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Photo-Catalytic Activity of Nanomaterials Synthesized from *Camellia sinensis* Leaves.

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ABSTRACT

Plant products can provide specially tailored nanostructures with highly optimised properties and characteristics. The photocatalytic activity of nanomaterials synthesised from Camellia sinensis leaves in visible light is reported in this paper.

Keywords: Camellia sinensis Leaves, Nanoparticles, Photocatalytic activity.

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INTRODUCTION

Based on size, distribution and morphology, nanoparticles exhibit entirely new or improved properties[1-4]. The particles ranging in size from 1-1000 nm are useful in medicinal and pharmacological studies. The use of nanoscale materials and structures, usually ranging from 1 to 100 nanometers (nm), is an emerging area of nanoscience and nanotechnology. Nanomaterials may provide solutions to technological and environmental challenges including of solar energy conversion, catalysis, medicine, and water treatment [5, 6]. Silver nanoparticles have proven to be most effective as it has good antimicrobial efficacy against bacteria, fungi, virus and other eukaryotic microorganism [7-11].

Considering the importance of nanomaterials for their possible catalytic activities, the present work furnished synthesis and photo catalytic efficiency of the nanomaterials obtained from *Camellia sinensis* Leaves under visible light using methylene blue solution.

MATERIALS AND METHODS

Synthesis of the Material

Synthesis and characterization by powder XRD, of the nanomaterial has been recently reported by this group [12]. Briefly, 10 g of dry processed tea leaves were burnt in open air at 200^0 C. The white ash left after was taken out and analysed 'as obtained'. The yield was recorded (3.5 %). The material was characterised by powder XRD as reported earlier

MEASUREMENTS

Photo catalytic activity was carried out by Visible Spectrophotometer Systronics106 at Department of Chemistry, S. S. College, Hailakandi, Assam, India. Powder X-ray diffraction (XRD) measurements were carried out on a Bruker AXS D8-Advance powder X-ray diffract to meter at SAIF, NEHU, Shillong with Cu-Kα radiation (λ=1.54056 Å) with a scan speed 2^O/min.

RESULTS AND DISCUSSION

The synthesized materials were white and found to be stable in air for months. The yields of the synthesized nanomaterials were recorded to be in the range of 3.5%. The material was characterised by powder XRD following the method reported in our earlier communication [12] (Figure 1)

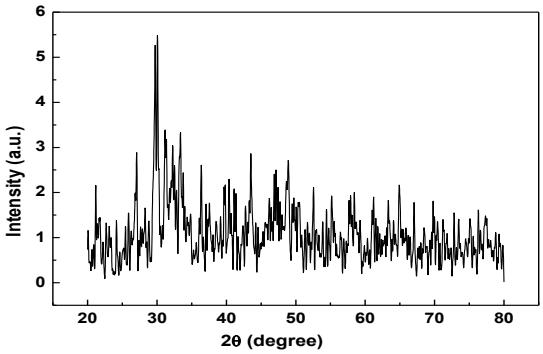

Figure 1: XRD pattern of nanoparticles from the roasted processed *Camellia sinensis* leaves

Photo catalytic Activity of the synthesised material

The photo catalytic activity of the as-synthesized nanomaterials (NMs) was evaluated by photo degradation of methylene blue (MB) solution under visible light irradiation. The decreasing concentration of the MB solution in the photo catalytic reaction was used to determine the effectiveness of products. The characteristic absorption peak of MB solution at 665 nm was chosen as the monitored parameter to detect the concentration of the MB solution.

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Before turning on the visible light lamp the solution are allowed to stand for at least 2 hours in the dark for allowing the adsorption/desorption to reach the equilibrium. The samples are taken out of the dark at the end of due time and centrifuged to separate any suspended particle. The readings are taken in a visible light spectrophotometer at an interval of 30, 60, 90, 120, 150, 180 and 210 minutes.

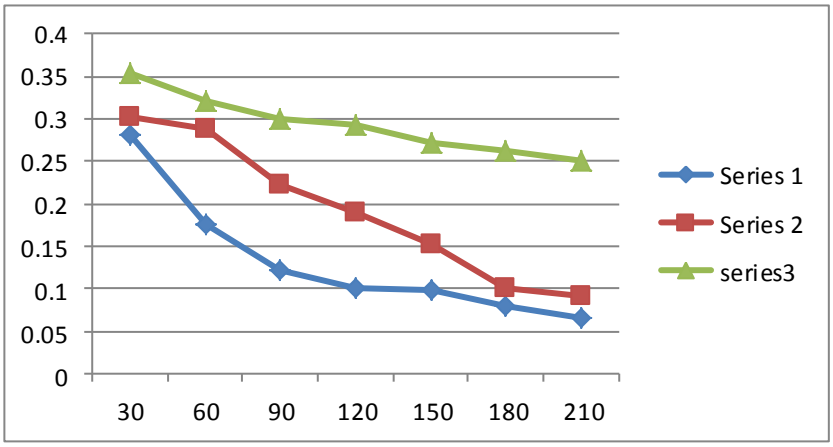

Figure 2: Action of NMs on different concentration of MB solution Series1- 1x10^{-5}mol/L, Series2-5x10^{-5}mol/L, Series3-1x10^{-4}mol/L

