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Chromium oxide regulated nanoparticles biosynthesis in Manihot esculenta leaf extract

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ABSTRACT

The green synthesis of nanoparticles using plant extracts plays an important role in the field of nanotechnology. The potential of biomolecules present in plant extracts in reducing metal ions to nanoparticles in a single step of green synthesis process is very important. In this study we report on synthesis of Chromium oxide nanoparticles (Cr_2O_3) by reduction of potassium chromate solution with Manihot esculenta leaf extract. The presence of water soluble carbohydrates which have an aldehyde group may lead the formation of Cr_2O_3 nanoparticles. The fabricated Chromium oxide nanoparticles were confirmed by UV–Vis spectroscopy, X-ray diffraction (XRD), Fourier transform-infrared spectroscopy (FTIR) and Scanning electron microscopy (SEM).XRD and UV–Visible absorption studies. The images showed that the size of NPs of Cr_2O_3 varied with average crystalline size 85–100 nm of nanosized Cr_2O_3.

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1. Introduction

Presently metal and metal oxides in NPs have outstanding approaches in various fields owing to their electrical, optical, thermal abilities [1]. Among the metal oxides, Cr_2O_3has perceptible properties to attract the researchers. Its thermal stability, hardness, chemical resistance and antiferromagnetic property lead to Cr_2O_3 NPs synthesis in various applications [2].The attractive adaptable properties ofCr_2O_3 NPs have led to the green synthesis. The crucial attractions of Chromium oxides (Cr_2O_3) have an importance in science as well as in technology [3–4].Distinguishable parts of the plants (leaves, fruit, roots, latex, seed and stem) are having prospective medicinal values. The fabrication of Cr_2O_3 nanoparticles have been developed by diverse technique such as thermal decomposition [5], hydrothermal method [6–8], solvothermal method [9], thermal process [10–12], microwave irradiation method [13], precipitation method [14], magnetron sputtering [15], combustion solution method using glycine [16], laser-induced deposition[17], sonochemical synthesis [18], sol–gel synthesis[19], combustion synthesis [20], thermal reduction [21], urea-assisted homogeneous precipitation [22] and precursor calcinations [23].Chromium (Cr_2O_3) possess specific applied applications such as liquid crystal displays [24], in high-temperature resistant materials [25], coating materials [26], corrosion resistant materials [27], green pigment [28], solar absorbers [29], heterogeneous catalysts [30], ceramics, coatings, printing and paint industry [31–33].

In contrast with the conventional method, bio synthesis is friendlier to environment because it utilizes plants extract as the chemicals substitute. The plant extract containing destructive compounds helps the reduction of chromium ions in the fabrication of Cr_2O_3 NPs. The Manihot esculenta leaves possess biomolecules such as carbohydrates, proteins and lipids [34–35], which could be used as reducing agent to react with chromium ions and act as scaffolds to direct the formation of Cr_2O_3 NPs in solution.

2. Materials and methods

2.1. Preparation of Manihot esculenta extract

Healthy leaves of Manihot esculenta were collected and washed several times with distilled water to remove the adhering dust par-

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