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Purification of water *via* nano oxide-charcoal composite

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ABSTRACT

Herewith, presented the application of nano metal oxides for the purification of water. Metal oxides in the different nanoforms made composite with activated charcoal, the surface area increases ultimately adsorption increases. Metal oxides like V_2O_5 in the nano level found excellent ecofriendly reagent useful for purification of water through selective adsorption.

Keywords: Adsorption, oxalic acid, Nanophase, V_2O_5, charcoal.

INTRODUCTION

One of the fundamental requirements for life on earth is water. World is suffering from growing health and hygienic problems and a high percentage of diseases in developing countries is caused by polluted water supply.

In this contest, contaminants from industrial waste streams, that seriously threaten human health and the environment has assumed growing importance in recent years [1]. Reduction, if not elimination, of such pollutants can be achieved through a combination of resource management, product reformulation, process modification and some form of end-of-pipe treatment [2]. The established technologies are based on incineration, biological treatment, condensation and absorption and adsorption processes.

In the field of nanotechnology, the special particles which are known as nanoparticles require minimum space for accommodation and gives more efficiency, as a rule

activated carbon is more effective in adsorbing nonelectrolytes from a solution than electrolytes, and the extent of adsorption is usually greater of the adsorbate [3]. Conversely, inorganic solids tend to adsorb electrolytes more readily than nonelectrolytes [5]. This tendency of adsorbents to attract certain substances in preference to other occasionally leads to the phenomenon of negative adsorption i.e. the concentration of a solute is actually increased after the treatment with the adsorbing agent. The explanation suggested for negative adsorption is that the solvent, in this case the water is adsorbed in preference to the electrolyte, and as a consequence the concentration of solute is raised [5].

The adsorption decreases as the temperature increases and increases when the surface area increases, by taking this advantage we are in touch to increase the surface of charcoal by making nanocomposite with nanomaterial because nanomaterial like V_2O_5 can act as catalyst as well as a good adsorbing agent by which the rate of adsorption increases because activation energy increases[6-8]. These characteristic features have tuned us to find feasibility of using nanomaterials for enhancing the charcoal adsorption in purification of water.

In this manuscript, we present the preparation of V_2O_5 in nano oxide powder ultimately used for water purification [9-10].

METHODOLOGY

All the chemicals were used of AR grade. Ammonium metavanadate, hydrogen peroxide, oxalic acid, activated charcoal etc. are the precursors.

The implemented method is divided into three parts. The first part consists of synthesis and characterization of V_2O_5 nano oxides. In the second part the preparation of composite of charcoal and nano oxides was done. In the third part we verified the validity of Frudndlich- Langmuir adsorption isotherm principle by which water purification is possible.

RESULTS AND DISCUSSION

Fig. 1 presented the XRD of V_2O_5 and charcoal composite. The sharp peaks indicated the microcrystalline state of composites.

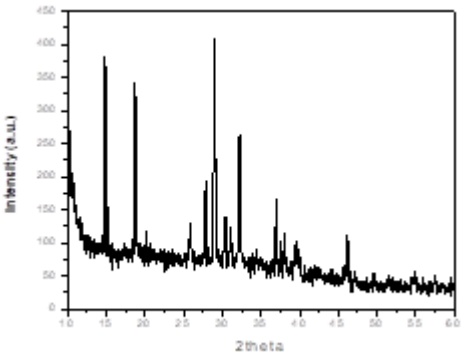

Fig. 1 XRD of V_2O_5 – charcoal composite

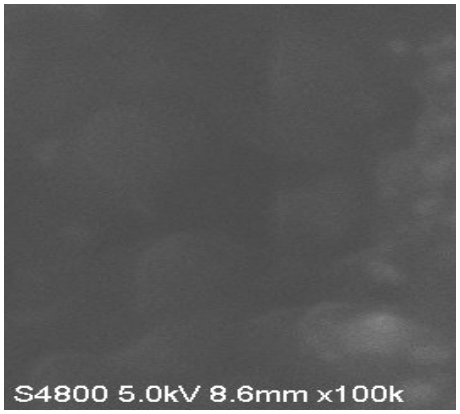

Fig. 2 SEM image of V_2O_5 – charcoal composite

Fig. 2 pertains the SEM image of V_2O_5 – charcoal composite. In the figure it is clearly observed that the V_2O_5 nanoparticles are clearly embedded in the layer of charcoal.

Experimental

The obtained nanophase oxide powders were sonicated in water and incorporated in the matrix of activated charcoal through adsorption. The oxide incorporated charcoal materials have been used as the adsorbing bed for the removal of trace amounts of pollutants from water.

The charcoal embedded fine powders of the inorganic oxides have been able to remove pollutants from water an efficient adsorption of charcoal using nanophase V_2O_5 powder [8]

Solid surfaces can adsorb dissolved substances from solutions of oxalic acid in water is shaken with activated carbon, part of the acid is removed by the carbon and the concentration of the solution decreases.

Observation No.1	Weight of Charcoal = 100 mg Oxalic acid concentration in water =0.05N Sodium hydroxide concentration = 0.01N Total quantity of solution consisting of charcoal and oxalic acid is 25 ml From 25 ml of total solution 5 ml is pipette out and titrated it with standard solution sodium hydroxide we found that 1.97 gm of oxalic acid is adsorbed with charcoal calculated by some tedious calculations of Frudndlich- Langmuir adsorption isotherm principle equation.
Observation No.2	Weight of Charcoal = 50 mg Weight of (V_2O_5) Nano oxide = 50 mg Oxalic acid concentration in water =0.05N Sodium hydroxide concentration = 0.01N Total quantity of solution consisting of charcoal and oxalic acid with (V_2O_5) Nanomaterials is 25 ml. From 25 ml of total solution 5 ml is pipette out and titrated it with standard solution sodium hydroxide we found that 2.08 gm of oxalic acid is adsorbed with charcoal calculated by of Frudndlich- Langmuir adsorption isotherm principle
Observation No.3	By changing the concentrations of charcoal and nanomaterials we found that the 1:1 ratio is more suitable for adsorption of oxalic acid on charcoal as well as on nanomaterials.
Observation No.4	Above observations are obeyed the important Frudndlich-Langmuir adsorption isotherm principle

CONCLUSION

Use of nanomaterials is feasible for enhancing the charcoal adsorption in purification of water; it is proved by the verification of Frudndlich-Langmuir adsorption isotherm principle.

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