

## Analysis of Coal, Flyash and Soil For Agricultural Use

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In the present work, various physicochemical properties of fly-ash, obtained from National Thermal Power Corporation of Korba district have been reported.

**Key Words:** Flyash, Analysis, NTPC, Korba.

### INTRODUCTION

Literature surveyed reveals that fly ash obtained from coal combustion has a number of trace elements required for plant growth, viz., Mo, Zn, Mn, Fe and Cu<sup>1-4</sup>. Trace elements flow through coal burning powder plant has been studied in few cases<sup>5,6</sup>. Widespread use of lower quality coal has increased the ash production to about 500 million tonnes<sup>7</sup>. Analysis by many research groups has shown that fly ash contains most of the essential nutrients required for plant growth<sup>8,9</sup>. The neutralizing effect of alkaline fly ash on acidic soils has been known for some time<sup>10,11</sup>. Mortens and Beahm<sup>12</sup> have conducted micronutrient investigations in order to evaluate the plant's availability of B, Mo and Zn from fly ash added to the soil. Klein and Russel<sup>13</sup> reported enrichment of Ag, Cd, Co, Cr, Cu, Fe, Hg, Ni, Ti and Zn in-the soil around power plants.

The effect of power plant effluents on soil is also discussed by Roffman *et al.*<sup>14</sup> According to them, there is no evidence of accumulation of trace elements caused by deposition of particulate matter from the power plant. Flyash of some coals contains sufficient boron concentrations to inhibit plant growth if applied directly to soil<sup>15</sup>. Another divergence in opinion is that Singh and Singh<sup>16</sup> found that flyash is acidic, while Plank *et al.*<sup>17</sup> and Hodgson *et al.*<sup>11</sup> suggest the basic properties of flyash. In the present work, the physicochemical properties of flyash, obtained from NTPC, district Korba (Chattisgarh, India), soil analysis of Rehar basin in Surguja district which is acidic in nature and amelioration of the soil for better nutrient uptake, by the use of flyash which has very good pozzolonic

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property due to the presence of  $\text{CaSiO}_3$ . Flyash is rich in essential plant nutrients such as Ca, Mg, P, K, Cu, Zn, Fe and Mn etc.

### EXPERIMENTAL

For trace elements analysis in flyash, coal and soil, spectrophotometric methods by Busev *et al.*<sup>18</sup> and Hesse<sup>19</sup> were employed along with other usual laboratory methods<sup>20</sup>. Ombrothermic diagram, distribution of acid soils are shown in Fig. 1.

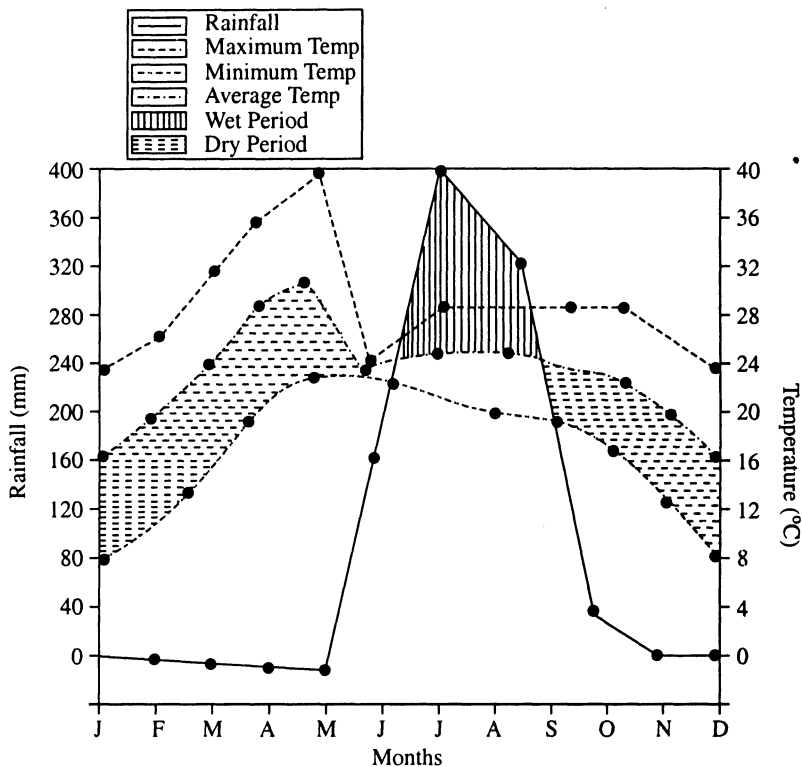


Fig. 1. Ombrothermic diagram (1968-1992) (Meteorological Station, Baikunthpur, Distt. Surguja, M.P.)

