Abstract

Acid mine drainage (AMD) is one of the major problems in high sulfur coal mining areas generating acidic water. The acidic mine water generated contains hazardous elements in varying concentrations. The AMD is naturally occurring in the abandoned coal mine. Samples have been collected from abandoned mine and active opencast coal mines of the Northern Coalfield Limited, Singrauli (India), in order to know, the water quality in the aqueous leaching experiment. The analysis of water was at laboratory scale analyzed by analytical techniques ICP-ES, AAS. Overburden and flyash sample have been collected from various opencast mines of NCL and Thermal Power Plants of Singrauli Coalfield. The characterization of overburden and flyash has been done using standard available techniques SEM, XRF, and X-ray diffraction. The geochemical (soil and leachability potential) and mineralogical characterization of overburden (OB), flyash and mixture of overburden and flyash samples was carried out to assess their suitability for dumping in pit suffering from acid mine drainage. The experiment was done at the laboratory scale. The present laboratory study has been useful in relating the characteristics of aqueous leaching from coal and mine overburden with the natural weathering condition at the coal mine area. Flyash, Overburden and overburden+30% Flyash samples were found to be mostly alkaline. The detail of mineral phases of the Flyash, overburden and overburden + 30% flyash mixture were confirmed by the XRF and XRD elemental mapping. The mineral peak of XRD include essential minerals SiO_2, Fe_2O_3, CaO, and Al_6SiO_2. The mineral phases of XRF include essential minerals Al_2O_3, FeO, CaO, K_2O, MgO, MnO and SiO_2. Reasonable pozzolanic activity of flyash with overburden has been confirmed in some of the SEM images as glassy fibrous particles observed. The overburden 70% + flyash 30% samples

were observed in SEM images to have micro-cracks and pores which confirms that increasing of permeability after addition of flyash.

Water quality analysis was studied where analysis using standard procedures involved the detection of some parameters on-site using a Multi-Parameter water quality analyzer. In the laboratory, water samples were analyzed using an atomic absorption spectrophotometer and Inductively Coupled Plasma Mass Spectrophotometer. The result indicates that the water is acidic, neutral and slightly alkaline in nature in most part of Singrauli coalfield. However, acidic water has been observed in the voids of the Gorbi abandoned mine, Amlohri opencast mine, and the Jhingurdah opencast mine. Whereas, alkaline water has been found in Dudhichua opencast mine. The major water types are found to be calcium - magnesium - sulphate and calcium - bicarbonate in Singrauli coalfield. The Physico-chemical parameters of groundwater of Singrauli coalfield found to be under the permissible limits. After laboratory investigation, the groundwater quality were found to be well within permissible limits in the study area. The ions, heavy metals, and other elements were found to be in low concentration in the monsoon season than pre-monsoon due to dilution effect caused by rain and surface runoff. In both season pre-monsoon and post-monsoon of water quality analysis of the samples reveals low pH and high concentrations of TDS, iron, lead and manganese in some samples in the Singrauli coalfield. Similarly, some heavy metal has been found in the permissible limit in samples of Singrauli coalfield in pre-monsoon and monsoon season. In this research work, an attempt, therefore, has been made to suggest mitigation measures and the ways how to manage the pollutants in a way so that the ecosystem of the area gets least disturbed by the associated mining activity. The laboratory investigation of the R-pH value of overburden and flyash indicates that the flyash and overburden (sandstone) both have appreciable neutralization potential and may effectively be used for neutralization of acid water of

mine. The use of Flyash and waste rock will further improve the water quality which may be gainful utilized. The above study on laboratory scale suggests that the acid-neutralizing property of flyash and overburden will be an asset for coal mines suffering from slight to moderate acid drainage problem both at exploitation and abandoned stages. Acid mine drainage is widely recognized as the single largest environmental issues faced by global mining Industries. Successful management of acid mine drainage at exploitation stage can play a significant role in improving the ecosystem of adjoining surrounding as well as the long-term sustainability of mine site.