FACT SHEET
WAX ESTERS – THE ENZYMATIC ROUTE

Wax esters, or wax, is by definition esters of long chain fatty acids and higher alcohols. Wax esters are widely used as lubricants, polishes, release agent, antifoaming agent, hydrophobization agent. Wax esters has numerous functions in cosmetics. In creams, they are used as emollients, and in lipsticks, wax esters yield gloss in addition to binding and wetting the pigments.

Traditionally, waxes are extracted from plants (Jojoba oil) and animals (Spermaceti, beeswax). Today, extraction of wax esters from natural materials are too expensive or scarce to meet the commercial demand. Industrial synthesized waxes are produced by direct chemical esterification at high temperature in presence of an inorganic catalyst. This non-selective high-energy route tends to produce waxes with coloration and odor, which needs further processing to yield a colorless and neutral end product.

Figure 1. Jojoba seeds – The seeds contain jojoba oils that is in fact a wax ester

It has been known for a long time that direct esterification of fatty acids and alcohols is possible by enzymatic catalysis. Historically the cost of enzyme has made this route commercially unfavorable and been regarded as a novelty.

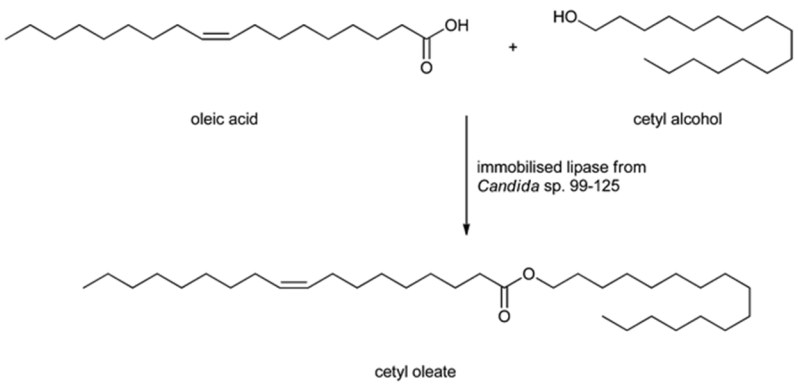

Figure 2. Enzymatic Esterification of Oleic Acid and Cetyl Alcohol

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APC has delivered enzymatic reactor systems for more than a decade for esterification of polyunsaturated fatty acids. These fatty acids cannot be processed by high temperature chemical esterification reactions. The enzyme cost of conversion in APC enzymatic reactors are today typically in the range € 0.05 /kg product. This makes enzymatic esterification a competitive process route for high-quality commodity, and specialty wax esters.

The Enzymatic Route – The Benefits

- **Low temperature (< 80°C)**
- **Green chemistry, no acids, alkali nor solvents**
- **No off-colored products**
- **No by-products**
- **Natural cut FA can be used – unsaturation is no problem**
- **Stoichiometric ratios of reactants – no or minor work-up necessary**
- **End product with acid number < 5 directly**

The enzymatic esterification route is suitable for wide variety of raw materials. Due to the low reaction temperature, unsaturated materials can be esterified without isomerization. The enzyme has a specific catalytic capability, so no side reactions occur in the system.

Applicable alcohols

- **Fatty alcohols (natural, Ziegler, oxo, Guerbet)**
- **Ethoxylated fatty alcohols**
- **PEG**
- **Diols (1,6-hexandiol)**
- **Glycerol**

Applicable products

- **Emollient esters for cosmetics**
- **Occlusive esters for cosmetics**
- **Bio-lubricants**
- **Food-grade non-silicon release agents**
- **Specialty co-surfactants**

For more information, please contact:

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