A comparative account of the experimental details has been shown in the Table-1.

### RESULTS AND DISCUSSION

Results of the experimental analysis show that flyash has very good pozzolonic (basic) property as found by several authors<sup>10, 11</sup>. Basic property of flyash has been found to ameliorate by acid soil which is essential for plant growth.

However, there is no definite pattern of concentration of trace and heavy metals in flyash and soil. It is to be recapitulated that the total concentration of trace and toxic metals in flyash is also present in the earth's crust and in some of the agricultural field soils.

TABLE-1  
EXPERIMENTAL RESULTS: PHYSICO-CHEMICAL AND MINERALOGICAL ANALYSIS OF FLYASH, FEED COAL AND ORIGINAL SOIL

Chemical analysis	Flyash	Feed coal	Original soil
SiO <sub>2</sub> (%)	650.00	64.52	78.37
Al <sub>2</sub> O <sub>3</sub> (%)	17.88	24.50	7.59
Fe <sub>2</sub> O <sub>3</sub> (%)	6.80	6.70	4.56
P <sub>2</sub> O <sub>5</sub> (%)	0.16	0.35	0.156
SO <sub>3</sub> (%)	0.25	0.29	0.19
SO <sub>2</sub> (%)	1.55	0.73	1.10
CaO (%)	1.24	0.37	1.10
MgO (%)	1.24	0.74	1.11
Alkalies by difference	1.29	1.01	0.85
pH	8.25	6.00	6.15
Electrical conductivity (m. mhos/cm)	0.15	—	0.05
Organic "C" (%)	0.30		0.35
Total N%	0.003	0.004	0.05
Available N (%)	0.001	0.009	0.008
Available P <sub>2</sub> O <sub>5</sub> (ppm)	25.00	12.00	22.00
Available K <sub>2</sub> O (ppm)	55.00	35.00	51.00
Available Cu (ppm)	50.00	30.00	45.00
Available Zn (ppm)	60.00	29.00	45.00
Available Mn (ppm)	68.00	25.00	42.40
Available Fe (ppm)	50.00	24.22	40.25

### Physical properties

Maximum water holding capacity: 43.50 25.21

### PROXIMATE AND ULTIMATE ANALYSIS OF FEED COAL SAMPLE

	Proximate analysis	Ultimate analysis	
Moisture	2.30%	C%	52.05
Ash	29.50%	H%	3.08
Ma. matter	29.09%	S%	0.40
Fixed carbon	40.00%	N%	1.39

## TRACE AND TOXIC METALS (CONC. IN PPM)

Metals		In flyash	In soil
Trace	Cu	40	60
	Co	48	20
	Zn	65	50
	Mn	250	150
	Mo	57	45.26
Toxic	Cd	3.50	ND
	Pb	89	68.5

N.D. = Not detected

A comparison between the chemical characteristics of flyash and soil clearly indicates that both are more or less chemically similar in respect of total elemental contents and available nutrients, save that the ash is organic 'C' and total 'N'.

The pH and electrical conductivity of both flyash and soil, vary distinctly and because of alkaline nature of ash (pH = 8.25) and acidic nature of red yellow soils of Chattisgarh region (pH = 5.15), by adjusting the ash and soil ratio, pH can be adjusted to 7 and maximum nutrient uptake can be made available to the plants.

Pot experiments can be carried out to study the plant growth. The ash, soil, water and plants will be analyzed to gain information about ideal conditions for maximum crop yield. The maximum nutrient uptake has been shown near pH 7 by several workers<sup>21, 22</sup>. Effluents from NTPC. Power Plant from Korba, Bilaspur discharge to the nullah and affect the ecosystem of several plants and animal species on both the sides of the nullah. This should be further studied from the zoological point of view.

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