EFFECTIVENESS OF FLY ASH FROM KANTI THERMAL PLANT (MUZAFFARPUR) IN CONTROLLING AQUATIC POLLUTION

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ABSTRACT

Fly ash sample was collected from Kanti Thermal Plant, Muzaffarpur, and Bihar. Fly ash sample was initially washed with distilled water to remove surface dust and dried at 100^0c and kept in desiccators. The physico-chemical characterization of fly ash was carried out in addition to its physical parameters (Density, surface area and particle size) using standard process.

In the present study with the treatment of fly ash, COD of waste water and Fluoride of water were measured. The adsorption efficiency of COD with fly ash was compared with that of activated carbon (commercially available) where as for fluoride before and after treatment with fly ash it was quantatively analyzed using SPAD NS spectro-photometric method. For this purpose a system of standardized batch absorbers under steady state conditions were used to study the effect of treatment time, adsorbent doze, pH of media, initial COD & Fluoride concentration, agitation speed around adsorbent particle size. Fly ash has shown quite effective adsorbent capacity for COD reduction from domestic waste water and fluoride content.

Keywords: Flyash, Waste Water, Activated Carbon, Adsorption

I INTRODUCTION

Contamination of ground water due to geo environmental causes is a worldwide problem including in our country. The problem further aggravates due to indiscriminate use of ground water. In the present communication the use of fly ash' for removal of COD from domestic waste water and removal of fluoride from ground water has been applied; since 216 districts of 19 states are affected by fluoride related disease.

II MATERIALS AND METHOD

Fly ash sample was collected from Kanti Thermal Power Plant, Muzaffarpur , Bihar . The sampling procedure was adopted as reported in literature. It was washed with hot distilled water several times and dried at 100^0c and kept in a desiccator. Fluoride solutions in the required concentration range were prepared by exact dilution (50 mg dm^{-3}) of sodium fluoride (E. Mark India).

III EXPERIMENTAL

The physico-chemical characterization of fly ash was carried out using standard procedures. The characterization data of fly ash sample is mentioned in Table -1, physico-chemical analyses of domestic waste water discharged from the adjoining villages situated near Kanti Thermal Power Plant is mentioned in Table 2. pH, conductivity and temperature of sample water was measured on the site and the other parameters were analysed in the laboratory according to the APHA (1989).COD of the sample were measured before and after treatment with fly ash. The does of fly ash in 50 cm^3 solution was varied from .5 to 2.5g.

IV ADSORPTION STUDIES

Experiments were carried out at ambient temperature in batch mode. Before start of each experiment, a predetermined amount of adsorbent was added to each flask containing 250 ml capacity. The stirring was kept constant throughout the experiment ensuring equal mixing. Each flask was filled with a known volume of sample whose desired pH was maintained using dilute NaoH/Hcl solution. The flask containing the sample after proper stirring were withdrawn from shaker at predetermined time interval, filtered through Whatman No. 44 filter paper. Now 100 ml sample of maximum COD containing waste water was mixed with known amount of fly ash as adsorbent and agitated for different time periods. After predetermined time intervals, samples were filtered and COD concentration was determined. Again varying the amount of adsorbent was added to the known volume of sample. Sample was agitated for specific tine, filtered and then analyzed for residual COD concentration.

Similarly varying pH volume and taking specific concentration, absorbent dose and contact time. pH variation between 1-12 using dilute NaoH/dilute Hcl was done. The sample was agitated for specific period, filtered and analyzed for the residual COD concentration. Similarly varying pH value and taking specific concentration, adsorbent does, contact time adsorbent particle size, initial COD concentration and keeping all condition constant, the residual concentration COD was measured.

The removal of COD was quoted (%) relative to the values measured for the untreated effluent. Similar kind of experiments was performed with the help of commercial activated carbon as an adsorbent for the shake of comparison.

The absorption studies of fly ash w.r. to fluoride was studied similarly as described above under the same condition before fluoride content of water was measured pre and post treatment with fly ash by spectrophotometer at λmax of 540 mn^3.

