

Liquefaction of scrap tires for recycling of fuel oils

H.-A. Lee
Department of Environmental
Engineering,
National Cheng Kung
University,
Tainan 70101, Taiwan

P.-C. Chang
Department of Environmental
Engineering,
National Cheng Kung
University,
Tainan 70101, Taiwan

P.-A. Chen
Department of Environmental
Engineering,
National Cheng Kung
University,
Tainan 70101, Taiwan

H. Paul Wang*
Department of Environmental
Engineering,
National Cheng Kung
University,
Tainan 70101, Taiwan
wanghp@ncku.edu.tw

Abstract

Scrap tires containing metal wires, fibers, carbon black, and poor thermal conducting rubbers, are far more difficult to be treated effectively. Million fuel oil equivalent are discarded every year through the disposal of scrap tires. Recycling of scrap tires is of increasing importance as incineration and landfilling becomes expensive, and the acceptance of these methods is decreasing. The feasibility for recycling of product oils, metal wires, and carbon black from liquefaction of scrap tires was thus investigated in the present work. The liquefaction process involves contacting the scrap tires (5-15 cm pieces) with hot used motor oil in an inclined screw reactor. Liquefaction of scrap tires at 643 K for 20 min yielded approximately oils (90%), non-condensable gases (5%), and non-liquefiable solid residues (metal wires and fibers) (5%). In the liquefaction process, ZnO (original in tire rubber) could be sulfurized with the tire rubber cross-linked sulfur, and a significant decrease of the sulfur concentration in the product oil and flue gas streams was found. Fuel oils, clean metal wires and fibers, and dry carbon black were recycled. In addition, the flue gas was used for keeping the circulated hot motor oil at 643 K. The bench-scale inclined screw liquefaction reactors suggest that the tire liquefaction process is technically feasible.

Keywords: Liquefaction, scrap tires, pyrolysis