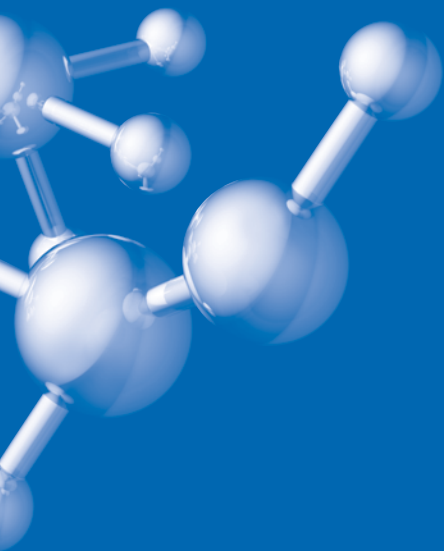
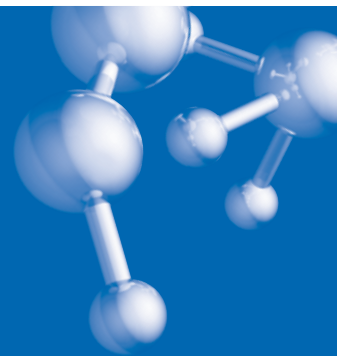




Fatty Alcohol – Ester Routes





Consumption Figures

The consumption figures vary with the feedstock. The figures given below provide a rough guideline and are based on the production of 1000 kg C_{12/14} distilled fatty alcohol from PKO:

Wax Ester Route	
Fatty acid	1099 kg
Catalyst	< 1 kg
Hydrogen (Purity 99.9 Vol. %)	230 m ³ (STP)
Cooling water	55 m ³
Steam (netto consumpt.)	30 kg
Electric power	165 kWh
Nitrogen	10 m ³ (STP)
Fuel	1500 MJ

Methyl Ester Route	
Methyl ester	1099 kg
Catalyst	< 1 kg
Hydrogen (Purity 99.9 Vol. %)	230 m ³ (STP)
Cooling water	85 m ³
Steam (netto consumpt.)	30 kg
Electric power	165 kWh
Nitrogen	–
Fuel	1000 MJ

Quality of final Fatty Alcohols	
Acid value	< 0.02
Saponification value	< 0.2
Iodine value	< 0.05
Color	< 5 APHA
Carbonyl value	< 3ppm
HC	< 0.3 %
Moisture	< 0.05 %
Pure cuts	> 99 % purity

