Study on the Decolorization of Biodiesel from Waste Cooking Oil

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Keywords: biodiesel, activated clay, decolorization, rectification

Abstract. Biodiesel has become more attractive recently because of its environmental benefits, and the fact that it is derived from renewable resources. Recently, the acidic oil and waste cooking oil were the main resources for the biodiesel production, due to the economical and environmental consideration. However, the product obtained from the transesterification with dark colour. Activated carbon (ACN), activated clay (ACY), activated bleaching earth (ABE), attapulgite (ATE) were employed to refine the undecolored biodiesel. Among all studied decolorants, activated clay exhibited higher activity and more economically competitive. In addition, decoloring process of undecolored biodiesel by activated clay was performed; the optimum conditions were obtained as decoloring temperature 60°C, time 60 min and dosage of activated clay 3 wt. % at atmospheric pressure. Besides, the water content of biodiesel should be below 1 wt. % while ACY was used as decolorant. This paper compared contents and features of decolorization by ACY and rectification under vacuum. The results indicated that higher decolorization ratio(DR) and better quality product will be achieved through rectification, while the decolorization by ACY method should be an proper choice if the biodiesel solded by mixing with diesel fuel.

Introduction

In the recent years, there has been increased focus on the depletion of resources and global warming caused by the heavy consumption of fossil resources [1]. This has stimulated recent interest in alternative sources for petroleum-based fuels [2]. These alternative fuels must be technically feasible, economically competitive, environmentally acceptable, and readily available [3-5]. Biodiesel produced by the transesterification of animal fats, vegetable oil and recycled cooking oil is expected to be used as the basis for a clean substitute for fossil fuel without any modification to diesel engines, due to its characteristics–renewability, high biodegradability, great lubricity, lack of aromatic compounds, low toxicity and almost zero sulphur emissions and low particulate matter content [6-10].

The production of biodiesel has received a lot of attention in the last few years. Various routes have been proposed for both chemical and enzymatic process of biodiesel production [11-13]. The most common method is the transesterification of oils or fats with an alcohol in the presence of a catalyst [14, 15]. Catalyst might be base, acid, or enzyme. However, the high costs surrounding biodiesel production remains the main problem in making it competitive in the fuel market either as a blend or as a neat fuel [16]. More than 75%of the production cost is associated with the feedstock itself and consequently, efforts are focused on developing technologies capable of using low price raw material, high efficiency catalysts, reasonable and optimized refining processes [17-19].

As a future prospective fuel, biodiesel has higher oxygen content than petroleum diesel and its use in diesel engines have shown great reduction in emission of particulate matter, carbon monoxide, sulfur, polyaromatics, hydrocarbons, smoke and noise [20, 21]. Besides, it is relatively safe to store and handle because of a high flash point. Although the biodiesel has lots of merits, there are many disadvantages, such as high cold filter plugging point destroying the low-temperature flow property, the presence of unsaturated double bond decreasing the oxidation stability, and pigments affecting the color [22, 23]. All of these will be the big obstacles in the commercial application of biodiesel.