
General Conclusions

Oleic acid presented a low thermal stability basically due to autoxidation at high temperature, even under inert conditions. External effects, such as light or stainless steel metallic components favoured its degradation. A suitable solvent, such as hexadecane, avoids the decomposition of oleic acid up to 300 °C.

The use of a fatty acid ester instead of an oleic acid as a dehydrogenating starting material rewards us with milder experimental conditions, better reaction thermodynamics, lower boiling point and a decrease/removal of thermal degradation.

Aromatic FAEE were structurally determined by combining the use of different techniques (GC-MS, UV, ¹H-NMR). They were detected as reaction product using ethyl linoleate as starting material and AC as a catalyst. The reaction gave also place to compounds, whose m/z of GC-MS analysis was 302, suggesting the formation of a higher unsaturated structure.

The obtaining of aromatic FAEE occurred following the mechanism consisting of : a) dehydrogenation reaction of starting material, b) cyclation to give a ring and, finally, c) a second dehydrogenation reaction.

AC presented catalytic activity at 240 °C when being used as a catalyst with ethyl linoleate as starting material in a flow bed reactor under non-oxidative conditions. The catalytic reaction products mainly consisted of four family compounds, which are isomers of di-unsaturated FAEE, aromatic FAEE, hydrogenated FAEE, such as, mono-unsaturated FAEE, and, finally, compounds, whose m/z in MS analysis was 302.

Benzene acted as a hydrogen capturer giving place to a lower hydrogenation of ethyl linoleate. Moreover, it favoured the total conversion of ethyl linoleate and avoided the deactivation of the catalyst. The mixture of 1:5-ethyl linoleate:benzene turned out to be the optimal for the obtaining of dehydrogenation products.

An oxidative treatment consisting of a thermal treatment under air during 3 or 11 hours modified the surface chemistry of the initial AC. The modification was basically the increment of oxygen-containing functionality, such as quinones, and phenols, which were determined by TPD-MS. The gasification of carbons decreased the surface area of the materials.

The most oxidized carbon, AC_{11h}, turned out to give the highest selectivity towards aromatic FAEE. This activity may be assigned to an increase of functional groups, such as quinone. Those oxidized surface groups did not show deactivation after 300 min run in the presence of hydrogen.

The addition of palladium affected the selectivity and conversion of the reaction; however, it was difficult to establish a relation between characterization and catalytic activity results.

HSAG-100 turned out to be an active catalyst in the dehydrogenation of FAEE. Analogously to AC, di-unsaturated FAEE, mono-unsaturated FAEE, aromatic FAEE were detected as reaction products. However, some products fruit of cracking reactions presented a selectivity value around 60 %. It presented a higher total conversion of ethyl linoleate than AC, if considering conversion relative to surface area

By decreasing temperature reaction to 200 °C, tri-unsaturated FAEE (some of them being ω-3 compounds) were detected using AC and HSAG-100 as catalysts supporting the proposed mechanism for the obtaining of aromatic FAEE. This fact proofed that temperature played a crucial role in the obtaining of tri-unsaturated FAEE. Hydrogenation and isomerization reaction were normally competing reactions which followed opposite trends.

Active carbon showed dehydrogenation activity at low temperatures such 70 °-120 ° C under non-oxidative conditions. Active carbon kept its dehydrogenation activity (zero conversion from a blank non-catalyzed reaction) at least after 24 hours.