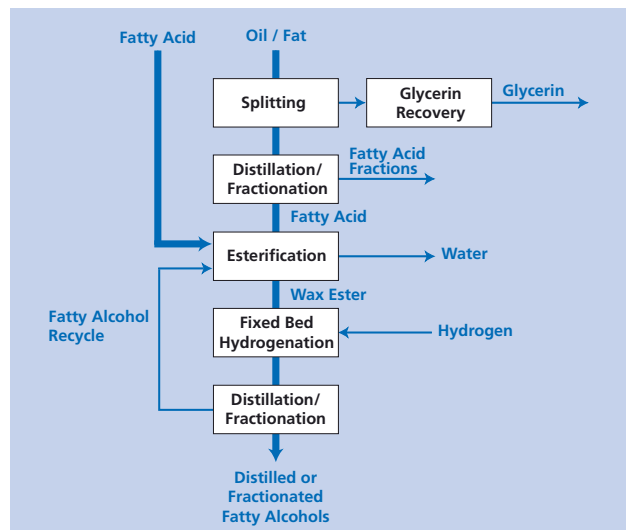


Wax Ester Hydrogenation,
VVF-India

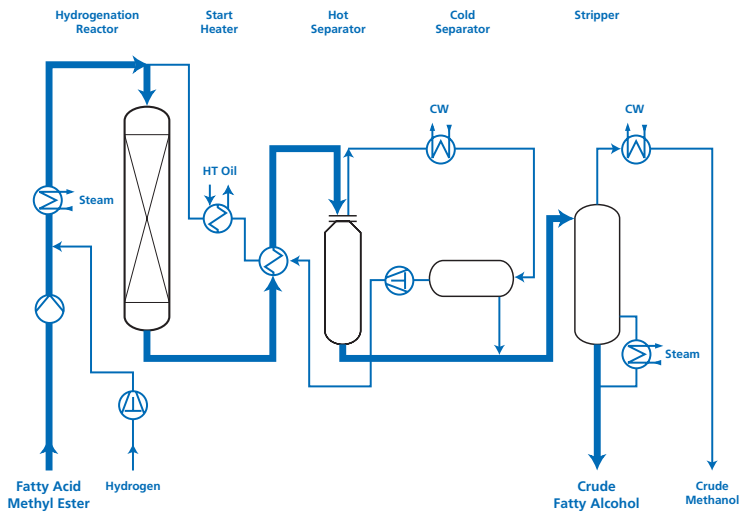
Fatty Alcohol Fixed-Bed Ester Route Low Cost, flexible Product Mix, proven Technology

Natural Oil and Fats as Feedstocks

Fatty-alcohol-based surfactants have gained growing significance in the detergent market due to their excellent washing properties and superior biodegradability. Nowadays, fatty alcohols derived from renewable resources are an important basestock for the production of cationic, anionic and nonionic surfactants such as fatty alcohol sulfates, ether sulfates, ethoxilates and alkyl polyglucosides. Today, natural oils with a high content of fatty acids in the detergent range (chain lengths $C_{12/14}$) are used. Coconut oil or palm kernel oil are the preferred feed stocks.



Wax Ester Route



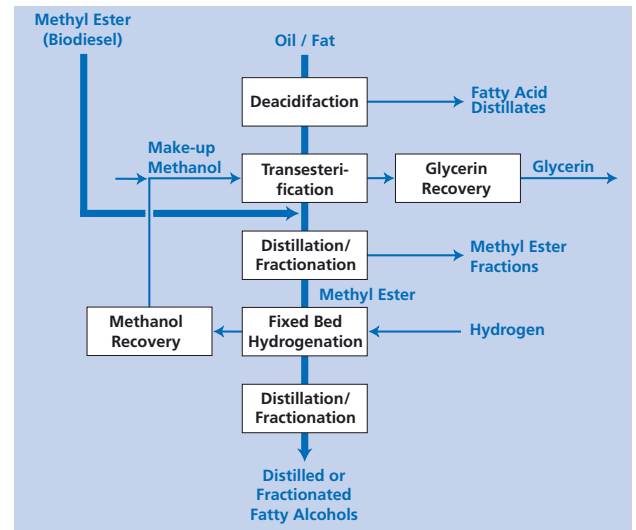
Fatty Alcohol Production via Methyl Ester

Fatty Alcohol Fixed-Bed Methyl Ester Route (2nd Generation)

