

Environmentally Friendly New Catalyst Using Waste Alkaline Solution from Aluminum Production for the Synthesis of Biodiesel in Aqueous Medium

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Abstract: Red mud (RM) is composed of a waste alkaline solution (pH = 13.3) obtained from the production of alumina. It contains high concentrations of soluble hematite (Fe₂O₃), goetite (FeOOH), gibbsite [Al(OH)₃], a boemite (AlOOH), anatase (Tetragonal - TiO₂), rutile (Ditetragonal dipyramidal - TiO₂), hydrogarnets [Ca₃Al₂(SiO₄)_{3-x}(OH)_{4x}], and perovskite (CaTiO₃). It was shown to be an excellent catalytic mixture for biodiesel production. To demonstrate the value of RM, an environmentally friendly process of transesterification in aqueous medium using waste cooking oil (WCO), MeOH and waste alkaline solution (WAS) obtained from aluminum production was proposed. Triglycerides of WCO reacted with MeOH at 60 °C to yield mixtures of fatty acid methyl esters (FAMES) in the presence of 0.019% (w/w) WAS/WCO using the WAS (0.204 mol L⁻¹, predetermined by potentiometric titration) from aluminum production by the Bayer process. The use of the new catalyst (WAS) resulted in a high yield of the products (greater than 99% yield).

Keywords: Environmentally friendly processes; Bayer residue; waste management; basic catalyst, contaminants, red mud, fatty acid methyl ester.

Copies of spectra

1) WCO

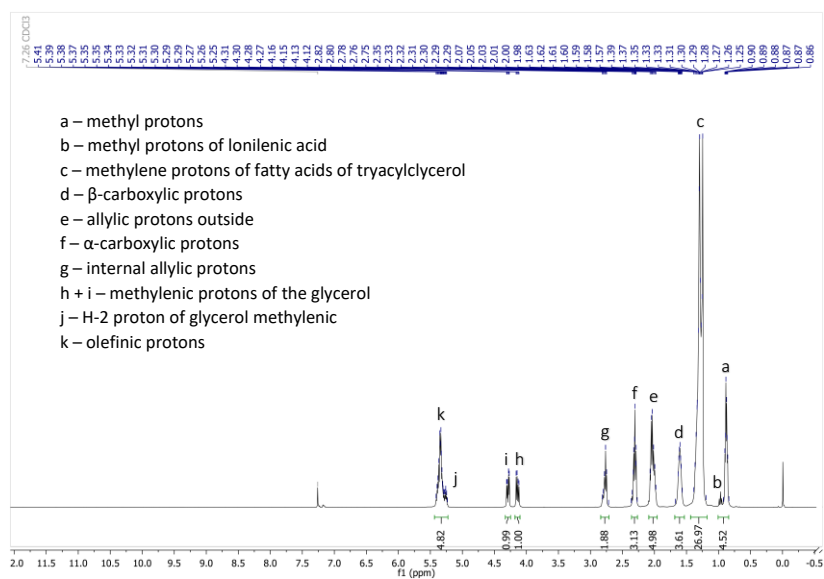


Figure S1. ^1H NMR WCO.

