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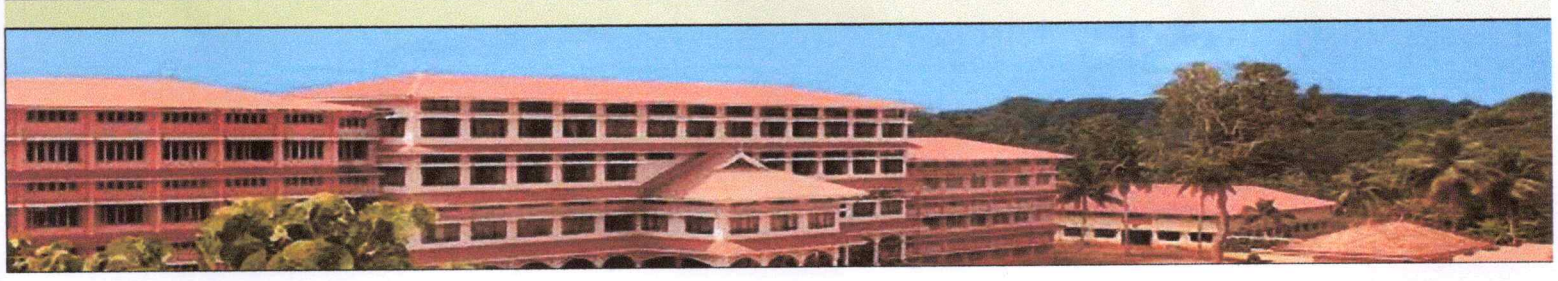

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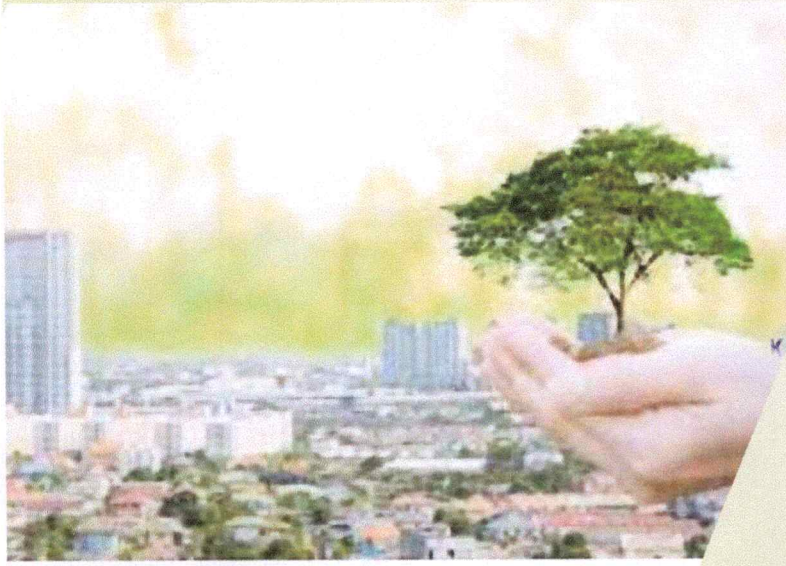

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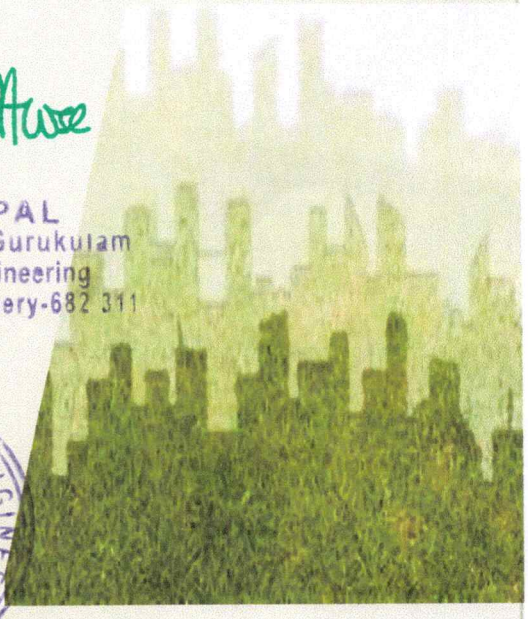

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Mineralization of a Model Pollutant over Platinum Loaded Nanotitania Photocatalyst under Sunlight

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***Abstract*—Mineralization of a model pollutant, methylene blue over bare and platinum loaded titania nanostructures was conducted. Nanotitania with three different morphologies were synthesized by microwave irradiation technique. Platinum particles were loaded on nanotitania. Synthesized nanostructures were characterized. The dye degradation capabilities of Pt/TiO_2 were found superior to bare titania nanostructures.**

***Keywords*— Photocatalysis,methylene blue, nanotitania, Pt/TiO_2, microwave technique**

1. INTRODUCTION

Microwave synthesis and photocatalysis have played pivotal roles in recent years toward the goal of switching to increasingly efficient and benign processes (Balachandran, Dar,Yang andZheng).As a most widely used photocatalyst, TiO_2 has a relatively large band gap of 3.2 eV andTiO_2 has to be activated by a UV light source. The general approach is to modify TiO_2 by by creating intra-band gap states that are close to the conduction or valence band edges, and absorb visible light at sub-band gap energies of less than 3.2 eV (Kisch).

We have already reported a simple microwave method to synthesize phase pure anatase and rutile nanotitania with different morphologies viz., cubes, spheres and rods (Suprabha). In an attempt to modify the optical properties of titaniasynthesized by microwave irradiation we were successful in loading Au and Ag into titania structure which shifted the absorption into visible region (Suprabha). In the present work, we could enhance the visible light photocatalysis of titania nanostructures by loading platinum by metal sol method(Grunwaldt). To the best of our knowledge no reports are available with regard to the preparation of Pt loaded TiO_2 using TiO_2synthesized by microwave irradiation. The catalytic performances of three morphologically different nanotitania and their platinum loaded nanostructures (Pt/TiO_2) were studied for dye degradation of methylene blue under sunlight.

2. MATERIALS AND METHOD

All reagents were purchased from Merck, Germany. Titanium trichloride (15 wt. % $TiCl_3$, 10 wt. % HCl) was used as the titanium precursor. NH_4OH (1.5 M), NaCl (5 M), NH_4Cl (5 M),hexachloroplatinic acid (H_2PtCl_6), $NaBH_4$, and polyvinyl alcohol (PVA) were employed for the synthesis. A typical microwave oven (Whirlpool, 1200 W) operating at a frequency of 2450 MHz was used for the synthesis.

The three TiO_2 nanostructures with different morphologies viz., cube, sphere and rod (S1, S2, S3) synthesized as per our early report (Suprabha), were loaded with 1 wt% Pt employing metal sol method. For this a suitable amount of PVA solution (1wt %) was added to an aqueous hexachloroplatinic acid solution (0.1 mg Pt/ml) under vigorous stirring. Then, a freshly prepared solution of $NaBH_4$ (molar ratio $NaBH_4$/ Pt = 4) was slowly added dropwise into the mixture. The TiO_2 samples were added after the pH of Pt sol was adjusted to 6.0 by NH_4OH or HCl solution. The mixture was stirred at 60°C for 3 hrs, then filtered and washed until no Cl^- was detected by $AgNO_3$ solution. After being dried at 100°C overnight, the samples were calcined at 550°C for 4 hrs. The platinum loaded on samples S1, S2 and S3 are represented as PtS1, PtS2 and PtS3 respectively.

Photocatalytic activity of TiO_2 was evaluated by the degradation of the dye, methylene blue (MB) in

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