International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 10 Oct 2021, pp: 1126-1129 www.ijaem.net ISSN: 2395-5252

Thermal Power Plant: Alklization Of Soil Through Fly-Ash Emmission Across Power Hub Of Chhattisgarh State. (Special Reference To Korba District)

Dr. Nand Kumar Tripathi, Prof. Pankaj Swarnkar
Deptt. Of ChemistryDeptt. Of Mechanical
Institute of Technology Korba (C.G.)Institute of TechnolgyKorba (C.G.)

Submitted: 15-10-2021 Revised: 26-10-2021 Accepted: 28-10-2021

ABSTRACT: In the introduction part, the significance of fly-ash emissions from a thermal power plant, the size of fly-ash particulate matter and the environmental impacts of fly-ash emission have been discussed. The growth of thermal power generation in India has been described. The working process and air pollution control devices in a thermal power have been described. The sampling strategy and the method for the fly-ash fallout measurements has been stated. It has been found that the fallout rates at a distance of about 1 km around the power plant range from 291.00 to 848.18 t/km2/month, those at an average distance of about 2.5 km range from 134.10 to 548.18 t/km2/month and those a distance about 4 km range from 64.28 to 478.18 t/km2/month. The presence of mercury in the fly-ash matter was found to be 0.81 mg/kg. The rate of entry of elementary mercury into the soil horizon has been found to be in the range from 0.214 to 0.687 kg/km2/month, within 1 km radius around the thermal power plant. The disseminations of toxic metals (Be, Co, Ni, Cu, Zn, Sn, As, Cd, Ag, Pb, Sb and Bi) has also been horizon worked out. Some selected metals (Al, Fe, Cr, V, Mn and Mo) have been analyzed in the fly-ash matter and their rates of entry i8nto soil horizon determined.

The concentrations of alkali and alkaline-earth metals have been determined, and the alkalinization of soil through fly-ash emissions has been examined. Permeation of some toxic metals (Cu, Co, Ni, Pb, Zn, Bi and Sb) up to the depth of 90 cm in the vicinity of thermal power plant has been studied. Permeation of some selected metals (Mn, As, Ag, Cr, V, Cd and Mo) in soil through fly-ash fallo0ut has also been studied.

Key words: - Alkalinization, Fly-ash, Thermal Power Plant, Toxic/Heavy Metals.

I. INTRODUCTION: -

Most of the coal consumed in India is burnt at power plant where the constituents-elements entering the boilers are partitioned between the bottom ash (or slag) stream, and the flue gas stream containing the suspended fly-ash and the vapours of volatile elements or compounds. The grain size of the dust fallout particles was found to be varying depending on the distance was found to be 5-30 micron (60%) and less than 5 micron (40%) whereas at the 4 km distance, the size distribution was 65% for particles smaller than 5 micron and 35% for particles greater than five microns. The discharged particles enter the terrestrial or aquatic environment by wet or dry deposition. Block and Dams reported the presence of a number of toxic metals in coal and coal ash. Klien have reported trace elements flows from a coal fired power plant and have given the rates of atmospheric discharge (g/min.) of toxic metals.The presence of a number of toxic elements in coals, their emissions in the form of particulate matter in to the atmosphere, the size of the fly-ash particulates and depositions of the fly-ash particulates on the soil horizon in the vicinity of thermal power power plants is given below; -

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 10 Oct 2021, pp: 1126-1129 www.ijaem.net ISSN: 2395-5252

Table No.1

Concentration of pollutants shown in ppm.

S.N.	Pollutants	Thermal Power Plants Fly-ash
1	As	3.5
2	Sb	63.7
3	Be	9.5
4	Bi	6.5
5	Cu	53.5
6	Co	31.5
7	Cd	3.0
8	Pb	46.5
9	Hg	0.8
10	Ni	83.5
11	Sn	269.5
12	Zn	115.0
13	Ba	350.5
14	Al	13577.5
15	Ca	22400.0
16	Mg	14500.0
17	Fe	20032.5
18	Li	19.0
19	Na	4300.0
20	Rb	18.0
21	Ti	--
22	V	212.5
23	Sr	90.0
24	Cs	9.7
25	Ag	9.5
26	Cr	205.0
27	Mn	286.7
28	Mo	39.3
29	F^-	375.5
30	Cl^-	--
31	SO_4^{--}	2500.0
32	SiO_2	582500.0
33	P_2O_5	4300.0
34	CO_3^{--}	--

II. EXPERIMENTAL: -

On the basis of data obtained, the distribution of the fly-ash fallout around the thermal power plant has been worked out and illustrated in table 2-3.Analysis data of macro components and toxic metals in sample of fly-ash and soils, Indian standard for industrial effluents is as described below.

Sampling: -

Three samples of soil were collected from each of the four sampli9ng sites which are located at a distance of one km in each direction with respect to the emission source by digging layer thicknesses of 30 cm, 60 cm and 90cm. Two samples of soil were collected from contamination free locations situated 20 km away from the emission source which had similar geochemical

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 10 Oct 2021, pp: 1126-1129 www.ijaem.net ISSN: 2395-5252

characteristics by digging a layer 30 cm at each of the locations.

Method and Results: -

The standard solution of the metals was suitably diluted to match the concentrations of the sample solutions within the measurement sensitivity for the calibration purposes. Three replicates of determination for each sample were made, and the mean values have been shown in Table 3. The analysis was carried out using an atomic absorption spectrophotometer (Varian Model AA 575).

