Electronic Supplementary Material (ESI) for New Journal of Chemistry.

Electronic Supplementary Information

Micelle effect on the conversion of micropore to mesoporous molecular sieves and biodiesel synthesis

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Energy Dispersive X-ray (EDX) analysis

Energy Dispersive X-ray (EDX) analysis is used to analyze the chemical composition of $AlPO_4$ and $AlSiO_4$. These spectra proved the presence of Al, P, O and Si in $AlPO_4$ and $AlSiO_4$ preparation is shown in **Figure S1 and S2 (ESI).** The oxygen percentage of the $AlPO_4$ and $AlSiO_4$ are almost similar. The Al and P percentage are also equal to $AlPO_4$ molecular sieves. In the case of $AlSiO_4$, the percentage of Al is 14 and Si is 27. It is indicated that the Al and Si sites are not alternative but the Al site may be available in-between two silicon units. So the percentage of Al is less compared to silicon.

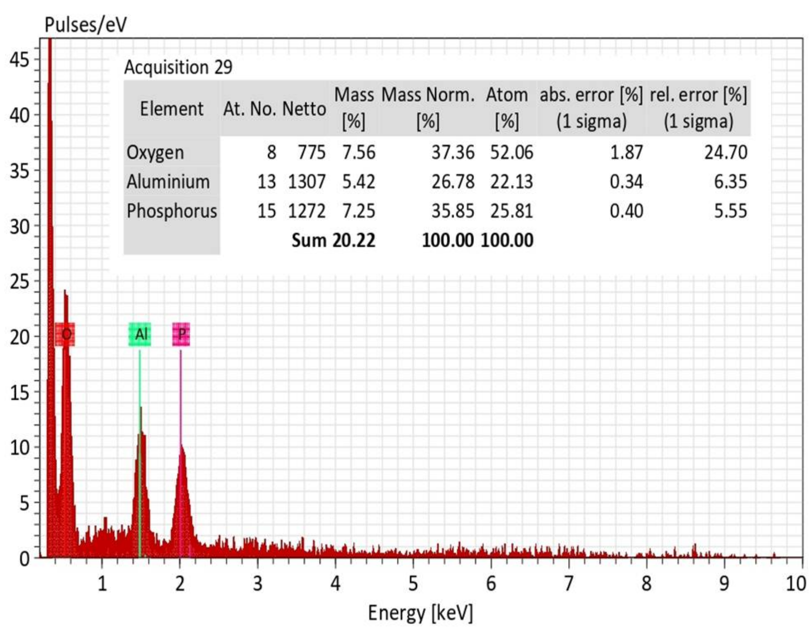


Figure S1 SEM EDX spectrum of $AlPO_4$

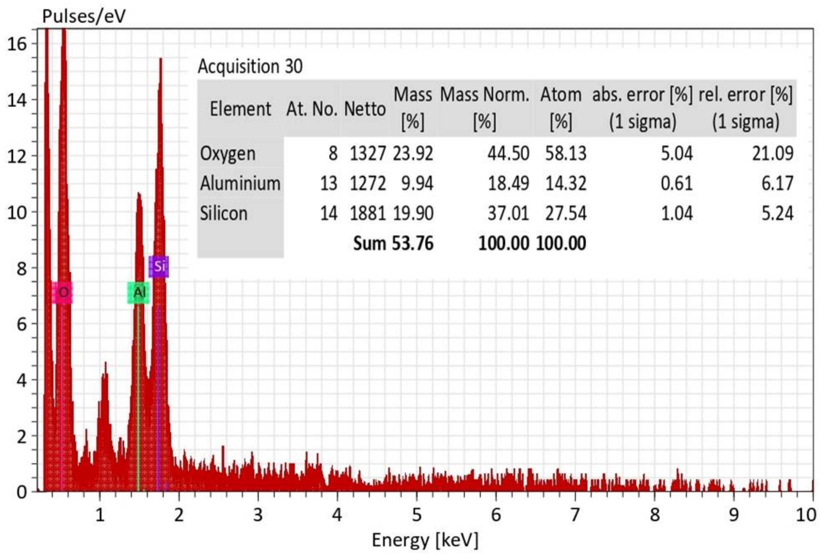
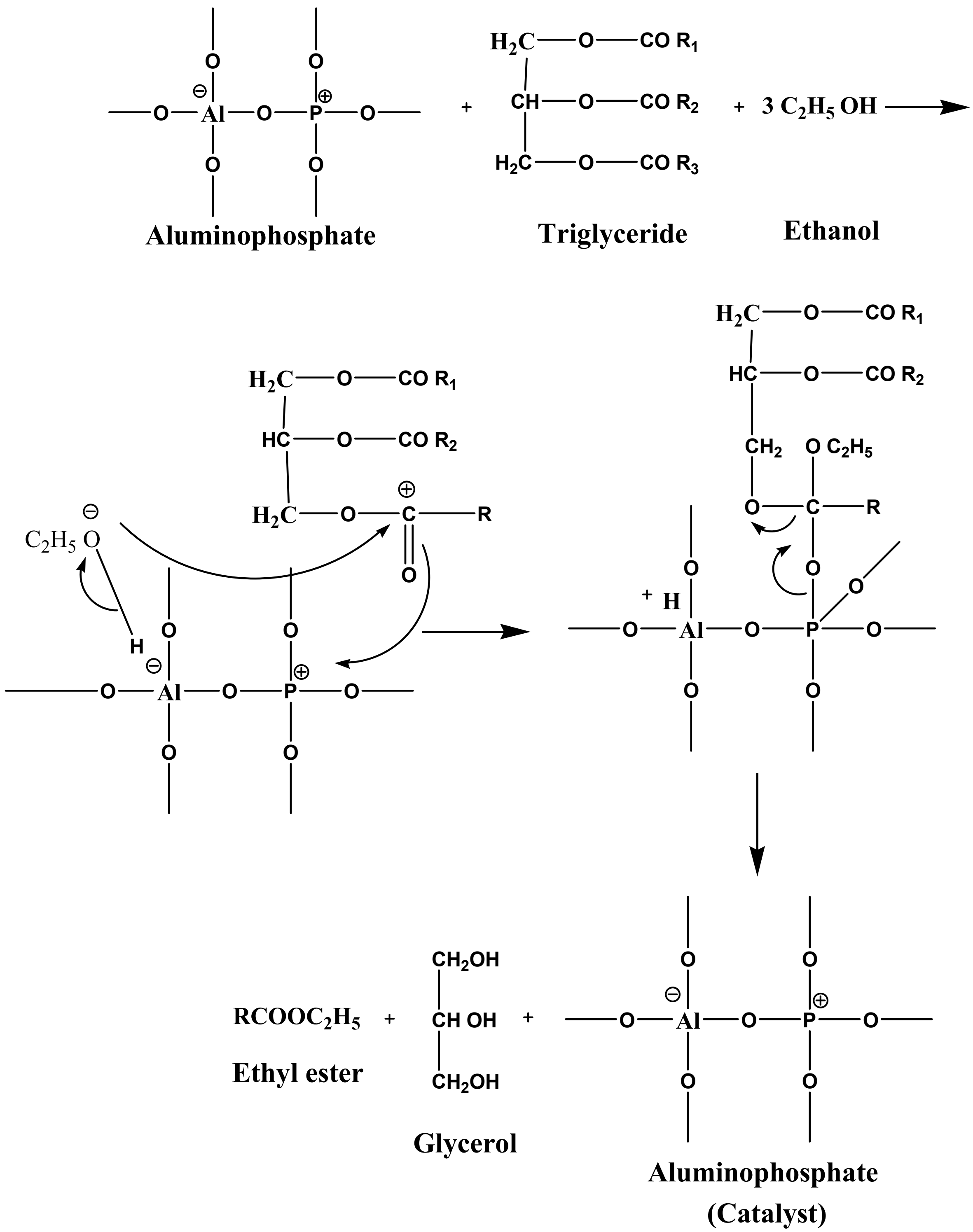


