Title: ***Environmentally Cleaner Use of Coals - Chemical Cleaning and Depolymerization of Low Grade Indian Coals and the Kinetic Studies of Its Co - processing With Plastic (Wastes).***

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SUMMARY

Coal is an important fossil fuel. The use of coal in thermal power plants and cement industries are associated with emission of obnoxious gases like NO_X and SO_X, which pollute the environment. There is thus a need to develop methods for cleaning of coal.

Present work describes the development of alkali-acid leaching process for chemical cleaning of coal. The coal was treated under reflux condition as well as at room temperature with 20% aq alkali NaOH followed by 10% H_2SO_4. The work was extended by using 5% aq NaOH followed by 5% H_2SO_4 and then 1% aq NaOH followed by 1% H_2SO_4 A step-wise process of alkali-acid treatment of coal was developed. The alkali-acid treated coal was also subjected to organo-refining studies by solvent extraction using some common organic solvents. Chinakuri coal was subjected to depolymerization reaction by acidic phenolation reaction. This resulted in enhancing the extractability of coal in chloroform. The acetylation reaction resulted in further improving the extractability of coal in chloroform. The average organic chemical structure of acetylated depolymerized Chinakuri coal has been proposed on the basis of IR, ^{1}H NMR, ^{13}C NMR and Mass spectral studies.

Co-processing of coal with plastic generates a plethora of reactive moieties, which react with each other to generate cleaner fuel .The non-isothermal kinetics of co-combustion of Topa coal with PVC, Bakelite and Polystyrene were studied. Coats and Redfern kinetics modeling was used to calculate the activation energy and order of the reactions. These processes were found to be mostly mass transfer/physically controlled. Parallel studies were also under taken to study the non-isothermal kinetics of co-pyrolysis/co-cracking of coal and plastics. These studies were carried out in Thermogravimetric Analysis (TGA) apparatus under nitrogen. The order and activation energy of the reactions were calculated. The possible mechanisms of the reactions involved have been suggested.

Based on these studies, a flow scheme has been devised showing the use of these different techniques for refining of coal.