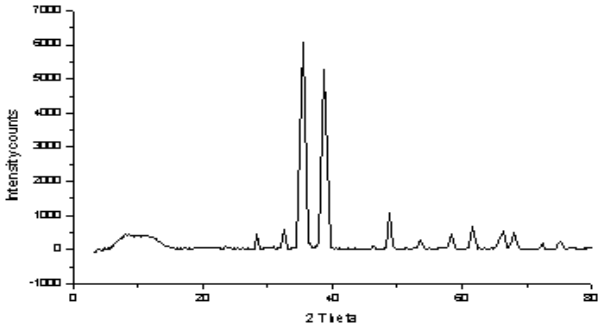

Fig. 1 XRD of CuO nanoparticles

IV. CONCLUSIONS

CuO nanoparticles was synthesized by the green synthesis method using Coffea powder extract. Its simple and low cost. The prepared CuO nanoparticles were characterized using XRD. The intensity counts and 2Theta graph was plotted, the peaks obtained from the experiment clearly matches with the JCPDS No.80-1268 data. CuO nanoparticles presence was confirmed. The average CuO nanoparticle size was found to be 27nm - 32nm.The preparation of metal oxides by Green synthesis is much approachable than the chemical and physical methods available today. Also, this method is eco-friendly to our environment.

V. ACKNOWLEDGMENT

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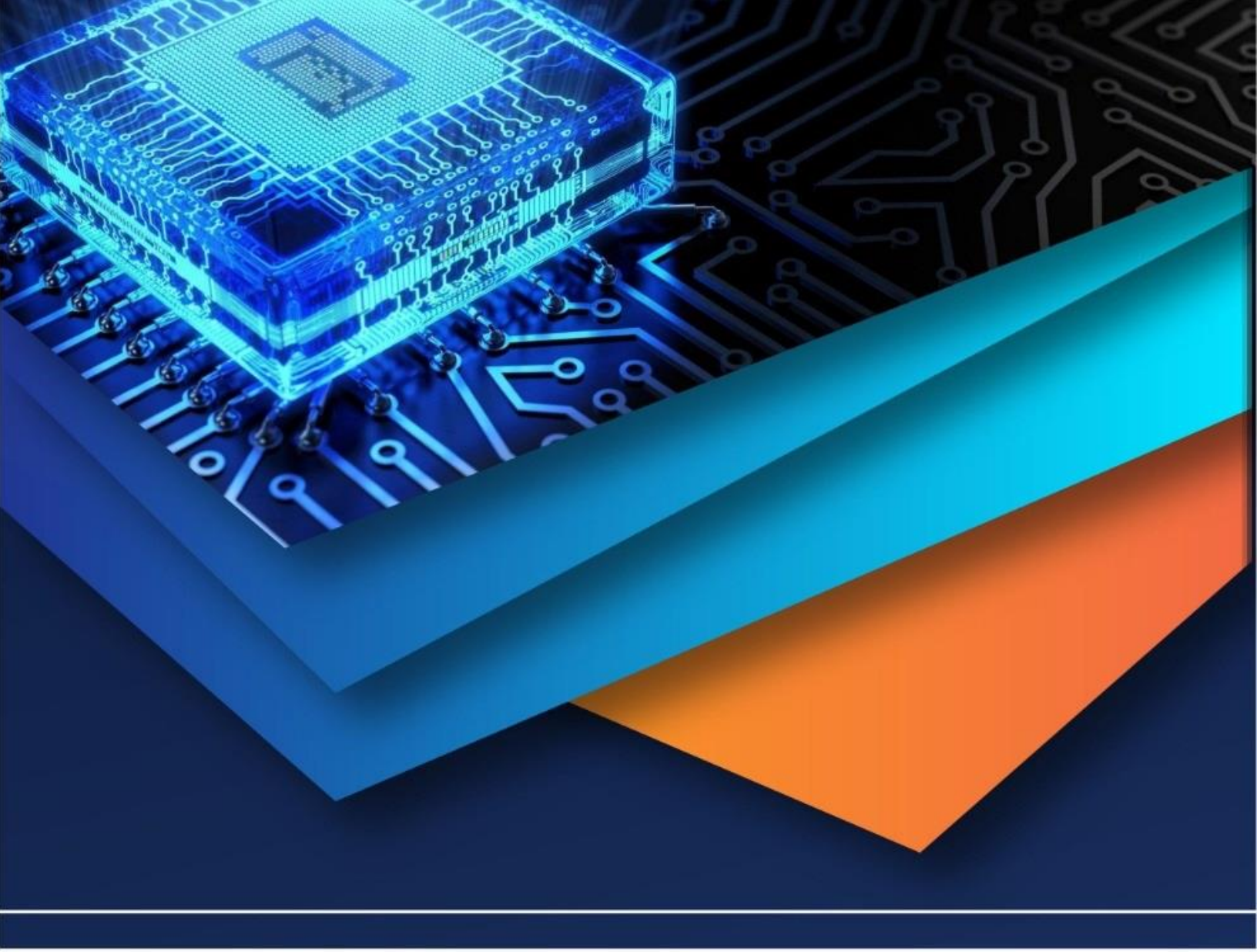

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