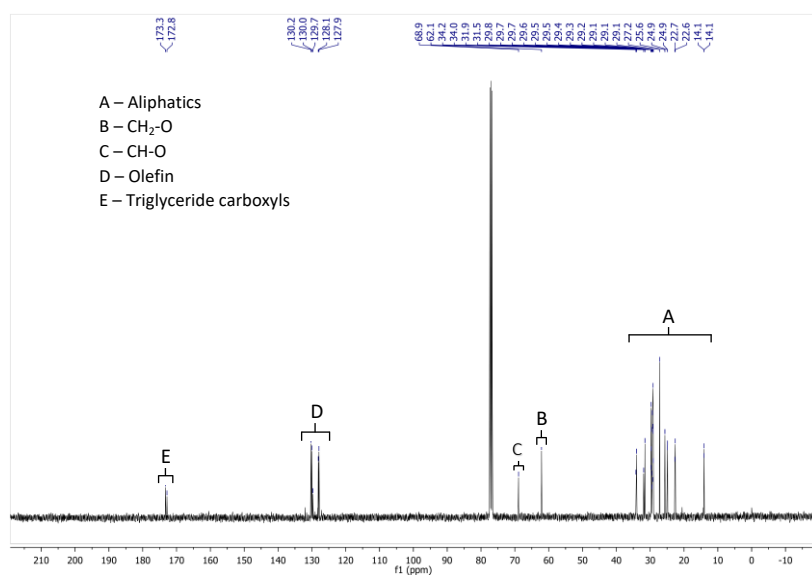


Figure S2. ^{13}C NMR WCO.

2) FAME (Fatty acid methyl ester)

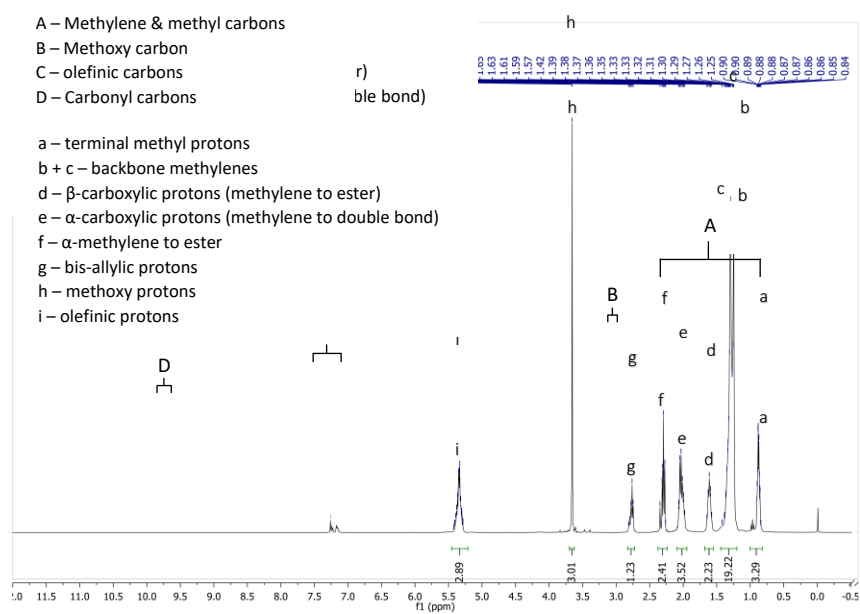


Figure S3. ^1H NMR FAME using WAS.

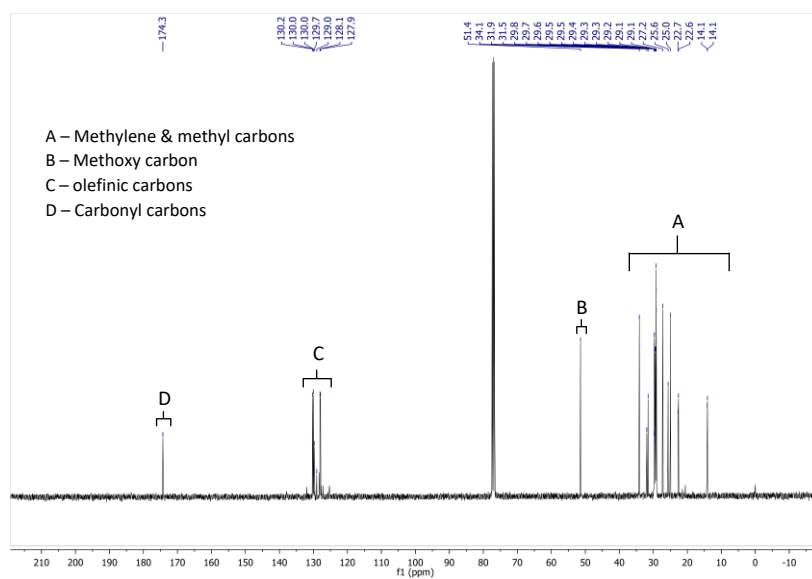


Figure S4. ^{13}C NMR FAME using WAS as catalyst.