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Research Article

Modification of Turen's Bentonite with $AlCl_3$ for Esterification of Palmitic Acid

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Abstract

Natural Turen's bentonite has been purified, modified and applied as catalyst for palmitic acid esterification. Modification of natural Turen's bentonite was conducted by cation exchange method using AlCl3 solution. Catalyst characterization was performed on X-ray Fluorescence, X-ray Diffraction, nitrogen adsorption-desorption and infrared spectroscopy techniques. The catalytic activity test in the esterification reaction of palmitic acid with methanol was conducted by bath at 65 °C with a variation of reaction time of 1, 2, 3, 4 and 5 h. Catalytic activity has been observed qualitatively using GC-MS and quantitatively by changes in acid number. The analysis showed the formation of Al^{3+}-bentonite. Observation on the elements has shown that the presence of calcium decreased from 10.2 to 4.17 %, with an increase of aluminium content from 9.9 to 13 %. Diffraction line at 2θ 5.7379º became 5.6489º, along with changes in *d*-spacing of 15.3895 to 15.6319 Å. The surface area increased from 83.78 to 91.26 m^2/g, while Brönsted acid sites increased from 10.2 to 67.5 µmol/g and Lewis acid sites increased from 94.9 to 132 µmol/g. Furthermore, Al^{3+}-bentonite has showed as active catalyst in the esterification reaction of palmitic acid with palmitic acid with conversion of 78.78 % for 7 h.

Keywords: natural Turen's bentonite; Al^{3+}-bentonite; esterification; palmitic acid

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1. Introduction

Fuel scarcity is solution current issue which continues to demand the finding of new solutions. Government and the society continue to seek alternative energy sources to substitute petroleum-based energy. One of the new and renewable energy sources (renewable resources) which could be relied upon is derived from various types of vegetable oils, as raw material for the manufacture of biodiesel. Synthesis of biodiesel from vegetable oils can be made through transesterification reaction using an acid or base catalyst. The profitable use of basic catalysts for the reaction is because of fast reaction [1]. However, the use of basic catalysts can lead

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