Solid Base Catalysed Transesterification of Triglycerides for Biodiesel Synthesis

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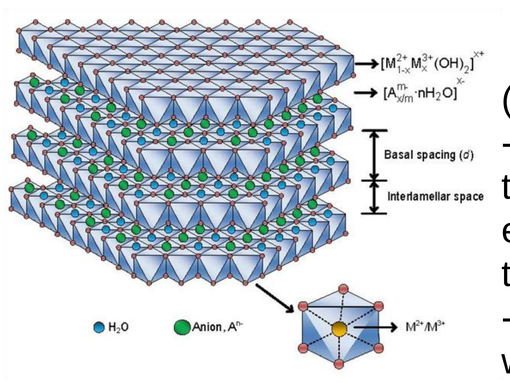
Background

- Castor oil from castor plant (*Ricinus communis)* seed is a colourless to pale yellow liquid with approximately ninety percent of fatty acid chains are ricinoleic acid.[1,2] Castor oil as a renewable template used as surfactants in the preparation of mesoporous catalyst support materials and its characterization been reported.
- The transesterification of tributyrin using hydrotalcite catalysts hereby presented which will be used for comparison purpose during transesterification of castor oil using amine functionalized mesoporous catalyst.[3,4]

Transesterification

Transesterification of tributyrin using hydrotalcite catalysts was done and will be used for comparison during transesterification of castor oil using functionalized mesoporous

Hydrotalcites



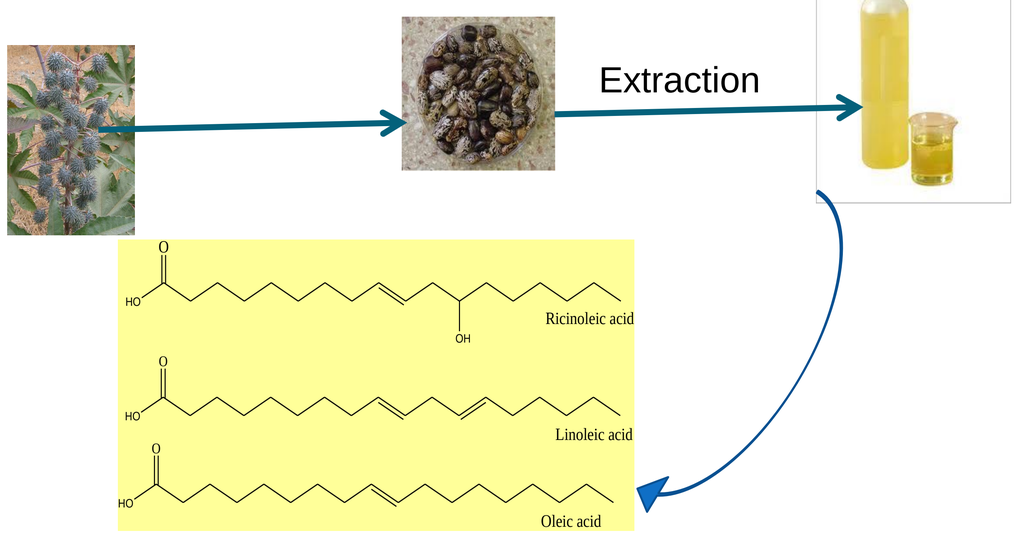
Schematic of hydrotalcite structure[6]

-Also known as layered double hydroxide (LDH)

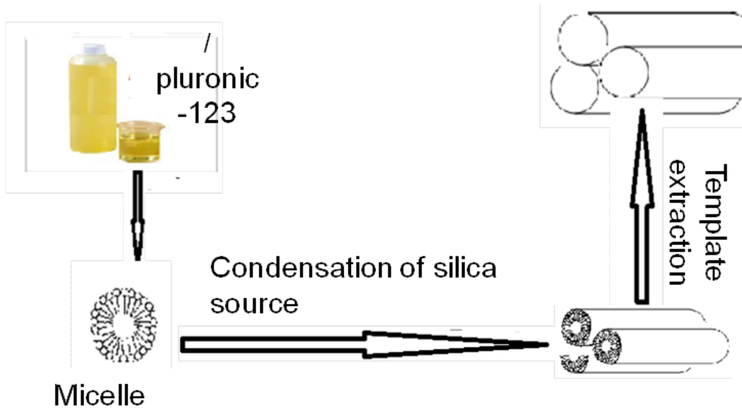
-Anionic clay consist of positively charged two- dimensional sheets with water and exchangeable charge-compensating anions in the interlayer region

