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[Gunge * *et al.*, 7(2): February, 2018]
IC™ Value: 3.00

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

SYNTHESIS AND CHARACTERIZATION OF ALUMINUM OXIDE NANOPARTICLES

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DOI: 10.5281/zenodo.1184024

ABSTRACT

The nanomaterials have many applications in industries such textiles, paints, petroleumproducts Aluminum oxide (Al_2O_3) nanoparticles was successfully synthesized by Urea decomposition method using metal nitrate as precursors in the presence of sunlight. The as-synthesized samples were characterized by X-ray diffraction (XRD), Fourier transform infrared (FTIR), The x-ray diffraction pattern indicated that as-synthesized sample had a crystal size with finest particle size of the catalyst (69.0nmappr.) was obtained at 600°C calcination temperature. Fourier transform infrared spectra confirmed the presence of hydroxyl group and Al-O bond vibration in the catalyst. Experimental result of the Al_2O_3calcined at 600°C for 2hr, exhibitedmany activities of under different investigation under process as of next research going to publish in the next session.

KEYWORDS: Nanoparticles, Characterization, XRD.

I. INTRODUCTION

Nanomaterials have many applications in industries such textiles, paints, petroleum products cosmetic products[1,2]. Industries has used different typesof dyes resulted in the release of large amounts of toxic compoundsinto environment [2,].This articlewill prove the usage of synthesized nanoparticles will decrees the waste as well as will purify the polluted waters by ecofriendly way.The waste water fromthose industries must be treated before their discharge. Variousphysical and chemical methods have been used for toxic removalfrom waste waters [3,4]. Thus, environmental contamination by these toxic chemicals has emerged as a serious global problem[5]. On the contrary, bleached dye after degradation of solution is relatively less toxic and almost harmless [6].Dyes containing colored water is almost no practical use, but if this colored solution is bleached to give colorless water, then it may be used for some useful purposes like washing, cooling, irrigation and cleaning [7,8]. Among various metal oxide Nanoparticles photo catalysts, Aluminum oxide (Al_2O_3,) exhibit promising photocatalytic activities due to their environmental friendly behavior, low catalyst cost, high specific surface area, high crystallinity and solar energy application and thus, could be an alternative material for environmental application and wastewater[9,10]. At the present studies is an attempt to clean the environment waste water through the nanomaterials. So, in this paper we tried to study the Al_2O_3, Nanoparticles through its characterization techniques. In our next studies the will prove Al_2O_3, Nanoparticles best for industrial waste water treatment.

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II. MATERIALS AND METHODS

Synthesis of Al_2O_3 nanoparticles

The nanoparticles Al_2O_3, powder was prepared by Urea decomposition method. The Urea was corresponded to total volume ratio of metal nitrate, ratio of 1:2. In each case, aluminum nitrate dissolved in stoichiometric amounts of water, 10% then mixed with vigorous stirring at room temperature (55°C). The prepared slurry was left to stand for the formation of solid. After the solidification was completed, the solid was kept for 2 days at room temperature and sample was dried at 75°C for 36 h. After grinding the dried samples, they were calcined at 600°C for 2 h. Nano sized materials of the catalyst were analyzed.

Characterization:

FTIR is carried out from our institute using Parkin Elmer FTIR instrument ranges from 400 cm^{-1} 4000 cm^{-1}. X-ray powder diffraction (XRD) analysis was carried out with Goniometer Ultima IV using a Cu Kα radiation (λ=1.54060Å) operating at 40 kV and 40 mA.Absorbance carried out by spectrophotometer.

III. RESULTS AND DISCUSSION

FTIR Studies:

The SynthesisAl_2O Nanoparticles $_3$produces clear white colored oxide, The formation of this oxide upon the heating of an aqueous mixture of $Al(NO_3)_3$. For the reaction mechanisms, an oxidation process for aluminum urea complex occurs during the decomposition of urea into ammonia, carbon dioxide and hydrogen chloride gases. The infrared spectra of synthetic oxide product are shown in Fig 1. The infrared spectra of the obtained products show bands due to characteristic groups of urea (carbonyl and amide groups) at 1629 and 1660 cm^{-1}, the bands associated to the O-H are observed at 3440 cm^{-1} is due to moisture absorbed during measurement of spectra.

