KINETIC STUDY OF TIRE CARBON BLACK AND BIOMASS SOOT STEAM ACTIVATION USED FOR THE REMOVAL OF PHENOL AND CHLORINE FROM DRINKING WATER

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Keywords: wastewater filters; biomass soot; carbon black from tires; H2O activation; kinetic model.

This study aims to demonstrate a novel method for removing toxic chemicals using soot produced from wood and herbaceous biomass pyrolyzed in a drop tube reactor and tire pyrolytic carbon black. In order to improve the economic performance and reliability of entrained flow gasification, biomass soot has the potential to be captured, activated and further used as a sorbent to remove a broad range of pollutants from wastewater. In recent years, the disposal of waste tires has become an important issue. The liquid hydrocarbons and solid char residue from thermal conversion of waste tires have potential to be used as environmentally benign fuel and activated carbon. In the present work, the influence of ash content, nanostructure, particle size, and porosity on the filter efficiency of steam activated carbon materials was studied. It has been shown for the first time that steam activated soot and carbon black can remove phenol and chloride with the filter efficiencies as high as 95 %. The correlation of the filter efficiency to material properties showed that the presence of alkali and steam activation time were the key parameters affecting filter efficiencies. Kinetic parameters for the steam activation of tire pyrolytic carbon black and biomass soot have been determined by thermogravimetric analysis using steam as an activation agent. The feedstock for the soot production, activation temperatures and residence time were varied. The results showed that the rate of steam activation is 10 times faster than the activation at lower temperature. This study demonstrated that the steam activation process is suitable to prepare activated soot with the high surface area at the short residence time and at temperatures below 800°C. Reaction evolution has successfully been modelled, including the maximum reaction rate obtained in experimental results. Moreover, intrinsic kinetic parameters of the activation reaction order, activation energy and pre-exponential factor – were calculated.