-General formula $M^{2+}_{1-x}M^{3+}_{x}(OH)_2A^{n-}_{x/n}\cdot yH_2O$ where M^{2+} are divalent anions (e.g., Mg^{2+},Zn^{2+}, Mn^{2+},Ni^{2+},Co^{2+},Fe^{2+}), M^{3+} are trivalent metal ions (e.g., Al^{3+},Cr^{3+},Fe^{3+},Co^{3+},Ga^{3+}) and A^{n-} is the interlayer anion with charge n.[6,7]

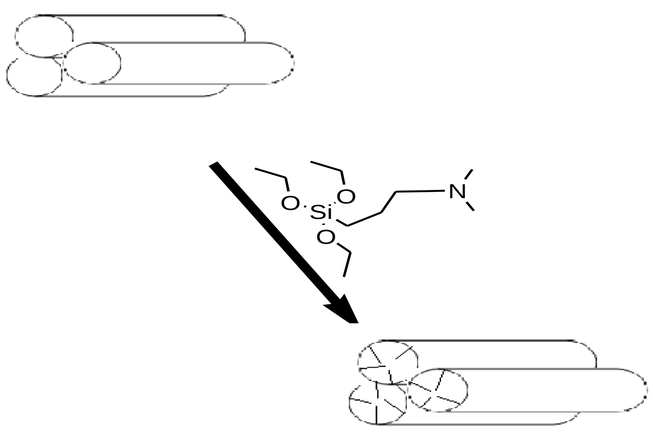
Experimental



Extraction of castor oil

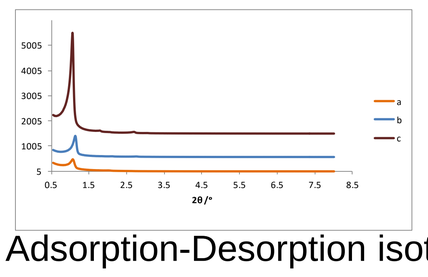


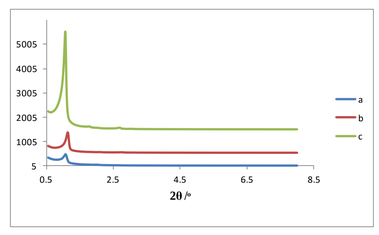
Synthesis of mesoporous material



Amine functionalization of SBA-15 via post-synthetic grafting method via APTMS

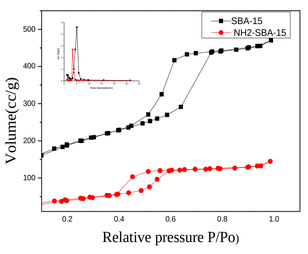
Characterization





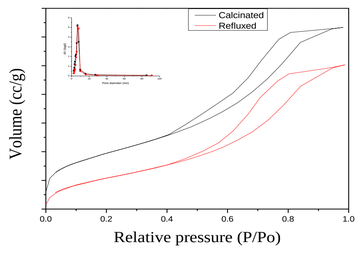
Adsorption-Desorption isotherm

-Low angle XRD-functionalization of the SBA-15 and amine functionalized SBA-15

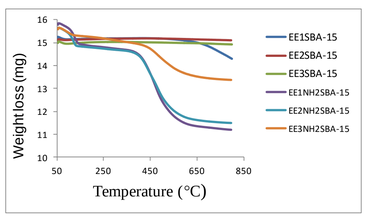


-Surface area and pore diameter SBA-15,[5] amine functionalized SBA-15

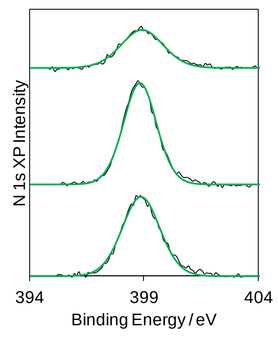
-surface area and pore diameter decrease after functionalization