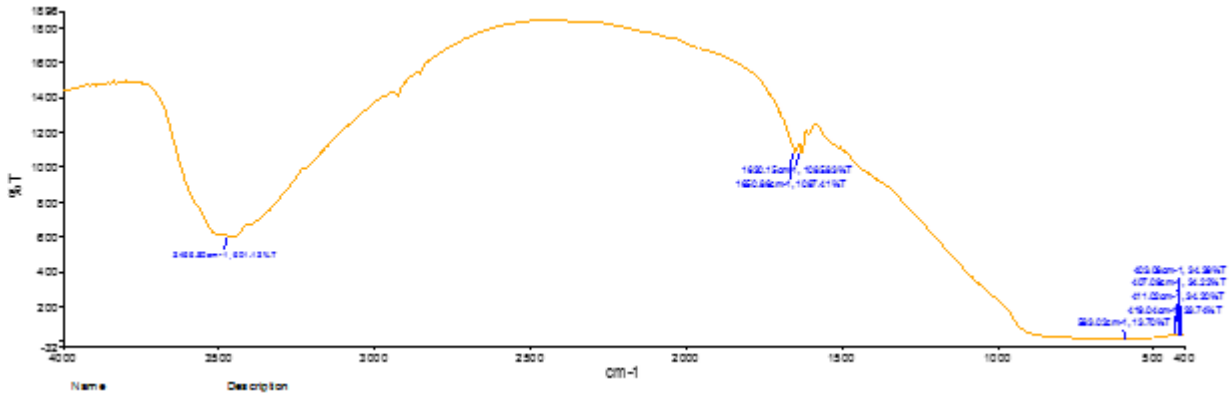

Figure 1. FTIR of Al_2O_3 nanoparticles

XRD Studies:

The phase formation and orientation of Al_2O_3nanoparticleswere investigated using X–ray diffraction in the ranges (20-80deg). X-ray diffraction patterns of nanoparticles with shown in figure 2. It was found that the presence of Al_2O_3 at temperatures 600ºC. The XRD results also reveal the structural results for work and the values obtainedusing the Scherrer equation: $D=k\lambda/\beta\cos\theta$ where D is the crystallite size, λ is the wavelength of the Cukα radiation, k is a constant equal to unity, β is corrected peak width at half maximum intensity and θ is peak position (62.79º used for all lines). The peaks at 34.09 and 44.89 are due to the incomplete burning of oxides. Crystallite size of Al_2O_3-NPs increases. The decomposition process is highly affected by the molar ratio. The nanoparticle size is found Approx. 69.0nm by Scherrer equation.

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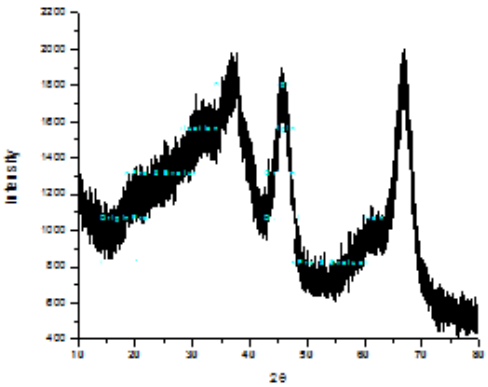

Figure 2. XRD of Al_2O_3 nanoparticles

IV. CONCULUSION

The phase of Al_2O_3 nanoparticles can successfully be synthesized by urea decomposition method using aluminum nitrate, at room temperature then the burnt product was calcined at 600°C for 2h. The prepared sample was characterized by using different tools; FTIR, XRD with average crystallite size 30.096 nm approx.was obtained at 600°C.The decomposition process is highly affected by the molar ratio. The produced Al_2O_3 NPs showed photocatalytic activity by degradation of 85 % approx. of the MG dye, under sunlight irradiation, respectively, within 5 h. in overall studies it is concluded that the Al_2O_3 NPs showed photocatalytic activity and it can be used as best degradation agent.

V. ACKNOWLEDGEMENT

The authors are thankful to Solapur University, and Nanotechnology dept of S.A.P.D. Jain Pathashala'sWalchand College of Arts & Science, Solapur for providingaccess to instrumentation..

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CITE AN ARTICLE

Gunge, A., Chavan, L., Ali, T., & Sharon, M. (n.d.). SYNTHESIS AND CHARACTERIZATION OF ALUMINUM OXIDE NANOPARTICLES. *INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY*, *7*(2), 609-612.