TABLE NO.2
ANALYSIS DATA OF MACRO COMPONENTS AND TOXIC METALS IN SAMPLES OFFLYASH AND SOILS

Microcomponent %					Toxic metals in ppm			
Fe_2O_3	CaO	MgO	Na_2O	K_2O	Mn	Ni	Pb	Cd
2.95	3.50	2.65	0.69	1.88	250	80	62	0.50
2.68	3.51	2.69	0.58	1.87	240	85	70	0.40
2.69	3.49	2.70	0.60	1.98	250	80	60	0.38
2.85	3.60	2.70	0.65	1.97	260	79	58	0.29
2.69	3.75	2.66	0.88	1.80	240	79	64	0.23
2.79	3.65	2.70	0.00	1.80	260	82	65	-
2.775	3.57	2.68	0.50	1.83	255	80.83	63.15	0.30

(B) Ash pond effluent samples (mg/l) Toxic metals Average values:

CaO	MgO	Na_2O	K_2O	Mn	Ni	Pb	Cd
41.5	17.8	55	20	37	4	8	0.28

(C) Contaminated effluent samples (mg/l) Average values:

Fe	CaO	MgO	Na_2O	K_2O	Mn	Cd
4.89	6.59	0.88	2.59	4.60 76	147	0.21

TABLE NO.3
INDIAN STANDARD FOR INDUSTRIAL EFFLUENTS IS AS DESCRIBED BELOW:

S.NO.	PARAMETERS	LIMIT
1	Suspended Solids	100 mg/l
2	Dissolved Solids	2000 mg/l
3	pH	5.5 to 9
4	B.O.D.	30 mg/l
5	C.O.D.	250 mg/l
6	Pb^{++} Concentration	0.1 mg/l
7	Cd^{++} Concentration	0.2 mg/l
8	Cr^{+++} Concentration	0.1 mg/l
9	Total Cr	2.0 mg/l
10	Se	2,0 mg/l
11	Zn	5.0 mg/l

TABLE NO.4
INDIAN STANDARD FOR DRINKING WATER
(IS: 10500-1998[2])

S.NO.	PARAMETERS	LIMIT
1	pH	6.5 mg/l
2	Total hardness as $CaCO_3$	300 mg/l
3	Ca	75mg/l
4	Mg	30 mg/l
5	Cu	0.05 mg/l

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 10 Oct 2021, pp: 1126-1129 www.ijaem.net ISSN: 2395-5252

6	Fe	0.3 mg/l
7	Mn	0.1 mg/l
8	Cl	250 mg/l
9	SO_4^{-2}	0.01 mg/l
10	Se	0.01 mg/l

For alkali and alkaline-earth metals determinations, samples were collected from four sampling sites. These sampling sites are located in the four directions around the power plant which received the highest rates of fallout during the period of the measurements. The determinations of the elements were made using atomic absorption spectrophotometer.

III. RESULTS AND DISCUSSION: -

The input of macro elements to the soil horizon, as shown by their percent increase, is in the order: K > Na > Mg > Ca for micro elements the input is in the order: Cs > Rb > Li > Sr>Ba(in the case of Be, a trace presence of 1.3 ppm was observed compared with its absence in the uncontaminated soil).

The higher concentrations of the elements in the soil samples from the contaminated area, up to a depth of 90 cm show that the surface deposition of the elements has penetrated into the soil to a considerable depth.

The retention concentration of individual elements in the 30-60 and 60-90 cm profiles compared with the concentration in the top 0-30 cm are (%):

Li-78.1, 50.0 , Cs- 66.7, 47.6, Ca- 91.3, 86.6,
Na- 89.4, 77.2, Be- 56.7 31.5, Mg- 90.2, 81.4,
K- 85.7 74.7 , Ba- 63.8, 74.3 Sr- 82.9, 69.5.
Rb- 76.8,57.8,

The leaching action of the elements has been found to be in the order K > Mg > Ca > Na > Ba > Sr > Li > Rb > Be > Cs.

REFERENCE:

[1]. "Air Pollution "its origin and control Kenneth wark, IEPA, dun-Donneley Publisher 1967.
[2]. Central Electricity Authority: Progress of electricity Supply Industry in India" Vol.1 Installed generating capacity, New Delhi 1982.
[3]. Air quality monitoring (A course manual), NEERI Nagpur, p. 78, 1981.
[4]. The measurement of air pollution, National Air Pollution Research Council, Tokyo, Coronsha, P. 360,1962.
[5]. Schroeader, H.A. The poisons around US Bloomington, Indian University press, 1974.
[6]. Uppal, S.L. Electrical Power Khanna publisher Delhi, 11TH Edition P. 20-30 1985.
[7]. Ahuja Dilip, R., AND Pandya, J.D. Power Industry, Pollution Control Handbook, Utility Publications Ltd, Secunderabad (A.P.) P 184,1986
[8]. Sanderson, H.P. Bradt, P. and Katz, M, A study of dust fall on the basis of replicated, arrangement of various types of collectors, J. Air pollution control Assoc, Vol. p.461,1963.
[9]. National Committee on Power-Report. Department of power, Ministry of Energy, Govt. of India, New Delhi, 1980.
[10]. Richer, L.A. Volkov, E.P. Pokrovsky, V.N., Thermal power plant and Environment Control, Mir Publishers, Moscow. P. 34-35, 1984.
[11]. Agrawal A.M. (1973). Ecological Study in Grasslands of Bhata Soil of Bilaspur, Ph.D Thesis, Ravishankar University Raipur (C.G.)
[12]. C.K.Jain, K.K. Bhatia And S.M.Seth (1998) Effects of Waste Disposal on the Water Quality of River Kali, Indian J. Envs. Hlth 40(4) ,372-375.
[13]. Trivedi, Ramesh Chandra (1979). Pollution studies of Chambal River and surroundings due to Nagda industrial complex Ph.D. Thesis, Vikram univ. Ujjain.