National Institute of Technology Rourkela

Defence Seminar

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| Seminar Title | : Petrography and Geochemistry of Talcher Coal, India: Implications on Depositional Environment and Gasification Characteristics |
| Speaker | : Mahima Panda ( Rollno : 518er2001) |
| Supervisor | : Sk. Md. Equeenuddin |
| Venue | : Seminar Room, Department of Mining Engineering |
| Date and Time | : 29 Jul 2025 (10:30 am) |
| Abstract | : India has the 4$^{th}$ largest coal reserve in world and is highly dependent on coal due to its growing economy. Hence, it is essential to utilize this large reserve of coal in a sustainable and environment friendly manner. Gasification offers a cleaner alternative to conventional energy production, in which coal is converted into gaseous fuel. The organic and chemical constituents of coal influence the suitability of coal during utilization processes including gasification, which are controlled by the depositional environment. Therefore, this thesis aims to carry out extensive petrographical and geochemical investigations on the Talcher coalfield, which has the largest coal reserve in India for evaluating its depositional conditions and gasification potential of coal, along with reaction kinetics of char-$CO_2$ gasification. This coal has sub-bituminous to high volatile bituminous rank and is characterized by high vitrinite content, followed by inertinite, and liptinite. The carbon (&delta$^{13}$C) and nitrogen (&delta$^{15}$N) isotopic values of the present coal ranges from &ndash23.7&permil to &ndash21.7&permil and +0.6&permil and +3.4&permil, respectively. The &delta$^{13}$C composition of palaeoatmospheric $CO_2$ found to vary between &ndash5.6 and &ndash2.3&permil. Terrestrial plants, specifically $C_{3,}$ are the precursors of Talcher coal. Deposition of coal has been taken place in a fresh water environment with a fluctuating redox conditions under a warm humid climate. Quartz and kaolinite are the dominant minerals in coal. Besides, illite, siderite, goethite, calcite, plagioclase, dolomite, apatite and Ti-oxide have also been identified in the coal. Elemental composition of Talcher coal show an enrichment of Al, Ti, P, S, Cd, Hg and Mo with respect to earth crust while Cr, Th, Hg and Mo content exceeds their world coal averages. Elements like, Ti, K, Na, Cr, Cu, U, Th and Rb show dominant silicate affinity Mg, Ca, P and Sr show both carbonate and phosphate affinities Fe, S, Co and Hg are found to be organically associated, and rest of the elements like Ni, Mo, Ba, Mn, Zn, Pb, Cd, As and Nb have dual affinities. The petrographic and bulk chemical composition indicated that the studied coal have gasification potential. The reaction kinetics of char-$CO_2$ gasification has been studied using isothermal thermogravimetric analysis at 900&ndash1050 °C. The activation energy for the present study ranges from 108 to 125 kJ/mol and 166 to 199 kJ/mol using first-order and nth-order reaction kinetics, respectively. The findings of this study will be beneficial for further utilization of coal as well as future palaeowetland research. |