# Hazardous Effect of Coal Ash

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***Abstract-*** This paper deals with the pollution originating from one of the by product of the coal called ash in Indian thermal power stations. Ash is obtained by the combustion of coal. This ash is again divided into two types based on its characteristics namely- fly ash, bottom ash. Mainly this ash can be used but not 100%. So rest of the ash which is not used is mixed with water. This mixture is called as slurry which is pumped to the ash pond. Some pollution is created during this process and after. Pollution caused by this assessed by taking samples. samples consists of the ash taken as soon as combustion takes place, other set of samples from ash pond. Samples extracted with Deionized water, a solution of potassium chloride and a solution of hydrochloric acid, the differences were compared in order to predict potential pollution.

***Index Terms***- *pollution, ash, elements, emission*

## I. Introduction

The power generation units, and in particular one of it is coal fired power plants, has been effecting the atmosphere greatly. there are mass emissions of solid particles and gases with high temperatures into the atmosphere and also discharge of contaminated water, chemicals, ash and slag during the process[1]. During coal combustion physical and chemical transformations takes place, often changing its solubility and association patterns of different elements [2]. By decrease in the practical size, the concentrations of copper, molybdenum, lead and zinc increases. The elements feature differ its distribution patterns among the mineral obtained after coal combustion, it is completely different if compared to the original associations. According to Bern, the physical and chemical properties of fly ash vary depending on the type of coal burned, boiler type and particle size and degree of weathering [3]. Generally, Ash is usually stored in huge ash dumping, either in dry or wet state [4]. Storage of wet ash usually protects from spreading when ever wind comes, but decreases the time for extracting of various elements [5], due to this extraction it can be destructive to the life forms, and it can imperil water resources and fertility of the soil, also cause radioactive contaminations. In ash, most of the elements examined and had enrichment factor <1, while arsenic, sodium, titanium and iron had enrichment factors ranging from 1 to 10 [6, 7]. Toxic constituents of coal ash are blowing and spilling from storage units will always leads to the great damage to the environment and also effect people's health living close to these coal fired thermal power plants.

## II. Details of Indian Coal

India has huge reserves of coal of order of 270 billion tonnes so, 59% of the power generation is from coal fired thermal power plants [8]. But at the same time , coal available in India does not contain high sulphur like coal in many other countries, and the resistivity in india is lower compared to other countries. Indian has coal reserves of large proportion of ash content of order 40 to 45% . Due to lower resistivity the ESPs in India, despite being much larger, have lower collection efficiencies compared to other country [9]. To analyze the elements which effect the environment, we have collected some ash samples.

Solubility of different elements often changes with coal combustion. So the portions of chemical constituents may become mobilized when ash is introduced into terrestrial, aquatic atmospheric environment [10]. The average characteristics of Indian coal are tabulated in Table I. The chemical composition of fly ash is tabulated in Table II. The chemical composition of bottom ash is tabulated in Table III. In general half of the fly ash is used in cement industries, Bricks manufacturing, Rest of the fly ash and bottom ash are mixed with water named as slurry which is sent to ash pond. The block diagram of ash disposal is shown in Figure 1.

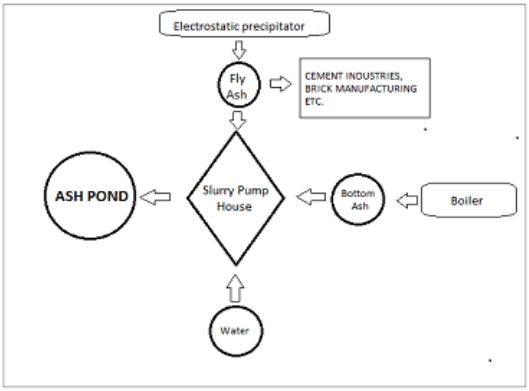


**Figure 1**
***Block diagram of ash disposal***

**Table I**
***Average characteristics of Indian coal***

| SNO | CHARACTERISTICS | VALUES (%) |
|---|---|---|
| 1 | Moisture | 9.6 |
| 2 | Ash | 40 |
| 3 | Sulphur | 0.363 |
| 4 | Silicon dioxide | 59.35 |
| 5 | Aluminium oxide | 22.04 |
| 6 | Calcium oxide | 8.05 |
| 7 | Magnesium oxide | 5.57 |

