Synthesis and Characterization of anthracite oxide nanoparticles of anthracite coal.

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Abstracts: Nanotechnology is a rapidly growing technique, due to its wide application in various fields viz. Medical, Engineering,Chemistry, Biotechnology and Physics etc. The Synthesis of anthracite nano particles by modified Hummmers method effective tool to overcome nanoparticle yield. Anthracite nanoparticles are of great interest due to its low cost and easy availability. The Size comparision of particles synthesized done by SEM, FTIR and XRD techniques. The preparation method used was modified Hummers method.The anthracite nanoparticles have biomedical applications The X-ray Diffraction analysis show the average particle size is about 38.32 nm

Keywords: nanotechnology, anthracite nanoparticles, SEM, XRD.

Introduction

Since early days, man has been using materials available around him to improve his lifestyle. Man learned to find and prepare materials with very novel properties, properties totally different from that of the bulk material. The race is now to achieve perfection in materials by Nanotechnology is the term used to cover the design, construction and utilization of functional structure with at least one characteristic dimension measured in nanometers. The most important criterion for a material to be called as a nano is that its properties must vary with the decrease in size (from bulk to nano). It has been said that a nanometer is "a magical point on the length scale, for this is the point where the smallest man made device meet the atoms & molecules of the natural world."

Nanotechnology has the potential to create many new materials and devices with wide range of applications such as in medicine, electronics, and energy production. It is the science of the small; the very small. It is the use and manipulation of matter at a tiny scale. At this size, atoms and molecules work differently and provide a variety of surprising and interesting uses. Nanotechnology is expected to have an impact on nearly every industry. The U.S. National Science Foundation has predicted that the global market for nanotechnologies will reach $1 trillion or more within 20 years. The research community is actively pursuing hundreds of applications in nanomaterial, nanoelectronics, and bio-nanotechnology. Most near term (1-5 years) applications of nanotechnology are in the form of nanomaterial. These include materials such as lighter and stronger nanocomposites, antibacterial nanoparticles, and nanostructure catalysts. Nano devices and nano electronics are farther off, perhaps 5-15 years, and will have applications in medical treatments and diagnostics, faster computers, and in sensors. This technology will have tremendous potential if it can developed; simple applications involves the creation of new and powerful materials, perfect diamond in bulk quantities and a tool to manipulate objects on any scale

Material & Method -

Take 2 g anthracite powder and 2g sodium nitrate in 90 ml of 98% sulphuric acid in volumetric flask and kept under the at ice bath (0-5^{o}c) with vigorous stirring. The resulting mixture was stirred for 8 hrs with maintain temperature. The 12 g potassium permanganate was added slowly. The temperature of suspension maintain below 15^{o}C. The mixture was diluted with very slow addition of 190 ml distilled water and kept under magnetic stirrer for period of 3 hrs. Then ice bath was removed and again stirred at 35^{o}C for 2 hrs. The above suspension is reflux at 98^{o}C for 10-15 min. Observed change of colour is brown. To decreased the temperature by 25^{o}C and maintain for 2 hrs. To finally add 45 ml H_2O_2 in brown coloured solution colour changes to bright yellow. 250ml water taken in two separate beaker and equal volume was added to stirred for 6 hrs. The nanoparticle settles down at bottom and washed with 10% HCl then distilled water. After centrifugation the powder was by characterized by XRD , FESEM.

Results & Discussion-

FT-IR analysis- Fig:1 shows significant peak at 1161.9 cm^{-1} corresponding to c-o linkage confirming the presence of oxide functional groups after the oxidation.The peaks at 1627.63 cm^{-1} and upto 1660 cm^{-1} due to C=C bond still remain before and after oxidation.The broad speak of –OH group stretching frequency observed at 2883.06 cm^{-1} to 3300 cm^{-1} due to absorbed water molecules. All data support that AO is highly absorptive material, as verified by its ability to become gel-like solution.