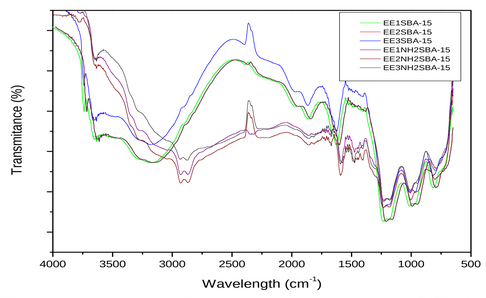
-Surface area and pore diameter for materials synthesized using castor oil as template



TGA curves showing thermal mass losses for SBA-15 and amine functionalized SBA-15



N 1s XP spectra of various amine functionalised SBA-15 materials



DRIFT spectra of synthesized SBA-15 and amine functionalized SBA-15

Results

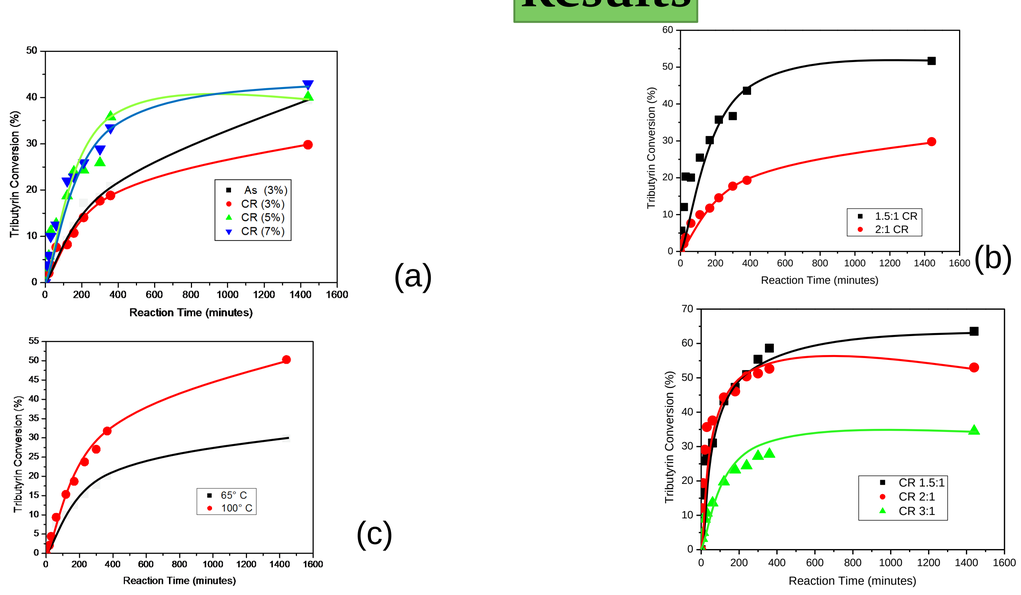


Fig. 3: Transesterification of tributyrin with methanol (1:30); (a) over hydrotalcite (2:1, Mg:Al) with different catalyst to substrate ratios at 65 °C, (b) over 3% hydrotalcite with different Mg:Al ratios at 65° C, (c) tributyrin with methanol (1:30) over hydrotalcite (2:1, Mg:Al), at different temperature, (d) over hydrotalcite (Ni:Al), 3%, at 65 °C in pressure flask

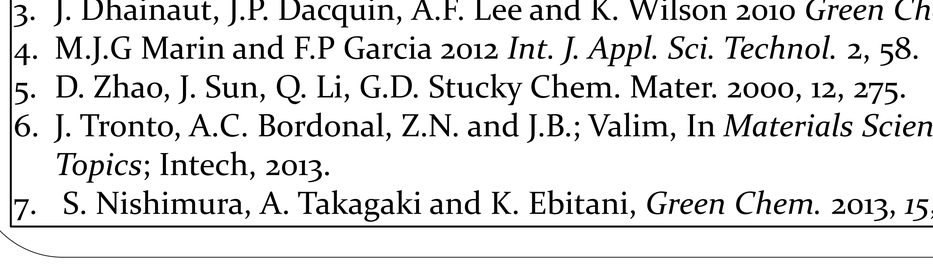


Fig. 4: Nomalised moles of the products of the transesterification of tributyrin with methanol (1:30) (a) over 3% hydrotalcite (1.5:1, Mg:Al) at 65 °C, (b) over 3% hydrotalcite (1.5:1, Ni:Al) at 65 °C.

Conclusions

- Materials synthesized using castor oil as template have good surface area and pore diameter.
- Increasing the amount of catalyst increase the tributyrin conversion

References

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