**Table II**
***Chemical composition of Indian fly ash***

| SNO | FLY ASH COMPOUNDS | VALUES (%) |
|---|---|---|
| 1 | Silicon dioxide | 60.83 |
| 2 | Aluminium oxide | 26.63 |
| 3 | Iron oxide | 4.19 |
| 4 | Magnesium oxide | 0.80 |
| 5 | Calcium oxide | 3.03 |
| 6 | Potassium oxide | 0.90 |

**Table III**
***Chemical composition of bottom ash***

| SNO | BOTTOM ASH COMPOUNDS | VALUES (%) |
|---|---|---|
| 1 | Silicon dioxide | 53.6 |
| 2 | Aluminium oxide | 25.3 |
| 3 | Iron oxide | 3.98 |
| 4 | Calcium oxide | 2.98 |
| 5 | Magnesium oxide | 4.2 |

## III. Experiment of Extraction

To estimate the pollution caused by extraction of some chemical constituent elements after ash is being pumped to ash pond. Here we are going to take samples and were subjected to extract. The first kind consisting of ash taken as soon as combustion takes place .While other is taken at the ash pond. these samples were extracted by using deionized water, A 1.6mol/L solution of potassium chloride, and 0.0017mol/L solution of hydrochloric acid .the differences in extractability are compared in order to predict the pollution .the ratio of liquid with solid is 10:1 and kept it for 20 hours in the closed glass vessel .

After both extractions the residues were cleaned with deionized water, and the combined extracts and cleaning were analyzed by using shimadzu AAS. The following wave lengths were used: 284.2nm (Magnesium), 765.5nm (potassium), 423.7nm (Calcium), 214.19nm (Zinc), 356.9nm (Chromium), 194.7nm (Arsenic), 226.98nm (Cadmium), 217.0nm (lead).

**Table IV**
**Concentration details after extraction (mg $kg^{-1}$)**

| Sample | Coal ash | | | Ash pond | | |
|---|---|---|---|---|---|---|
| Extraction | $H_2O$ | KCL | HCL | $H_2O$ | KCL | HCL |
| Cr | 3.7 | 2.8 | 36.7 | 0 | 3.2 | 37.65 |
| Zn | 0 | 2.30 | 15.42 | 0 | 1.75 | 16.34 |
| As | 4.56 | 13.5 | 5.40 | 6.75 | 11.32 | 10.91 |
| Cd | 0 | 0 | 0 | 0 | 0 | 0 |
| Pb | 0 | 0 | 0 | 0 | 0 | 0 |
| Ca | 2195 | 8969 | 1093 | 1237 | 8838 | 1182 |
| Mg | 1.55 | 1899 | 135.8 | 0.39 | 1916 | 138.4 |
| K | 103.4 | ---- | 487.6 | 62.43 | ----- | 405.5 |

## IV. Result Analysis

The Concentrations of extraction are tabulated in Table IV. After analysis of samples we have found that Pb and Cd were not detected in any of the extraction and other elements revealed the following behaviour. Cr is one of the elements which are extensive pollutants, considering exchangeable fractions only [11, 12]. These results have shown that chromium is already released during and after pumping to ash pond.

Where Zinc has not present in water extraction, but showed its behaviour in the case of kcl extraction so dry ash contain more extractable zinc than the samples of ash pond. Half of the ion exchangeable Zn is released during the ash pumping to ash pond.

Where coming to Arsenic it can be extractable from all samples, but here we observed that there is unexpected increase of water extraction at ash pond, so after mixing with water and at the time of pumping mobility of As increased.

Alkaline earth and alkaline major elements show similarity in their behaviour Calcium, potassium and Manganese are significantly extracted during the ash pumping. Here in river water extraction of ash have only slight influence on ion-exchangeable fractions Ca. Where K was not analyzed because extraction was performed with KCL. At the time of pumping Ca seems to be the largest pollutant. Near ash pond Cr is the largest pollutant.

## V. CONCLUSION

Zn, Cr and Ar are elements were extracted during and after pumping. Cr is the largest pollutant which is toxic and danger to the environment. If human exposes to chromium it leads to lung

cancer or respiratory problems [15]. Exposure to lower levels of arsenic cause nausea, abnormal heart rhythm, decreased production of red and white blood cells and also may increase the damage to developing fetus. Ca, K and Mg were extracted which will also cause great damage to the human kind & environment. Cd and Pb are not extracted from the samples, so from these conclusion we came to know that since some of these are inorganic compounds due to these pollutants there will be a great impact and danger to the environment and also on future generations.

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