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Microwave enhanced alcoholysis of non-edible (algal, jatropha and pongamia) oils using chemically activated egg shell derived CaO as heterogeneous catalyst

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Abstract: Microwave enhanced fast and efficient alcoholysis (methanolysis and ethanolysis) of non-edible oils (*algal, jatropha and pongamia*) is achieved using chemically activated waste egg shell derived CaO (*i.e.* CaO(cesp)) as heterogeneous catalyst. CaO(cesp) was extracted from waste chicken egg shell and further activated chemically by supporting transition metal oxide. The maximum conversion was achieved using 3 wt% catalysts under 700W microwave irradiation and 10:1 alcohol/oil ratio in 6 minutes. Alcoholysis using ZnO activated CaO(cesp) catalyst has shown higher reaction yields in comparison to other modified catalysts. Methanolysis has shown better biodiesel conversion in comparison to ethanolysis. The catalyst has shown longer lifetime and sustained activity after being used for four cycles. Due to more saturated fatty acid content; algal biodiesel has shown improved fuel properties in comparison to other biodiesels.

Key words: Microwave; Biodiesel; Algae; Jatropha; Pongamia; Heterogeneous catalyst.

1. Introduction

In recent years, biodiesel has gained more attention as an alternative of fossil fuels due to its excellent fuel properties, clean combustion characteristics, biodegradable, nontoxic, non-flammable and non-explosive nature (Verma et al., 2016; Mofijur et al., 2016). Biodiesel is generally produced from edible (soybean oil, sunflower oil etc.) and non-edible (algae, jatropha, pongamia, polanga, castor seeds) oils, animal fats as well as waste cooking oils from food industry with short chain alcohols such as methanol and ethanol (Moser, 2016). However, for developing countries like India, China and countries from south east Asia; the less expensive non-edible oils are the most promising feedstock