PROCESS:

The manufacture of Stearic acid is typical to fatty acid manufacture in general.The particular process used depends upon the raw material available and the quality of product desired.The raw material may be any fatty material that will yield a reasonable quantity of required fatty acid. Tallow and Grease are the usual raw materials for Stearic acid.

Tallow is a mixture of fats that are obtained by steam treating low fat. Tallow contains Tristearin, which is just 3 Stearic acid molecules joined to one Glycerol molecule.

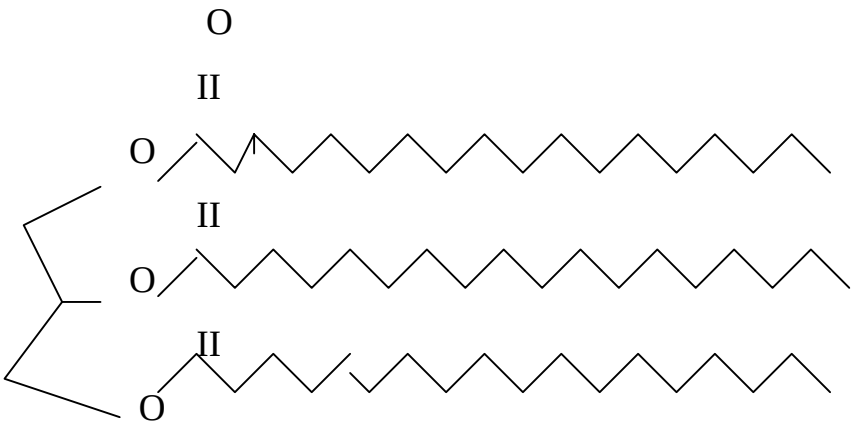


Fig 1.2 Tristearin

The two main steps involved in the manufacture of Stearic acid is

1) hydrolysis of a fat or oil to produce a mixture of fatty acids and glycerine followed by separation of two products.

2) Purification and separation of fatty acid mixtures into two or more fatty acid mixtures.

The two principal grades of commercially produced stearic acid are called:

- Commercial/Pressed acid and
- Distilled / Solvent – crystallized acid

produced by

1. TWITCHELL PROCESS AND PRESSING
2. CONTINUOUS HIGH – PRESSURE SPLITTING AND SOLVENT CRYSTALLIZATION

respectively.

TWITCHELL PROCESS:

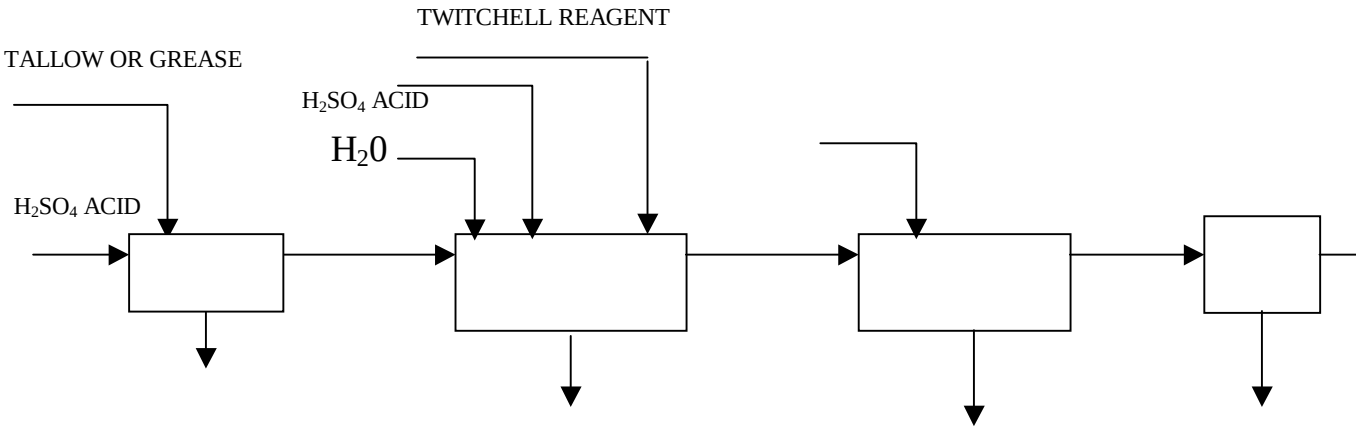
The manufacture of Stearic acid, the most important of the fatty acids of commerce, is typical of fatty acid manufacture in general. The particular process used depends upon the raw material available and the quality of product desired. In any case, manufacture involves two separate operations: (1) hydrolysis of a fat or oil to produce a mixture of fatty acids and glycerine, followed by separation of the two products and

