National Institute of Technology Rourkela

Progress Seminar

Seminar Title	: Geo-hydrological investigation of fly-ash based composite materials in haul roads of open-cast mines
Speaker	: Jajneswar Biswal (Rollno : 521mn1006)
Supervisor	: Dr. Tushar Gupta
Venue	: Seminar Room, (R. N. 208, 1st Floor) Mining Engineering Department
Date and Time	: 23 Sep 2024 (11:00 am)
Abstract	: Stabilization using industrial wastes like fly ash is becoming increasingly popular. While this method is effective in enhancing the geo-mechanical properties of the material, it is also crucial to evaluate its environmental impact. Leachate analysis is key in assessing the environmental effects of stabilized materials used in haul roads and dumps in open-cast mines. Stabilizing agents such as fly ash, sand, and lime can interact with the environment, potentially producing leachates that may contaminate groundwater and surface water. Understanding the chemical composition and behaviour of these leachates is essential for evaluating the long-term sustainability and environmental safety of the stabilization process. In this study, we investigate the physical and chemical characteristics of stabilized materials through particle size analysis, optimum moisture content (OMC) & maximum dry density (MDD), X-ray diffraction (XRD), X-ray fluorescence (XRF), field emission scanning electron microscopy (FESEM) and inductively coupled plasma optical emission spectrometry (ICP-OES). These methods provide detailed insights into the mineralogical composition, particle distribution, and microstructural properties of the stabilized materials, helping to understand their mechanical and chemical stability. Further optimization of the stabilization mix is performed using the Design of Experiment (DOE) methodology to determine the ideal combination of fly ash, sand, and lime for enhancing load-bearing capacity while minimizing environmental risks. Hydrological analysis is conducted through column and batch leaching tests to assess the leaching behaviour of key contaminants over time. Additionally, surface runoff studies coupled with infiltration analysis help evaluate the impact of stabilized materials on water movement and retention in haul road systems. These combined assessments provide a comprehensive understanding of the geo-environmental and hydrological behaviour of stabilized materials in open-cast mine settings, offering guidelines for improving the design and sustainability of mine infrastructure.