

A Study of Heavy Hydrocarbons Upgrading by Microwave Pyrolysis

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Abstract : By-product upgrading is crucial in hydrocarbon industries as it can increase overall profit margin of the business. Microwave-assisted pyrolysis is relatively new technique which induces heat directly to raw materials. This results in a more energy saving and more energy-efficient process. It is also a promising method to enhance and accelerate chemical reactions, thus reducing the pyrolysis reaction time and increasing the quality of value-added products from different kinds of feedstocks. In this study, upgrading opportunity of fuel oil by-product from an olefins plant is investigated by means of microwave pyrolysis. The experiment was conducted in a lab-scale quartz reactor placed inside a 1,100 watts household microwave oven. Operating temperature was varied from 500 to 900°C to observe the consequence on the quality of pyrolysis products. Several microwave receptors i.e. activated carbon, silicon carbide (SiC) and copper oxide (CuO) were used as a material to enhance the heating and reaction in the reactor. The effect of residence time was determined by adjusting flow rate of N₂ carrier gas. The chemical composition and product yield were analyzed by using gas chromatography (GC) and gas chromatography/mass spectrometry (GC/MS). The results showed that hydrogen, methane, ethylene, and ethane were obtained as the main gaseous products from all operating temperatures while the main liquid products were alkane, cycloalkane and polycyclic aromatic groups. The results indicated that microwave pyrolysis has a potential to upgrade low value hydrocarbons to high value products.

Keywords : fuel oil, heavy hydrocarbons, microwave pyrolysis, pyrolysis

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