Understanding the Effects of Fatty Acid Structures on Catalytic Selectivity and Deactivation in Ketonization

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The catalytic selectivity and deactivation during ketonization (*i.e.*, ketonic decarboxylation) of C_{18} fatty acids having different unsaturation degrees were rigorously investigated. The ketonization results demonstrated that the yield of fatty ketone gradually decreased with increasing unsaturation degree, while byproducts such as methyl ketones and olefins were produced via McLafferty rearrangement and cracking. It was verified that carboxylic acids longer than C_5 can be decomposed via this pathway, of which the rate increased with the chain length. In the ketonization of unsaturated fatty acids, the McLafferty rearrangement and cracking produced conjugated polyunsaturated olefins, which could be easily transformed to coke. The results implied that the ketonization of natural fatty acids requires pre-saturation for increasing the fatty ketone yield and preventing catalyst deactivation. In this aspect, the ketonization of saturated fatty acid mixture obtained by hydrogenative hydrolysis of natural triglyceride (*e.g.*, palm oil) showed high fatty ketone yield and negligible deactivation.