Beneficiation and Geochemical Evaluation of Coal and Associated Rare Earth Elements in Cherat Area, District Nowshera, Pakistan

Sana Azhar[1*], Liaqat Ali[1], Asghar Ali[2], and Saleem Khan[1]
[1]*National Centre of Excellence in Geology*
[2]*Department of Geology, University of Peshawar, Pakistan*
[*]*Email:sana.azhar@uop.edu.pk*

The economic potential of the Paleocene coals in the Cherat region of Pakistan remains largely untapped, as detailed studies on their major and trace element compositions, as well as rare earth elements (REEs) upgradation have been limited. The study focused on examining the geochemical characteristics of existing coal deposits in Bakhtai, Shahkot, and Naguman areas and exploring their potential for enhancement using the froth flotation technique. Additionally, the research aimed to determine the economic abundance of rare earth elements in the coal samples of 10 coal mines from this area. The geochemical analysis including REEs determination and comprehensive proximate analysis were conducted to assess coal quality. The detailed proximate analysis included the evaluation of volatile matter, moisture content, ash content, fixed carbon, Gross Calorific Values (GCV). The geochemical analysis of the gangue samples following coal washing showed higher concentrations of major oxides such as SiO_2, Al_2O_3, Fe_2O_3, TiO_2, and K_2O, while CaO, P_2O_5, and Na2O had lower concentrations. Trace elements (Cr, Ni, Co, Cd, Zn, Pb, and Cu) were found in very low concentrations (<1ppm). After applying the Froth Flotation technique, the overall coal quality was improved. Among the REEs contents (ppm) an enrichment in Yb, Gd, Er, Sm, Ho, Tm, Eu, Tb, and Dy and depletion in Y, La, and Pr was noticed in the raw coal samples as compared to the average Chinese and US coal standards. While an enrichment in Yb and Y and depletion in in Er, La, Pr, Sm, Gd, Dy, Ho, Eu, Tb, and Er occurred in gangue as compared to the average Chinese and US coal standards. In conclusion, the processing techniques applied to the coal samples in this study have shown promising results in upgrading the coals from Bakhtai, Shahkot, and Naguman areas. The data obtained will be valuable for industries such as energy, power, coal exploration, and cement manufacturing.