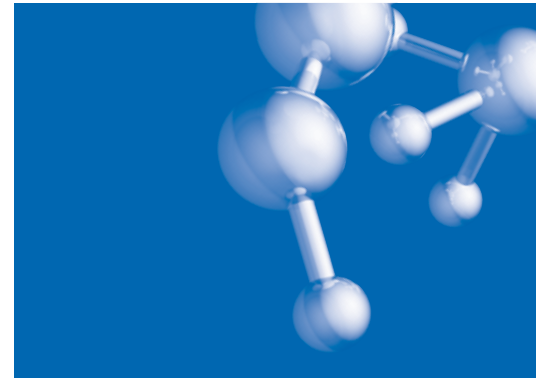
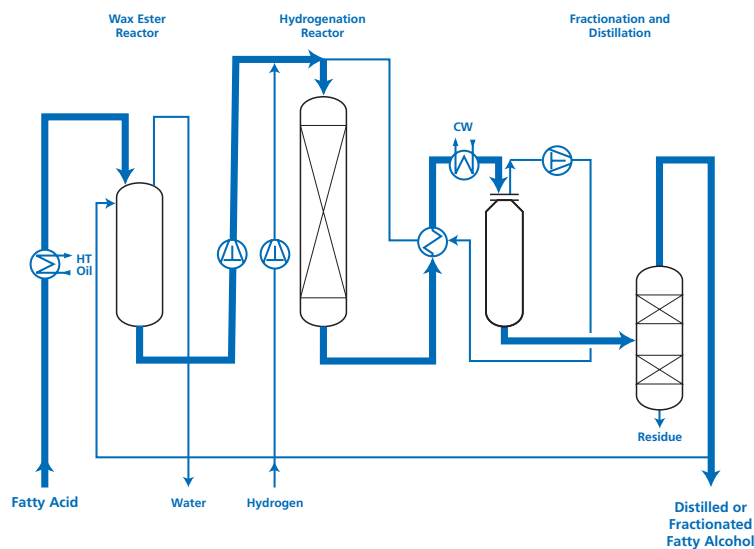
Since the late nineteen fifties, Lurgi has built fatty alcohol plants operating on our proprietary Acid Route applying the advanced slurry process (1st generation). Until now this process has been the only one for direct hydrogenation of fatty acid to fatty alcohol without prior esterification. However, the continuous addition of fresh catalyst and the removal of spent catalyst required a complex catalyst handling system.

The Methyl Ester Route was developed by Lurgi in the late nineteen eighties to produce both unsaturated and saturated fatty alcohol.

This process used an oil transesterification with methanol and fed the corresponding methyl ester to a fixed-bed reactor. Methanol formed by hydrogenation requires an additional recovery process. The short chain fraction ($C_{6/10}$) as well $C_{12/14}$ and the $C_{16/18}$ fractions can be obtained as fatty alcohols or as methyl esters.



Methyl Ester Route



Fatty Alcohol Production via Wax Ester

Fatty Alcohol Fixed-Bed Wax Ester Route (3rd Generation)

Lurgi's 3rd generation fatty alcohol technology has been proven and in commercial operation since 2004. The combination of the advantages of the two previous routes, the slurry route and the fixed-bed Methyl Ester Route, has led to the Wax Ester Route. In a first step, fatty acids are produced from oil and fat by the well-known fat splitting process. The fatty acids are divided into a cut to be marketed and a cut for producing fatty alcohol. The short chain fraction as well the C_{16/18} fraction can be economically separated as fatty acid, or can be hydrogenated to fatty alcohols. On this route only the fatty acid fraction which is needed as fatty alcohol is to be fed to the wax ester process. The hydrogenation of the wax ester to fatty alcohol takes place in a fixed-bed and liquid-phase trickle reactor which allows low reaction temperature, low catalyst consumption and simple plant operation. This most advanced technology reduces investment, operating and maintenance cost considerably. The catalyst either as chrome or chrome-free version is freely available on the market.

General Process Description

The process for the production of fatty alcohol covers the preparation of methyl ester or wax ester and subsequent hydrogenation of the ester to form fatty alcohol. The ester is charged to the hydrogenation reactor, together with hydrogen. In the fixed-bed reactor, the liquid trickles down through the catalyst packing, forming fatty alcohols in the process. The reactor discharge product is cooled and separated into recycled hydrogen and liquid crude fatty alcohol. In the fatty alcohol fractionation and distillation stages, distilled fatty alcohols are obtained as final products. Depending on the product requirements, a carbonyl conversion stage may be added to attain an extremely low carbonyl level. The final products may be defined cuts, e.g. C_{6/10}, C_{12/14}, C_{16/18} or C_{12/18} or pure individual cuts like C₁₂, C₁₄, C₁₆, C₁₈.

Lurgi is a leading technology company operating worldwide in the fields of process engineering and plant contracting. The strength of Lurgi lies in innovative technologies of the future focusing on customized solutions for growth markets. The technological leadership is based on proprietary technologies and exclusively licensed technologies in the areas gas-to-chemical products via synthetic gas or methanol and synthetic fuels, petrochemicals, refinery technology and polymer industry as well as renewable resources/food.

Lurgi is a member of the Air Liquide Group. 

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