V RESULT AND DISCUSSION

Physico-chemical analysis of waste water mentioned in table 2 clearly showed that domestic waste water is highly polluted with organic load and other suspended matter. This has been exhibited in items of COD values. The composition of fly ash depicted in table 2, shows predominately silicon dioxide, followed by insoluble oxides of aluminum, iron, calcium, magnesium, titanium, alkali oxides and negligible amount of phosphorous pent oxide. In case of fly ash as an adsorbent the metal salts hydrolyses in the presence of natural alkalinity to form metal

hydroxides. The multivalent cations present in fly ash can reduce the zeta potential while the metal hydroxides are good adsorbents. They form monomolecular layer on the surface of suspended organic matter and removes it by enmeshing them . The operational variables studied for COD removal from domestic waste is mentioned in Table 3. Absorption of COD by fly ash w.r. to extended time period, extended dose of adsorbent, increased H^+ ion concentration, agitation time (rpm) , simulated COD bearing solutions and absorbent particle size performed and data obtained converted into graph clearly exhibits that enhanced contact time decreases % COD by fly ash and reaches maximum at 250 minutes. Also increased adsorbent doze of fly ash reduces % COD. It was observed that at the dose .65 g/l for fly ash there is about 80% removal of % COD.

It was observed that at pH level 2-5 fly ash had higher adsorption capability and at higher pH adsorbent get recessed. The agitation speed was varied from 100 rpm to 800 rpm keeping initial conc., pH, contact time and adsorbent dose constant. Initially with increase in agitation speed there is a increase in extent of adsorption and an equilibrium was established after 700 rpm. However with increase of particle size there is a decrease in % COD adsorption. Adsorption capability of activated carbon was performed and compared with fly ash however given better % of adsorption capability under differs condition.

In the case of Fluoride adsorption of fly ash initial concentration of solute was kept between 2-10 mg dm^{-3}. Batch experiments were carried out to investigate the sportive characteristics of fly ash. The sensitivity of the process for the shaking time and speed, pH, particle size, fly ash doze, temperature and initial solute concentration were tested. The variables for interaction of fluoride solution with fly ash are indicated in Table 4.

With increase in initial concentration of fluoride ion , fluoride ion adsorption increases. For a dose of fluoride ion concentration, as the dose of fly ash increase the amount of adsorption increases gradually [4]. . The does of fly ash in 50 cm^3 solution was varied from .5 to 2.5 g. The maximum adsorption of fluoride ion was 74% corresponding to initial concentration of 2 mg dm^{-3} at 313K. Small particle size favours better adsorption [5]. With Increasing time, of increased speed of agitation and at lower pH adsorption of fluoride has increased.

Therefore fly ash is a recommended low cost adsorbent for decreasing % of COD from domestic waste and fluoride removal from underground water.

Table 1 : Characterization Data of Fly Ash

Chemical Characteristic	%	Approximate analysis	%	Physical	Parameters
Si 0_2	69.0	Ash	70.84	Density (gam^{-3})	3.98
Fe_2O_3	6.20	Ignition Loss	10.15	Surface area (cm^2)	13/68
Al_2O_3	19.98	Volatile matter	2.85	Particle size (mm)	2.8,0.710
Cao	2.9	Moisture	1.25		
Mgo	1.2				
P_2O_5	1.84				
Tio_2	1.94				
Na_2 o /K_2o	1.91				

Table 2 : Physico- chemical analyses of domestic waste water of villages situated around Kanti Themral Power Plant, Kanti, Muzaffarpur

Parameters	Concentration	Maximum Limit
pH	7.9	8.5
Electrical conductance	.41	0.1
Temperature (^{0}C)	29	16-32
Turbidity (NTU)	350	5-10
Total suspended solids (mg/l)	369	10-50
Total dissolved solids (mg/l)	710	450
COD (mg/l)	980	30-45
BOD *|(mg/l)	760	3-4

Table 3 : Range of operational variables studied for COD removal from domestic waste

Variables	Range
Contact Time (Minutes)	20 – 320
Adsorbent dose (g/l)	10 – 80
pH	1 – 12
Agitation speed (rpm)	50-800
Adsorbent particle size (mm)	.5 – 2.5
Initial COD conc. (mg/l)	200 – 1200

Table 4 : Range of operational variables studied for fluoride adsorption.

Variables	Range
Initial concentration (mg dm^{-3})	2 – 10
pH	2.00- 10.00
Temperature (k)	306-321
Dose of Fly ash (g)	.5 – 2.5
Particle size (mm)	.71- 2.8
Agitation time (min)	up to 250
Agitation speed (rpm)	100 – 450
Volume	50

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