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Authors: Yulin Xiang, Yukun Xiang, Lipeng Wang

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Microwave radiation improved biodiesel yields from waste cooking oil in presence of modified coal fly ash

Yulin Xiang^{1*}, Yukun Xiang², Lipeng Wang¹

1 College of Chemistry and Chemical Engineering, Yulin University, Yulin 719000 Shaanxi Province, China; 2 Yanshou No.1 Middle School, Harbin 150700 Heilongjiang Province, China

Abstract: This paper studied the effects of modified coal fly ash as catalyst on the waste cooking oil (WCO) conversion into biodiesel under microwave strengthened action. The coal fly ash was modified with sodium sulfate and sodium hydroxide. The obtained catalyst was characterized by FT-IR and X-ray diffraction (XRD). Experimental results showed that the modified coal fly ash catalyst could improve biodiesel yields under microwave assisting system, and the maximum biodiesel yield from waste cooking oil reached 94.91% under a molar ratio of methanol to WCO of 9.67:1, a 3.99% wt% modified coal fly ash catalyst (based on oil weight), and a 66.20 °C reaction temperature. The reusability of the modified coal fly ash catalyst was well, and the conversion yield was still higher than 90% after the catalyst was used for 8 times repeatedly. The produced biodiesel met main parameters of the ASTM D-6751 and EN14214 standards.

Keywords: Biodiesel, Modified coal fly ash, Microwave assisting system, Waste cooking oil

1. Introduction

Biodiesel, a renewable diesel fuel, is obtained from oil or fat resources such as vegetable oils and domestic fats or waste cooking oil (WCO) using alcohol by means of a acidic or basic catalyst [1]. Researches showed that biodiesel properties (such as low emissions, carbon neutral, biodegradable and non-toxic) were superior to that of non-renewable fuel (diesel and petroleum) [2, 3]. However, the

* Corresponding author E-mail: yulinx@126.com; Phone: +8613720699281

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