Figure S2 SEM EDX spectrum of $AlSiO_4$

Mechanism of Aluminophosphate catalyzed Transesterification Reaction

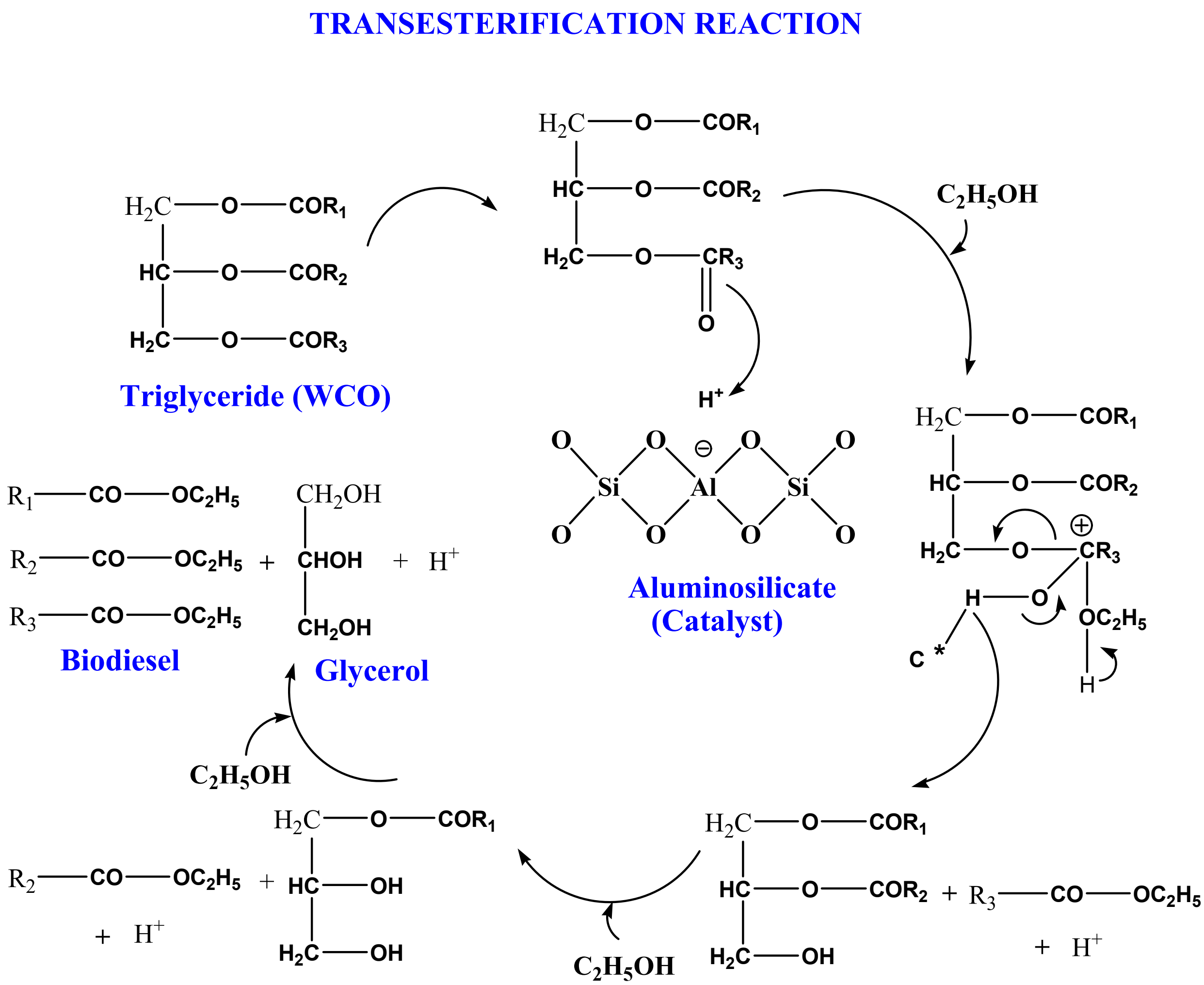
Aluminophosphate is a neutral framework. It has no proton, but it has a terminal OH group. This terminal OH produces only a lower yield during the transesterification reaction. But the aluminophosphate produced 59% yield. In this mechanism, triglyceride reacts with ethanol in the presence of aluminophosphate. Aluminophosphate has a zwitter ion framework, it contains a negative charge on Aluminium and a positive charge on phosphorous. Ethanol has one acidic proton, it is taken by the negative charge on the Aluminium to produce ethoxide ions ($C_2H_5\,O^-$). Carbonyl carbon from triglyceride is attached to the positive charged phosphorous to produce the C^+ intermediate. The $C_2H_5\,O^-$ ion attack the C^+ ion, then the P-O bond cleaved shifted towards oxygen and simultaneously C-O bond is cleaved and shifted to CH_2-O^- and ethyl ester is formed. The proton from Aluminium combined with the oxygen of CH-O^- and CH_2-O^- of triglyceride combined with ethanol to produce glycerol. Finally, the catalyst is removed or regenerated. That is why neutral aluminophosphate is effective for converting WCO to biodiesel.



Scheme S3 Aluminophosphate catalyzed Transesterification Reaction

Mechanism of Aluminosilicate catalyzed Transesterification Reaction

The aluminosilicate catalyzed transesterification reaction mechanism is illustrated in scheme ii. The protonation of triglyceride at the carbonyl group is produced tetrahedral carbocation. It is attacked by lone pair of electron of alcohol. Then H^+ migration to glycerol. This process is repeated and fatty acid ethyl esters are formed and glycerol is the byproduct.



Note: * C - Catalyst

Scheme S4 Aluminosilicate catalyzed Transesterification Reaction