(2) purification and separation of the fatty acid mixtures into two or more fatty acid products.

The process shown in the flowsheet shows widely used, if not the most modern, processes of fat – splitting (hydrolysis) and subsequent purification and separation of the resulting fatty acids.The raw material may be any fatty material that will yield a reasonable quantity of the required fatty acid. Tallow and Grease are the usual raw materials for Stearic acid. Either raw material is first washed with strong sulfuric acid to remove albuminous material and other catalyst poisons. The fat is then mixed with 25 to 50 per cent water (by weight), about one per cent Twitchell reagent (an aromatic sulfonic acid that acts as a catalyst), and 0.5 per cent sulfuric acid. It is then hydrolyzed by boiling in open tanks with steam for 24 to 36 hr. Two to four stages are normally used with the glycerol – containing sweetwater being withdrawn and replaced with fresh water at the end of each stage. The efficiency with which the fat is hydrolyzed to fatty acids and glycerine is better than 90 per cent. The sweetwater (glycerine – water solution) is

purified and concentrated. The dark – colored fatty acids are then fed to a batch still where by vacuum or steam distillation the acids are distilled overhead, and a tarry residue is removed as bottoms. A typical distillate from grease fatty acids contains 40 to 50 per cent saturated acids (chiefly Palmitic and Stearic acids), up to 10 per cent Linoleic acid, and 40 to 45 per cent Oleic acid.

To separate the solid, saturated acids from the unsaturates, the distillate produced as above is pumped into pans which are chilled in a refrigerated rack. After cooling, the solid cakes are removed, wrapped in burlap bags, and pressed in a hydraulic press.The liquid pressed out is "red oil" (commercial Oleic acid): the residue is single – pressed Stearic acid (actually in common practice 55 percent Palmitic acid and 45 percent Stearic acid, with an iodine value of 9 to 14). If the solid cake is reformed and given a hot press in the presence of steam, the product is double – pressed stearic acid. Recasting and repressing at a higher temperature yields triple – pressed acid.



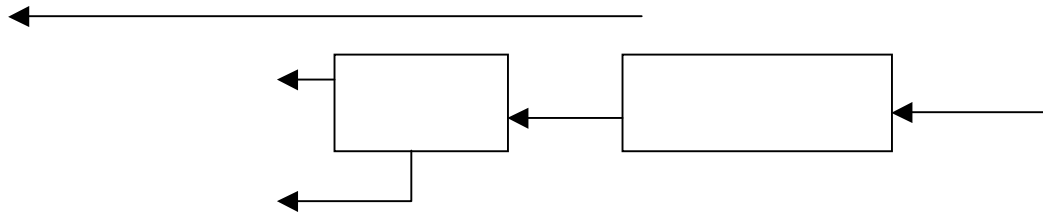


Fig 1.3 From Fat By Twitchell Process And Pressing

HIGH PRESSURE SPLITTING AND SOLVENT CRYSTALLIZATION

A selected fat stock is first pumped through a deaerator to prevent darkening by oxidation during processing. It is then pumped at a temperature of 140^0F into the bottom of a continuous reaction chamber or column where it flows counter currently to hot water descending the column.The molten fat feed enters the reactor through a sparger which disperses the fat stock to droplets so as to give better contact with the water. The liquid in the middle of the column is heated to 500^0F (725 psi) by the introduction of 800 psi steam at appropriate levels in the tower. Contact time is 3 to 5 hours. Efficiency of splitting is 97 to 99 per cent. The sweet water leaving the bottom of the column contains 10 to 25 per cent glycerine and needs only a light lime treatment prior to concentration.