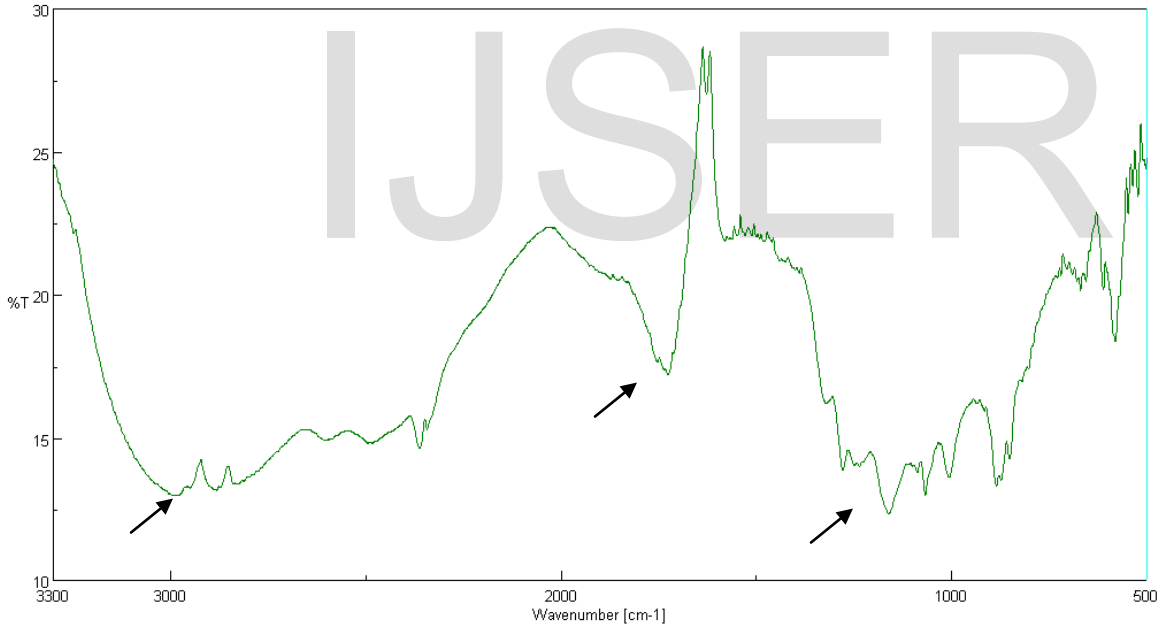

Fig.:1 FT-IR spectrum of AO nanoparticles

X- ray Diffraction (XRD) analysis- The particle size and nature of the anthracite oxide nanoparticle were determined using XRD. This was carried out using Shimadzu XRD-6000/6100 model with 30 Kv, 30 mA with Cu kα radians at 2θ angle. X-ray powder diffraction is a rapid analytical technique primarily used for phase identification of a crystalline material and can provide information on unit cell dimensions. The analyzed material is finely ground, and average bulk composition is determined. The particle or grain size of the particles on the anthracite oxide nanoparticles was determined using Debye Sherrer's equation = 0.94λ / B cosθ.The

$2\theta=13.29^{o}$, this value indicate the oxidation of anthracite.The diffraction peak is found to 26.59^{o} with highly organized layer. The nanosize obtained was ***38.32 nm.***

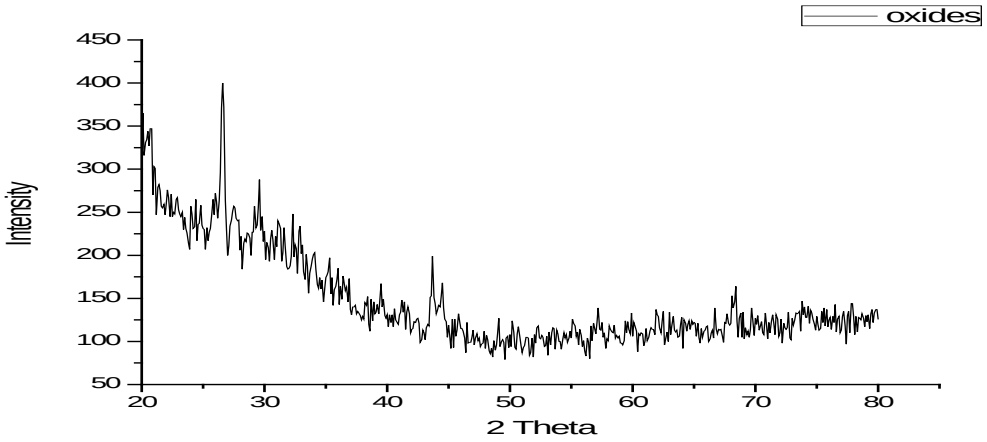

Fig: 2 EDX spectra recorded from a film after formation of anthracite nanoparticles.

FESEM analysis- Field emission scanning electron microscope is a type of electron microscope that images a sample by scanning it with a high-energy beam of electrons in a raster scan patterns. In this experiment after the synthesis of nanoparticles using the plants and then lyophilisation was done using virtis benchtop machine. SEM analysis was done using Jeol-Model 6390 machine. Thin films of the sample were prepared on a carbon coated copper grid by just dropping a very small amount of the sample on the grid, extra solution was removed using a blotting paper and then the films on the SEM grid were allowed to dry by putting it under a mercury lamp for 5 min. FESEM images of the anthracite Oxide (AO) have well defined and forming a porous network that resembles a loose sponge like structure as shown in Fig (3).

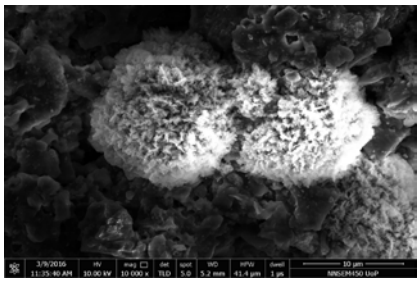

Fig:3 FESEM image of AO nanoparticles.

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