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Development of Adsorbents for Removal of Hydrogen Sulfide and Ammonia Using Pyrolytic Carbon Black form Waste Tires

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Abstract : It is estimated that 1.5 billion tires are produced worldwide each year which will eventually end up as waste tires representing a major potential waste and environmental problem. Pyrolysis has been great interest in alternative treatment processes for waste tires to produce valuable oil, gas and solid products. The oil and gas products may be used directly as a fuel or a chemical feedstock. The solid produced from the pyrolysis of tires ranges typically from 30 to 45 wt% and have high carbon contents of up to 90 wt%. However, most notably the solid have high sulfur contents from 2 to 3 wt% and ash contents from 8 to 15 wt% related to the additive metals. Upgrading tire pyrolysis products to high-value products has concentrated on solid upgrading to higher quality carbon black and to activated carbon. Hydrogen sulfide and ammonia are one of the common malodorous compounds that can be found in emissions from many sewages treatment plants and industrial plants. Therefore, removing these harmful gasses from emissions is of significance in both life and industry because they can cause health problems to human and detrimental effects on the catalysts. In this work, pyrolytic carbon black from waste tires was used to develop adsorbent with good adsorption capacity for removal of hydrogen and ammonia. Pyrolytic carbon blacks were prepared by pyrolysis of waste tire chips ranged from 5 to 20 mm under the nitrogen atmosphere at 600℃ for 1 hour. Pellet-type adsorbents were prepared by a mixture of carbon black, metal oxide and sodium hydroxide or hydrochloric acid, and their adsorption capacities were estimated by using the breakthrough curve of a continuous fixed bed adsorption column at ambient condition. The adsorbent was manufactured with a mixture of carbon black, iron oxide(III), and sodium hydroxide showed the maximum working capacity of hydrogen sulfide. For ammonia, maximum working capacity was obtained by the adsorbent manufactured with a mixture of carbon black, copper oxide(II), and hydrochloric acid.

Keywords : adsorbent, ammonia, pyrolytic carbon black, hydrogen sulfide, metal oxide
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