The fatty acids leaving the top of the splitter may be purified and separated by either fractional distillation or crystallization. The method shown in the flowsheet, continuous – process fractional crystallization, is adapted to a wider range of fat stocks than the pressing process. In the latter process only solid animal fatty acids with the proper ratio of Palmitic acid to Stearic acid may be crystallized easily. In the continuous process no such limitation exists.

The most common solvents are acetone, aqueous methanol, and liquid propane. In the process shown, a solution of fatty acids in aqueous methanol is pumped through a chiller in which the solution is cooled indirectly by a refrigerant.The saturated fatty acids crystallize and are removed on a continuous vacuum filter. The cake goes to a stripping

still where solvent is removed and the Stearic acid recovered. The product is equivalent to double – pressed Stearic acid. In a like manner, Oleic acid is recovered from the filtrate, at about 90 per cent purity.

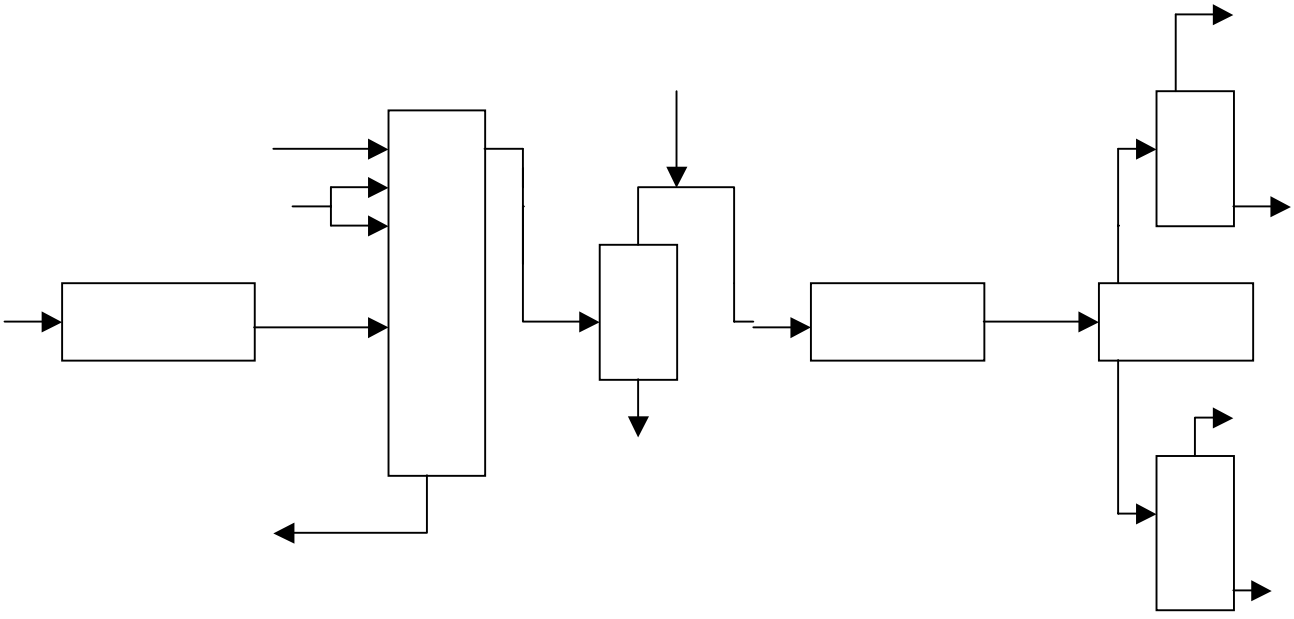


Fig 1.4 Continuos High Pressure Splitting And Solvent Crystallization

PROCESS CHOSEN:

The process chosen is **Fat by continuous high pressure splitting**, and separation of Stearic acid and Oleic acid by crystallizatiaon using flooded chiller. Also, this process is widely used in commercial process known as Colgate – Emery process by Hindustan Lever

The continuous process fractional crystallization is adapted to wider range of fat stocks than pressing process.