

## ABSTRACT

Land degradation is an undesirable yet unavoidable feature of surface mining-the principal technology for producing mineral in India. Conservative estimate suggests that during the current plan period (2002-2006) the requirement of total land for coal mining purposes is likely to be about 539 km<sup>2</sup> (Chaoji, 2002).

Currently, in India thermal power plants produce nearly 110 million tones of fly ash annually as a by product which is expected to cross 170 MT per annum by 2012 (Anon, 2005). India's dependence on coal as a source of energy shall continue in the next millennium and therefore coal ash management would remain an important area of national concern. Huge tracts of land used for disposal and storage of fly ash generated from thermal power plants are rendered unfit for further use. The issues related to disposal of fly ash are the cost of transportation, water bodies and land resources utilized for dumping ash, and also ecological problems like contamination of soil, surface and ground water.

Safe and economic disposal/utilization of this waste is also a matter of paramount importance. Therefore, a major challenge is to develop satisfactory techniques that pledge optimum production along with improved quality.

This study addresses the suitability of application of fly ash for the amendment of overburden dump of opencast coal mines to make it suitable for commercial crop production. In this study, all the major contributing factors of the application of fly ash are considered while using it as an amendment material for the overburden dump soil. The results of the study can be used for improving the physical as well as chemical properties of overburden dump soil of opencast mines. The improvement in physical properties (water holding capacity, porosity, texture etc.) as well as chemical properties (pH, phosphorous content, iron content, boron content etc.) of the overburden dump soil may result in the potential increase in the plant/crop yield grown in reclaimed land of overburden dump soil and its significance for waste land reclamation.

The heavy metal concentrations in the overburden dump soil amended with fly ash as well as crops do not exceed the toxic limit up to a dose of 25% fly ash. In other words the amount of fly ash which is to be amended in the overburden dump soil for the cultivation of crops has heavy metal concentration which is far below the toxic limits and it will not adversely affect the crops

In this research pot experiment has been done to study the plant growth in the overburden dump mixed with fly ash in various proportions. After maturity of the crop parts of the crops (i.e. roots, shoots, leaves and seeds) are analysed using Atomic Absorption Spectrophotometer in order to study the distribution pattern of metals/elements in different parts of commercial crop and their suitability for human consumption. The amended soil is also analysed after the maturity of the crop to know the status of the amended soil as far as heavy metals and nutrients are concerned. Bivariate data analysis and regression modelling is successfully applied in this field to estimate the heavy metals /elements concentration in the amended soil and parts of the crop growing on the fly ash amended soil.

In the laboratory study it is found that the healthy growth of the crop *Cajanus cajan*s (Arhar) is observed in the amended overburden dump soil containing 20% fly ash. It is found that the total mass of seeds yielded per crop increased with addition of fly ash. The yield of the crop is only 8 g/crop for the crop growing on pure overburden dump soil. The average yield per crop increases to 86 g, 177 g, 246 g, 333 g and 303 g for the crop growing on amended soil containing fly ash 5%, 10%, 15%, 20% and 25% respectively. Hence the best performance in the laboratory is obtained in the overburden dump soil containing 20% fly ash.

It is found that the growth of citrus grass increases with increase of fly ash concentration in the amended overburden dump soil. It is found from the present study that the legume like *Cajanus cajan*s(Arhar) seemed to show very good response toward dump soil amended fly ash. This shows a promise for its recommendation as a successful crop and their viable utilization to cultivate in dump soil amended fly ash. They can also contribute towards the nitrogen recuperation of the coarse sandy soil.