



## A new heterogeneous acid catalyst system for esterification of free fatty acids into methyl esters

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### ABSTRACT

A new heterogeneous acid catalyst system for production of environmentally friendly fuel, biodiesel was created from ferric sulfate and non-toxic, inexpensive source of biopolymer, sodium alginate. The catalyst, in the form of ferric-alginate beads produced from the reaction of 2 wt.% sodium alginate gel with 0.1 M ferric sulfate solution gave excellent methyl ester conversion of 98% with mild reaction conditions. The esterification of 0.5 g lauric acid was carried out at optimum conditions; 16 wt.% of ferric-alginate beads (2.8 wt.% Fe) methanol refluxing temperature, 15:1 methanol to lauric acid molar ratio for 3 h. The ferric-alginate beads were reusable up to 7 times without any pre-treatment. Characterization of the ferric-alginate beads showed the formation of FeOOH that held the alginate chain in place. Thermal analysis showed that the beads are able to withstand the refluxing temperature without degradation. Iron content was found to be 0.175 g Fe/g beads as determined by AAS and 0.189 g Fe/g beads as determined by TGA. Easy catalyst separation, reusability and ability of the ferric-alginate beads to esterify lauric acid to give high conversion of methyl laurate makes this catalyst desirable for biodiesel production from high free fatty acid oils.

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