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Adsorption of Ni (II) from aqueous solution by fly Ash

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Abstract
Fly ash adsorbent was used for the removal of nickel ions from aqueous solution of Shahdol. The solution of Nickel was prepared of 100 ppm & Analyzed by AAS. Sorption of metal ion has been studies as function of contact time, Temperature, PH of the solution and metal ion concentration. These factors have Remarkable positive effect on sorption Process.
The Adsorption data of fly Ash at different initial condensation was filled to freundlich & Longmuir adsorption isotherms and monolayer sorption capacity determined was 94.5 (Ph 5.0 Temperature 27^0c) Thermodynamics parameter indicates that the sorption is Exothermic, spontaneous with a greater affinity of metal species for the adsorbent.

Keywords: sorption, fly ash, activated carbon, AAS

Introduction
We study the fly ash an adsorbent for the removed of Heavy metals from aqueous solution. Fly Ash is a powdered material producer by the combustion of pulverized coal in thermal Power Plants [1].
A Number of methods are available for the Removal of metals ions from aqua's solution, Preparation of fly ash adsorbent sample, studied contact time, temperature ph of the solution and metal in constructions heavy metals found in fly Ash ad Toxic in Nature [2, 3].
Fly ash defined in cement and concrete terminology as "The finely divided Residue resulting from the combustion of grand or powered coal, which is transported from the he wise box through the striver by flue fares". Fly ash in a by produced of coal filed electric generating plants.
Fly as is a finely divided reduce result in from the combustion of powdered coal lignite and collected form the flue gas of pulverized fuel fired Bailers with the help of electrostatic precipitations it is generally grey in colour abrasive Refractory, generally acidic in Nature. It has specific surface area which varies between 2500 and 7000 sq. and possesses pozzolanic characteristic. Particle size of fly ash ranges from as high as 120 to as low less than 5 microns, it also contains particles of unburnt carbon soot.
Fly ash is a waste material generated from electric power plants and approximate 500 million tunes of fly ash is discharge per year thought the world. Because fly ash has pozzolanic properties after reacted with line [4] about 20 % of fly ash is used as building materials. However, the remaining fly ash disposed in landfills still causes an increasing treat so the environment due to its fine structure and toxic elements as one of economically viable Solutions, the utilization of fly ash as inexpressive adsorbents nor also been widely attempted far. Blue gas clearing [5, 7] and removal of toxic metals [8-13] and arganism [14] from waste waters. However, in cases, the fly ash still exhibit low adsorption capacity.

Experimental
Preparation of fly ash adsorbent sample for our study a stock solution in Nicke (II) can be made of either Ni So_4. $7H_2o$ as Nickel chloride $Nicl_2.H_2O$ we made 1000 ppm solution of $NiSo_4$. $7H_2O$ in 100 ml water.
All Reagents or AR or GR grade 100 ml of metal solution is taken with 0.5 gm of fly ash is a sakes (100 cpm) after about us minutes surplus were withdrawn from the shaker, Centrifuged ad the supernatant solution was analyzed for redial metals by AAS.

Result and Discussion
Studies of various factors such as contact time ph absorbent dose, metal ion concentration to temperature on the adsorption can be given in the following way. The results obtained from

AAS study is shown is table 1 and it are evident that the adsorption of Ni (II) is maximum at this concentration and at Ph 5.0 the contact time was 60 min.

Table 1: Removal of Ni (II) by fly ash temperature 303 k PH 5.0 Contact time 60 min

S.No.	Weight of Adsorbent gm/100ml	Time (min)	Adsorbed	% Removal of metal ion
1	0.5	15	179	17.9
2	0.5	30	278	27.8
3	0.5	45	462	46.2
4	0.5	60	930	93.0
5	0.5	75	935	93.5
6	0.5	90	946	94.6
7	0.5	105	959	95.9

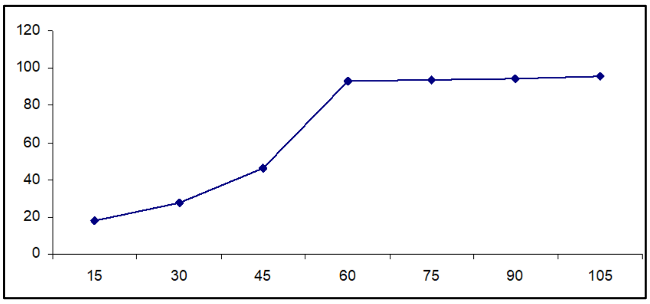

Fig 1: Effect of Contact time on adsorption of Ni (II) 303k on fly ash

The dependence of sorption of Ni (II) on contact time was determined by batch techniques at different time Intervals of 15 mints 30 mints, 45 min, 60 min, 90 min, 105 min, at 303 k maximum adsorption was achieved at 105 mints 95.9%.

