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Preparation and Characterisation of Waste Tire Pyrolytic Char

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Abstract

Accumulation of waste tires is a serious environmental issue around the world. As a developing country, Sri Lanka also generates several hundred tons of waste tires every year. At the moment, there is no clear solution to dispose waste tires; however, pyrolysis is of interest to obtain tire pyrolytic oil which has a beneficial value as a fuel for broilers in local industries. After the pyrolysis, a black color-solid waste is formed as a byproduct which has no any economic value. In the pyrolysis process, waste tires are used as a feedstock and heated up to 400-450° C in a closed reactor in absence of oxygen. During pyrolysis, waste tires are broken down in to smaller molecules such as pyrolysis oil (45-55%), pyrolysis gas (8-10%), carbon black (30-35%) and steel (10-15%).The current study was focused on preparing and purifying pyrolytic char to investigate the possible end uses for the char produced. The collected char was processed by chemical and physical treatment methods separately. As the first step, physical separation methods were employed in a successive way; magnetic separation followed by particle separation by sieving. The magnetic separation allowed the char to become free from magnetic particles whereas sieving allowed separating impurities from char. In the second method, char was treated with an acid and a base which successfully leached metallic and other impurities from char. CHNS analysis was completed using Perkin Elmer 2400 serious. CHNS analysis results confirmed that purified carbon black sample contain 78.31% of C, 1.36% of H, 0.55% of N and 2.57% of S. Metal oxides analysis was completed using Horiba scientific XGT 5200 X-ray analytical microscope. This confirmed that purified carbon black consist trace amount of Silica, Sulphur and Zinc. Particle size distribution was conducted using Malvern instruments master sizer 3000 particle size analyser. Particle distributed through 20 to 800 micrometer. Oil absorption capacity 96% 100 gcm^{-3} and Iodine absorption capacity 77 gkg^{-1}. Therefore, we believe that these novel findings may shed the light on the possible use of tire pyrolytic char in many industrial applications in near future.

Keywords: Pyrolytic char, Upgraded methods, Waste tire pyrolysis