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Investigation on the surface properties of native and modified cenosphere- a nano technology approach

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Cenosphere is a lightweight, inert, hollow sphere made largely of silica and alumina and filled with air or inert gas, typically produced as a byproduct of coal combustion at thermal power plants along with the fly ash having low density. The material employed for the present study is collected from the tuticorin thermal power station.

In the present communication, the chemical stabilization of cenosphere was carried out. Also the properties of surface modification were investigated.

The characterization studies are carried out using Scanning Electron Microscope (SEM), Electron Dispersive Spectroscopy (EDS), X-Ray Diffraction Spectroscopy (XRD), and Surface Area Analyzer. SEM examination shows the material morphology to be scattered and the particle size to be in the micrometer range with nano particles attached on its surface (Figure 1). The elemental composition examined using EDS shows the various elements present in it with major composition of silica and alumina. This is because the cenosphere is one of the combustion products of coal, exhibiting chemical composition similar to that of fly ash. The grain size calculated from XRD showed the values to be in the nanometer range. The results of surface area analysis showed that the surface area is very low thus indicating the necessity of modification.

In order to increase the surface binding sites, cenosphere is chemically activated using salts of magnesium, manganese and sodium by the process of calcination, dissolution and re-precipitation. The modified cenosphere are again characterized with chief emphasis on elemental composition and surface area. The modification is evident from the EDS results as a corresponding increase in metal oxides composition is observed. Between these parameters surface area is of prime importance in the view of adsorption and pollutant removal.

This is because increase in the surface area can be attributed to the active adsorption sites. Subsequently, the surface area is found to be increased by 90% when compared with the native material. Further investigation is carried out using ball-milled cenosphere to achieve uniformity in particle size.

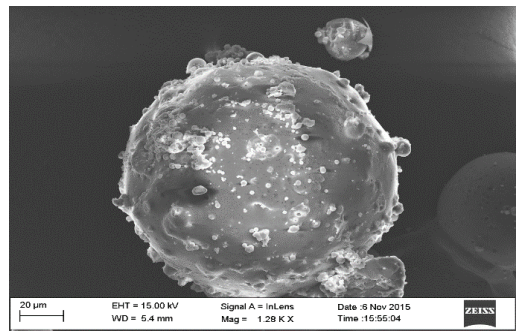

Figure 1: SEM Micrograph of Cenosphere with nanoparticles attached on its surface

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