The Removal of metal ions from aqueous solution by adsorption is highly dependent on the ph of the solution which effects the surface change of the adsorbent the degree of Ionization and speciation of the adsorbate.

Table-2 & Figure-2 illustrate the influence of ph on adsorption and indicate the ph of the solution play a vital role in any adsorption process. the removal of there methods in creased with increases in ph and reached a shoulder like maximum a followed by a sharp in crease in removed clause to 99% over the ph range 5 to 7.

Table 2: Percentage adsorption of Ni (II) by fly ash (Effect of PH) Temp. 303 K Adsorbent weight 0.5 gm contact time 60min

S.N.	PH	Removed Amount of Ni(II) in ppm	Removed % Ni(II)
1	3	245	24.5
2	4	655	65.5
3	5	930	93.0
4	6	965	96.5
5	7	970	97.0

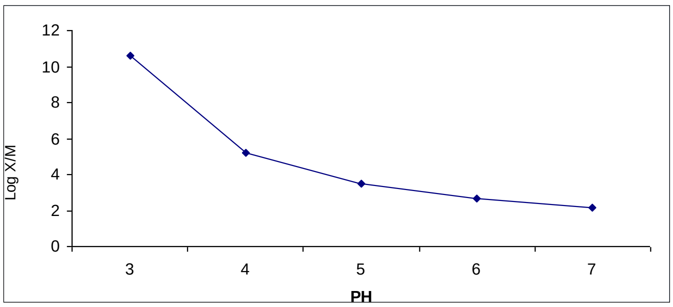

Fig 2: Effect of PH on adsorption of Ni (II) At 303 Fly Ash

The effect adsorbent dose was studied by varying the amount of absorbent dose (001, 002, 0.03, 0.04. 0.05, 0.06. 0.07, 0.08) and performing the studies at ph 5.0 the data obtained are depicted in table-3 and figure-3.

The data obtained in the study indicated that the amount of Ni (II) adsorbed on fly Ash significantly increased with increase in the adsorbent dose.

Similarly removed percentage of Ni (II) with the increasing adsorbent dose rise form 62.0% to 94.0% so like the other factors of adsorption dose of adsorbent also plays a vital role in the removal of metal ion form the salvation.

The Higher dose of adsorbent due to an increase surface are would have cause the availability of more number of adsorption sites resulting in higher metal removed. At the adsorbent dose 0.08 gm maximum at 94.0% initial were obtained.

Table 3: Effect of adsorbent dose on adsorption of Ni (II) by fly Ash Temperature 303 k Ph 5.0Contact time 60 min

S. No.	Adsorbent dose gm/ 100ml	Removed amount of Ni (II) in ppm	Removed % Ni (II)
1	0.01	620	62.0
2	0.02	850	85.0
3	0.03	900	90.0
4	0.04	920	92.0
5	0.05	930	93.0
6	0.06	936	93.6
7	0.07	940	94.0
8	0.08	940	94.0

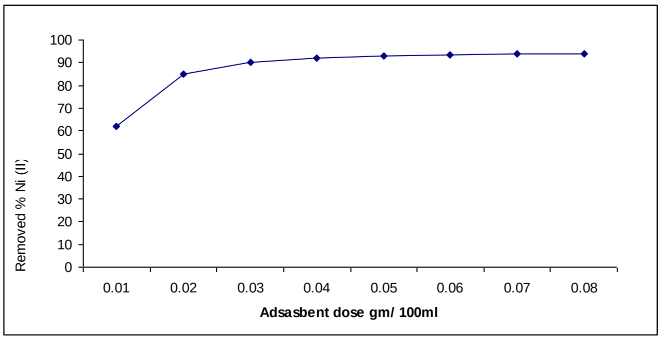

Fig 3: Effect of Adsorbent dose on adsorption of Ni (II) at 303 k on Fly ash

The effect of initial concentration of metal ions on the sorption potential of adsorbent fly ash at the temperature 303 k was investigated at ph 5.0 and the adsorption data of adsorbent at different Initial concentration of Ni (II) is shown in table-4 the results so obtained were fitted to line as liked freundlich and Langmuir adsorption isotherm. The adsorption increases with the metal ion concentration increase as shown in.

