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Removal of Sulfur from Black Gold of Pakistan, an Approach towards Sustainable Energy

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Abstract

Coal is one of the extensively used fossil fuel around the globe but coal having high sulfur content is posing serious environmental concerns. Many techniques and technologies have been evaluated to combat this issue. Pakistan is a signatory of SDGs so present research is aligned to achieve SDG 7, 12 and 13. Recently ionic liquids have gained importance due to their low vapor pressure, high thermal and electrical stability and low melting points as compared to ionic salts. Considering these facts this research is an exploration of room temperature ionic liquids (RTILs) synthesis and application as desulfurizing agent. Imidazole, N-methyl imidazole, 2-Ethylimidazole, and N-butylimidazole were reacted with Methane sulfonic acid to produce imidazolium based RTILs sharing the same mesylate anion. Imidazolium-mesylate $[IM^+][MeSO_3^-]$, N-methyl imidazolium-mesylate $[MIM^+][MeSO_3^-]$, 2-Ethylimidazolium-mesylate, $[EIM^+][MeSO_3^-]$, and N-butylimidazolium-mesylate $[BIM^+][MeSO_3^-]$ were analyzed by spectroscopic techniques for structure elucidation. Desulfurization capacities of RTILs were evaluated against coal samples collected from Sharigh coal mine located in Baluchistan province of Pakistan. Proximate and ultimate analysis of coal samples was done according to reported ASTM methods and the highest sulfur content was recorded as 11.8 % having gross calorific value of 13318 BTU/Lb. The analyzed coal samples were subjected to oxidative and extractive desulfurization process using RTILs. FTIR and HPLC data suggest these RTILs very effective in remediation of organic as well as inorganic sulfur.

Keywords: Coal, Ionic Liquids, Oxidative-extractive desulfurization