

Hardening – Hydrogenation of Fatty Acid / Methyl Ester in a Fixed Bed Reactor

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At the end of the 19th century, the hydrogenation of organic compounds was discovered. This process allowed to make “plastic fats” from liquid oils and, thus, made the margarine and shortening industries less dependent on the limited availability of fats. In addition, the hydrogenation opened markets for oils (e.g. fish oil), which are too unstable for food use without hydrogenation.

The hydrogenation of fatty acids (FA) or fatty acid methyl esters (FAME) is a fundamental process to manufacture basic oleochemicals in the chemical industry, like stabilizer and surfactants. These kinds of oleochemicals are used in downstream processes, to produce products which are easy bio-degradable and non-irritant to the skin. In principle the FA or FAME are hydrogenated with hydrogen in a reactor under pressure, higher temperature and under presence of a metallic catalyst, such as nickel or palladium.

The process can be controlled in a desired direction by appropriate choice of the above mentioned parameters to produce a product with different degrees of saturation, melting properties and color from the given feed.

The most used process nowadays is a batch process. The hydrogenation reaction is carried out in a loop or stirred reactor, with suspended form of catalyst. After the reaction the catalyst must be removed from the product by a complex and time-consuming filtration. Thus lead to the higher consumption of catalyst. The next disadvantage is that Ni-soaps can be formed during the process and this leads to an inactivation of catalyst.

The fixed bed method was developed to discard the disadvantages mentioned above. Therefore a pilot plant was constructed in which the catalyst is fixed on a carrier matrix and filled into the reactor. A test run with FA from tallow and FAME from palm oil was accomplished for several months. The iodine value of < 0.05 in hydrogenated FAME was achieved, which is required by the industry for the production of surfactants. In the fixed bed hydrogenation for FA palladium catalyst will be used. Furthermore catalyst is reused and his consumption is reduced, formation of byproducts is minimized. The process is characterized by a high reliability, feed flexibility, easy control and high yield.