Executive Summary of UGC Minor Research Project

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Tenure of Project: 1 Year; Amount Sanctioned: ₹ 1,00,000/-

Synthesis, Characterization and Applications of a novel composite material, polyaniline cerium zirconium antimonate

Polyaniline (PANI) a well-known conducting/ electroactivepolymer, has found important applications in diverse fields. Key attractions of polyaniline are the relatively low cost of the route from aniline and the fact that it has very important features that distinguish it from other conductive polymers.

Inorganic ion-exchanger based on organic polymeric matrix must be an interesting material, as it should possess the mechanical stability due to the presence of organic polymeric species and the basic characteristics of an inorganic ion-exchanger regarding its selectivity towards some particular metal ions. Special interest today is focused on composite system having high conductivity at ambient and sub-ambient temperatures, since they find unique applications, such as separators in high power and rechargeable lithium batteries. Moreover, composite materials composed of oxides or polyvalent metal acid salts and conducting polymers have brought out more fields of application, such as smart windows, toners in photocopying, conducting paints etc.

The composite material, polyaniline cerium zirconium antimonate (PANI CZA) studied was synthesized by precipitation method followed by conversion into the H^+ form. Chemical composition was determined by EDS method and structural characterizations were done by Thermo gravimetric analysis, XRD analysis and FTIR Spectroscopic analysis etc. UV-Visible DRS studies were used for characterization as well as to study the optical properties. SEM and TEM showed the material as nanocomposite. BET surface area, pore size distribution and size distribution analysis were carried out. Electrical conductivity studies were carried out using Keithley high voltage current source and low noise multimeter.

Ion exchange properties were studied by determining ion exchange capacity and distribution coefficients for various metal ions. pH titration studies, effect of hydrated ionic radii and temperature on ion exchange capacities and stability in various media were also studied. The use of various spectroscopic and non-spectroscopic techniques provided interesting information on the physicochemical characteristics of the material. The material

showed very high stability. The introduction of organic species has enhanced the properties of inorganic ion exchanger. It showed high selectivity towards toxic metal ions like Pb^{2+}, Cd^{2+}, Th^{4+} etc. These results are very significant in environmental chemistry and can be utilized for applications involving separation and removal of these metal ions.

Electrical conductivity studies showed that the material possess high conductivity compared to that of pure poly aniline. The conductivity is due to PANI, protonic conduction and electron transfer from CZA.

The studies have shown entirely different ion exchange selectivities and enhanced properties than that of their single counter parts. The electrical conductivity data reveals various applications. The results encourages us to pursue studies on synthesis of new materials of this class, their properties and applications.

Sd/-

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