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SYNTHESIS AND CHARACTERIZATION OF SILICON DIOXIDE NANOPARTICLES

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ABSTRACT
The Nanotechnology has started a boom in the field of research nanomaterials have many applications in industries such textiles, paints, petroleumproducts Silicon dioxide (Si_2O) nanoparticles was successfully synthesized ultrasound assisted method using (TEOS)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 (Si_2O) calcined at 500°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, XR .

I. INTRODUCTION
Nanoparticles from mechanical attrition are produced by a “top-down” process, unlikenanoparticles produced from“bottomup” processes such as self-assembly and templatesynthesis. These nanoparticles are formed in a mechanical device, generically referred to as a “mill,” in which energy is imparted to a course-grained material to affect a reduction in particle size[1]. The resulting particulate powders can exhibit nanostructural characteristics on at least two levels. First, the particles themselves, which normally possess a distribution of sizes, can be “nanoparticles” if their average characteristic dimension (diameter for spherical particles) is less than 100 nm. Second, many of the materials milled in mechanical attrition devices are highly crystalline, such that the crystallite (grain) size after milling is often between 1 and 10 nm in diameter. Such materials are termed “nanocrystalline” The sizes of the nanocrystals and the nanoparticles may or may not be the same [2,3]. In some of the nanostructured materials literature, particularly that involving bottom-up processes, the term “nanocrystal” is reserved for crystalline particles with low concentrations of defects, such as are found in single crystals, whereas “nanoparticles” are those nanoscale particles that contain gross internal grain boundaries, fractures, or internal disorder, whether the crystals they contain are nanocrystalline or not [4,5] SiO_2 NPs are used in many industries such as semiconductor technology, optical communication, removal of heavy metals and dyes from water, catalysts, pigments and pharmacy industry [6]. SiO_2 NPs have been prepared by several techniques sol –gel process, microemulsion oxidation of tetraethyl-orthosilicate TEOS in the bench-scale diffusion flame reactor an interdigital micromixer and a batch reactor, have been used to prepare silica nanoparticles [7,8]. Recently, encapsulation of water insoluble drugs in mesoporous silica nanoparticles using supercritical carbon dioxide has been described [9]. At the present studies is an attempt to clean the environment

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waste water through the nanomaterials. So, in this paper we tried to study the SiO_2, Nanoparticles through its characterization techniques. In our next studies the will prove SiO_2 Nanoparticles best for industrial waste water treatment.

II. MATERIALS AND METHODS

Synthesis of SiO_2 NPs

The SiO_2 NPs, powder was prepared by ultrasound assisted method. The TEOS was corresponded to total volume ratio of TEOS and NH_4ratio of 1:2. In each case, 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 500°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:

Synthesized SiO_2 Nanoparticles $_3$produces clear white colored oxide, The formation of this oxide upon the heating of an aqueous mixture of SiO_2. For the reaction mechanisms, an oxidation process for complex occurs during the decomposition of TEOS into,SiO_2. 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 (amide groups) at 1422 and 1637 cm^{-1}, the bands associated to the O-H are observed at 3500 cm^{-1} is due to moisture absorbed during measurement of spectra.

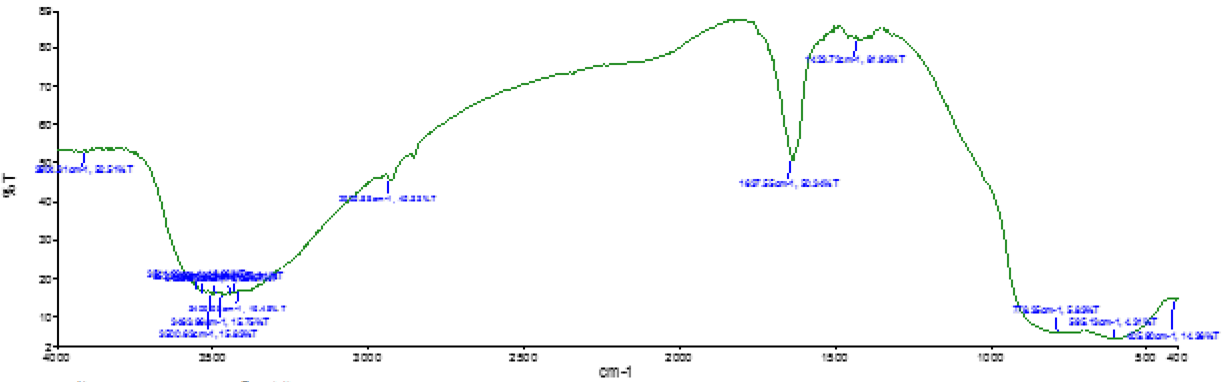

Figure 1. FTIR of SiO_2nanoparticles

XRD Studies:

The phase formation and orientation of SiO_2nanoparticleswere 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 SiO_2 at temperatures 500°C. The XRD results also reveal the structural results for work and the values obtainedusing the Scherrer equation: D=kλ/βcosθ 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 (62.79° used for all lines). The peaks at 34.09 and 44.89 are due to the incomplete burning of oxides. Crystallite sizeSiO_2-NPs increases. The decomposition process is highly affected by the molar ratio. The nanoparticle size is found Approx. 69.0nm by Scherrer equation.

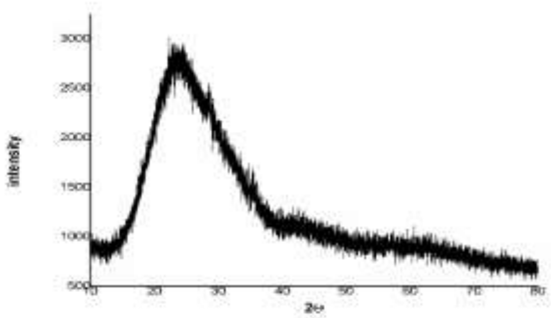

Figure 2. XRD of SiO_2nanoparticles

IV. CONCULUSION

Nanoparticles phase ofSiO_2 nanoparticles can successfully be synthesized by urea decomposition method using aluminum nitrate, at room temperature then the burnt product was calcined at 500ºC for 2h. The prepared sample was characterized by using different tools; FTIR, XRD with average crystallite size 23.096 nm approx.was obtained at 500ºC.The decomposition process is highly affected by the molar ratio. The produced SiO_2 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 SiO_2 NPs showed characteristics it can be used as best many industrial applications.

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