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**STUDIES ON ADSORPTION FOR THE REMOVAL Fe AND Pb FROM WATER**

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**INTRODUCTION:**

For the study of the progress of adsorption, experiments were performed in a shaking incubator by agitating different glass bottle containing 1.0g of adsorbent with 50ml aqueous solution of the adsorbent ( ferrous sulphate & lead chromium tera oxide ) of desired concentration , temperature and pH. The pH of the adsorbate solution was adjusted using HCl or NaOH solution of appropriate strength, prior to each run. The progress of adsorption was noted at desired time intervals till saturation. The suspension was then centrifuged and the supernatant liquid was analysed to determine the residual adsorbate concentration by standard method. Blanks were run without adsorbent under similar condition of concentration, temperature and pH in all the cases in order to check the accuracy of the experiments and to know the existence of any background adsorption correction have been made accordingly.

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**ANALYTICAL PROCEDURE FOR Fe:**

The residual concentration of Fe at any time interval at saturation was estimated spectrophotometrically. In a 50ml volumetric flask, 20 ml supernatant or standard solution of ferrous sulphates was taken and 2ml of con HCl and 1ml of hydroxylamine hydrochloride solution was then added. Boil the content of half of the volume and after cooling that, 10 ml of ammonium acetate buffer and 2ml of 1, 10 phenanthroline solutions was added. An orange red color was developed the flask was shaken for 5 minutes and then filled with distilled water up to the mark. The adsorbance of the orange redcolor was measured at 510 nm with spectronic- 20 spectrophotometer.

A calibration curve was constructed by plotting adsorbance of some standard ferrous sulphate solution against the Fe(II) concentrations. The concentration of residual Fe was determined with the help calibration curve.

**ANALYTICAL PROCEDURE FOR Pb:**

Take a sample solution containing 0.1-0.2 g lead neutralized solution by adding sodium hydroxide until a precipitate just began to form. Add 10ml of acetate buffer solution (6 m in acetic acid and 0.6 m in sodium acetate), 10ml chromium nitrate solution (2.4 g per 100ml) and 10 ml potassium bromate solution (2.0 g per 10ml). Heat to 90-95 °C after generation (of chromate) and precipitation are complete ( about 45 minutes) as shown by clear supernatant liquid , cool filter through a weight sintered glass porcelain filtering crucible was with a liter 1 percent nitric acid and dry at 120 °C weight as  $PbCr_4O_4$ .

**OBSERVATION:**

The present investigation is totally devoted with the study of the removal of Fe and Pb, which are major pollutants from various industries from water by adsorption such as Fly Ash and China Clay. The variables investigated are initial adsorbate, concentration, adsorbent, particle size, temperature and pH . Such studies are quite helpful in developing an appropriate technology for designing a water treatment plant for the removal of above pollinates.

The chemical analysis of various adsorbent describe in the present investigation indicate the following composition of the adsorbents.

**FLY ASH:**

55.80% SiO<sub>2</sub>, 26.14% Al<sub>2</sub>O<sub>3</sub>, 1.32% Fe<sub>2</sub>O<sub>3</sub>, 2.16% CaO and 0.96% MgO, 13.62% ignition loss.

#### CHINA CLAY:

45.88% SiO<sub>2</sub>, 0.62% Fe<sub>2</sub>O<sub>3</sub>, 38.46% Al<sub>2</sub>O<sub>3</sub>, 0.34% MgO, 0.89% CaO, 13.81% ignition loss.

The infrared spectrum of fly ash shows the presence of quartz Hematite and Kaolinite, where different band in the spectrum china clay characterizes the presence of Kaolinite, Illite and Hematite. The presence of above mineral phase in fly ash and china clay has been further confirmed by the x-ray diffraction analysis.

The removal of Fe and Pb is more by Fly ash than the China clay. The attempt has been made to explain the adsorption in these system on the basis of formation aqua- complexes on the surface of adsorbents and there subsequent acid base dissociation to produce positive and negative charge respectively at the surface.

The kinetics studies suggest that the rate of uptake of Fe and Pb by different adsorbent used is mainly diffusion controlled and process follows first order rate kinetics. The mass transfer coefficients of each adsorbate in different system have been calculated using the mathematical relationship given by McKay and co-workers at various temperatures. The value of mass transfer co-efficient thus obtained suggest that the rate of adsorbate particle transport is rapid enough to use such adsorbate for water quality control.

The effect of temperature on the adsorption of Fe and Pb indicate that an increase in temperature lowers the extent as well as rate of adsorption of Fe and Pb whereas equilibrium period remains altered with temperature change. The decrease in temperature in adsorption of Fe with increase in temperature is probably due to positive temperature co-efficient of the solubility of this cation . On the other hand the adsorption of Pb requires energy of activation to activate the adsorbate species and therefore the uptake of ions increase with temperature. The thermodynamics of adsorption have also been studied. The negative values of  $\Delta G^0$  for the system studied at different temperatures indicate that favorable adsorption of adsorbates. The negative enthalpy change in Fe and Pb systems indicate the exothermic and endothermic nature of the process respectively.

The equilibrium data for Fe and Pb at 20, 30 and 40 °C follow the Langmuir isotherm. These indicate the formation of monolayer coverage of the adsorbate on the surface of adsorbents. The validity of Langmuir isotherm was further confirmed by the regression analysis of equilibrium data .The adsorption capacities of various adsorbent for the removal of Fe and Pb at different temperatures have been determined from the isotherm plots. The apparent heats of adsorption determine for all the systems show the possibility of physio-sorption followed by chemi-sorption .In most of the cases and are dependent on surface of coverage.

The present observations in adsorption have been explained on the basis of charge in the extent and nature of charge on the oxide surface of adsorbate with pH of the solution. The speciation of adsorbate with respect to pH plays an important role in the removal of these pollutants.

#### CONCLUSION:

The result of the present study show that the adsorption of Fe and Pb on Fly ash and China clay are quite encouraging and will prove to be vital importance in purification of wastewaters from mines and other industries which provide influents with these metals.

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