Table 4: Table adsorption of Ni (II) on fly ash with varying metal concentration temperature 303 k Adsorbent dose 0.5gm Ph 5.0 contact time 60 min

Initial Con. mg/L	C_e	X	X/M	Log C_e	Log X/M	$\frac{1}{C_e}$	$1/\frac{x}{m}$
50	1.10	47.12	0.094	0.041	-1.026	0.909	10.63
100	2.10	96.71	0.193	0.322	-0.714	0.476	5.18
150	5.13	143.12	0.286	0.710	-0.543	0.194	3.49
200	9.98	188.64	0.377	0.994	-0.423	0.101	2.65
250	13.12	233.72	0.467	0.117	-0.330	0.076	2.14

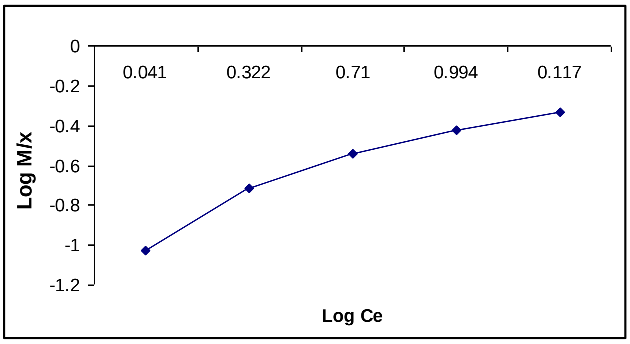

Fig 4: Freundlich adsorption isotherm of Ni (II) at 303 k on Fly Ash

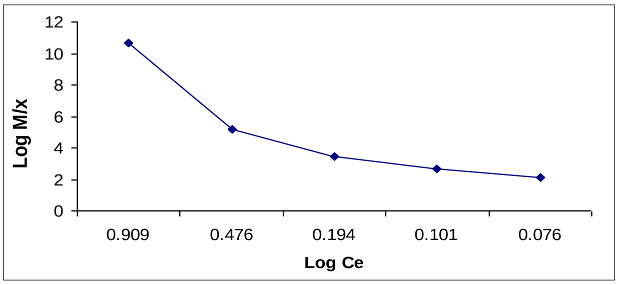

Fig 5: Langmuir adsorption of Ni (II) at 303 k on Fly Ash

The freundlich & Langmuir model has been applied to the experimental data & Result shows that both models are fit to the study. The linear plots of $1/\frac{x}{m}$ verses $1/C_e$ clearly indicate monolayer coverage of adsorbate at the outer surface of the sorbent.

The adsorption data obtained with the adsorbent correlate will with the freundlich & Langmuir adsorption models. Freundlich Content form adsorption data are given in the table-5 the value of K increased as temperature increased indicating t that adsorption increases or temperature increases. The value r comes between 1 to 10 represents beneficial adsorption.

Table 5: Value of Freundlich Constants for pb (II)

Metal Ion	Log		1/n		r(Corr. coefficient)	
	303k	313k	303k	313k	303k	313k
Ni (II)	-0.9738	-0.986	0.556	0.595	0.984	0.980

Values of freundlich & langmuir constants, RL Values & Thermo dynamic parameters are calculated and shown in the table 6 and 7 form the data shown in table 6 it in evident that the exothermic nature of the Adsorption is indicated by a decrease q_0 with rise in temperature the result shown in table 6 also indicate ΔG^0 values are negative which means that the reactions spontaneous the values of ΔG^0 generally increased with temperature pointing towards sharp spontaneously of the reaction and sharp change in affinity of metal ions by fly Ash.

The Negative values of ΔH^0 Suggested that the adsorption was exothermic also negative values of ΔH^0 Suggest that the adsorption was energetically stable

As indicate table ΔS^0 values for the adsorption process are positive. Positive entropy of adsorption also reflects the affinity of adsorbent material for Ni (II).

The Positive value of Entropy also suggests a high degree of disordersness at the solid solution interface during the adsorption of metal ions fly Ash.

The value of R_L indicates the shape of the isotherm to be either unworkable ($R_2 > 1$) linear ($R_L = 1$) favarable ($0 < R_L < 1$) as irreverble ($R_L = 0$)

This study shows that the shape of the iso thermo is favorable ie. R_L values ($0 < R_L < 1$).

Table 6: Values of langmuir constants and thermodynamics parameter

Metal Ion	q value related to the equilibrium constant (Lmole^{-1})		b (lng^{-1})		ΔG^0 K. Cal mole^{-1}		Mean ΔH^0 K. Cal mole^{-1}	Mean ΔS^0 K. Cal mole^{-1}
	303K	313K	303K	313k	303k	313k		
Ni(II)	1.6311	1.3812	8.921	9.762	-0.3219	-0.3559	-0.00029	0.00109

Table 7: Equilibrium parameters R_L calculated from langmuir adsorption isotherm

Metal Ion Concentration (mg/L)	Pb (II)	
	303k	313k
50	0.00223	0.00204
100	0.00111	0.000102
150	0.00074	0.00068
200	0.00056	0.00051
250	0.00044	0.00040

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