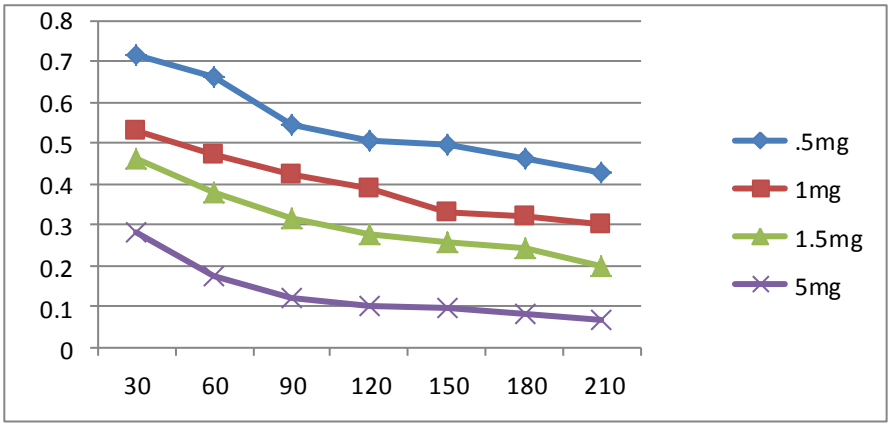

Figure 3: Rate of degradation of MB solution (1x10^{-5}mol/L) with different amount of NMs.

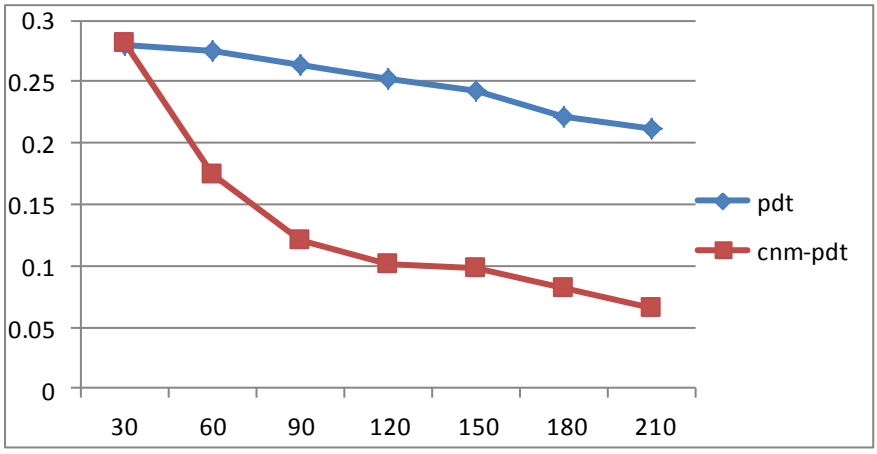

Figure 4: Degradation of MB solution (1x10^{-5}mol/L) with treated product (NMs-pdt) and simply pyrolysed product.

The materials from processed *Camellia sinensis* leaves exhibited a profound photo catalytic activity even in visible light. In the third plot(Figure 4), it was observed that the substrate alone as such do not have any photo degradation behavior. But in presence of NMs, marked degradation of MB was observed. It is also important to highlight that the photo degradation of MB in presence of NMs was not linear. The initial rate of degradation gets reduced at about 90 minutes and regains the acceleration after 120 minutes. This could be due to the fact that during photo reduction of MB on the surface of NMs caused adsorption of some of the substrate/Product over the surface of the NMs. It is assumed that after certain degree of adsorption, the desorption gets initiated thereby freeing up some of the surface area over NMs which could be responsible for the acceleration in photo reduction.

CONCLUSION

The materials obtained from roasting of processed *Camellia sinensis* leaves exhibit a profound photo catalytic activity even in visible light. The photo degradation of Methylene Blue solution suggests that the obtained products are potentially good photo-catalysts. The synthesis of nanoparticles using plant leaves provides a green environmental friendly, simple and efficient route for synthesis of benign nanoparticles. This method can be scaled up and other plant source can be used for the synthesis of nanoparticles of desired dimension with profound photo catalytic activity.

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