Link 7: Process of classic plant oil refinery and quality

A classic chemical plant oil refinery process undergoes the following typical steps:

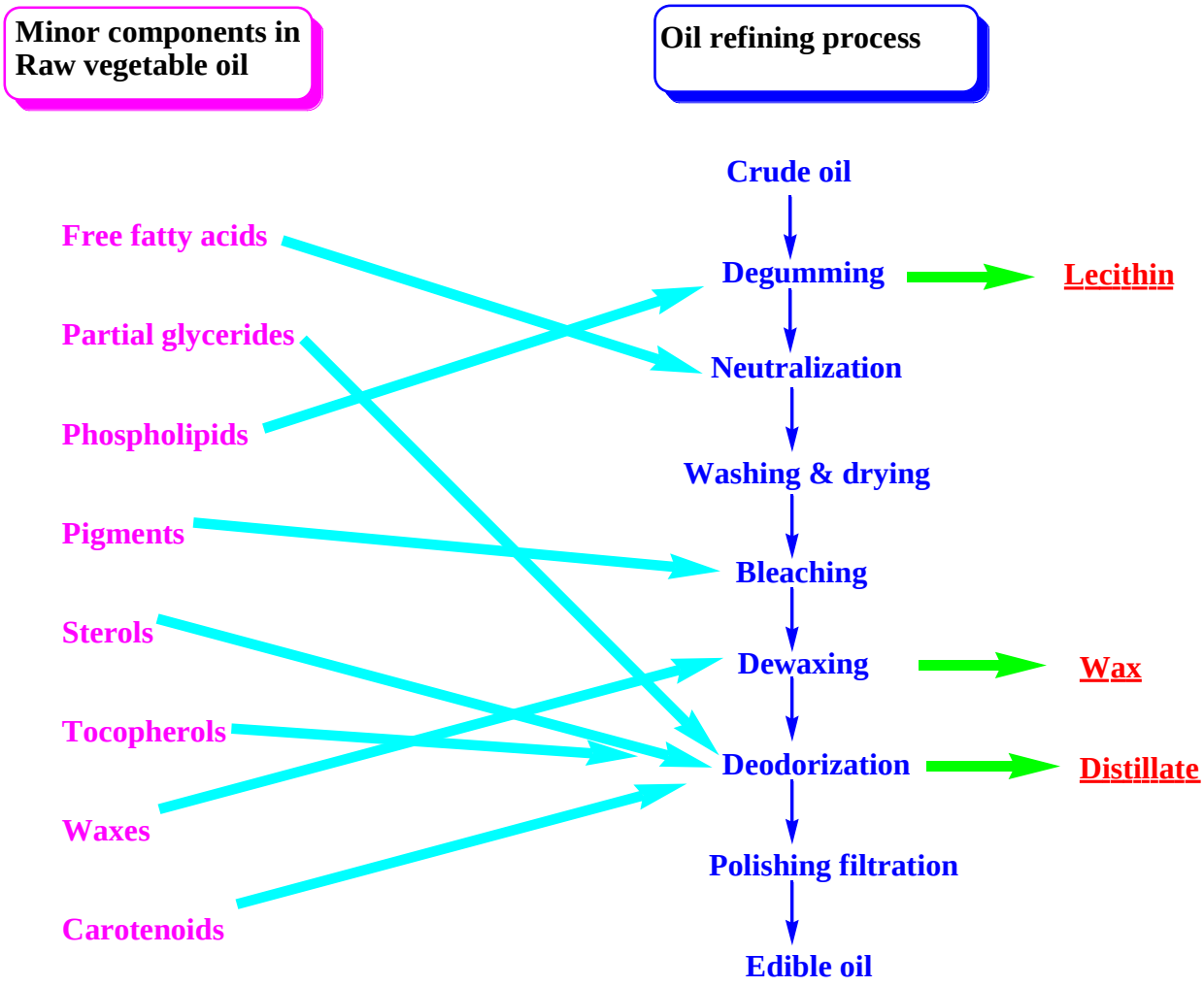

Fig. 1. General procedure of chemical refinery and minor components removed in each step

Grude plant oil from mechanical pressing and solvent extraction contains a certain content of minor components. These components such as free fatty acids, partial glycerides, phospholipids and pigments etc, either influence the oxidation stability and flavor, thus leading to short shelf life of oil product; or affect the physical state or appearance, leading to decreasing product value and physical stability. The purpose of refinery is to remove these minor components to obtain high quality oil.

Our lab is equipped with lab-scale and pilot-scale reactors to carry out degumming, neutralizing, bleaching, dewaxing and deodorizing process. The scientists in our lab have all essential reagents and experiences to conduct these processes in the lab and assay the product quality according to standard specification of commercial. Corresponding to these processes, we can do:

- **Degumming (5 liter glass reactor)**: measure phosphorus content before and after hydration according to AOCS official method Ja 5-55;
- **Neutralizing (1, 2, 5 liter glass reactor)**: measure free fatty acid content (Acid Value, AV) before and after neutralization according to AOCS official method Cd 3a-63;
- **Bleaching (2 setups of bleaching equipments with autocontrol vacuum and heating)**: Measure oil color according to AOCS official method Cc 8a-52 (Lovibond tintometer);
- **Dewaxing: (Cooling bath)** to measure content of wax before and after dewaxing using weight reduction method.
- **Deodorization (lab-scale 5 L glass reactor; pilot scale performed in connection with AAK)**: Measure peroxide value (POV), Acid value (AV), color (Lovibond tintometer) and mono-and di-glyceride contents according to AOCS official method Cd 11b-91 using GC with the silylation derivation of sample.

Short Path Distillation and Fractionation of glycerides

Principle of Short Path Distillation SPD

Short path distillation is a thermal separation technique operating at a process pressures in the range of 1 to 0,001 mbar. It lowers the boiling temperature and is an excellent method for gentle thermal treatment of heat sensitive, high boiling products. The Short Path distillator consist basically, of a cylindrical body with a heating jacket, a rotor and condenser inside. On the supporting structure of the rotor mobile precision wiper blades are mounted. They are forced by centrifugal force to fold open in direction of the inner shell and are pressed against this (*Fig. 1*).

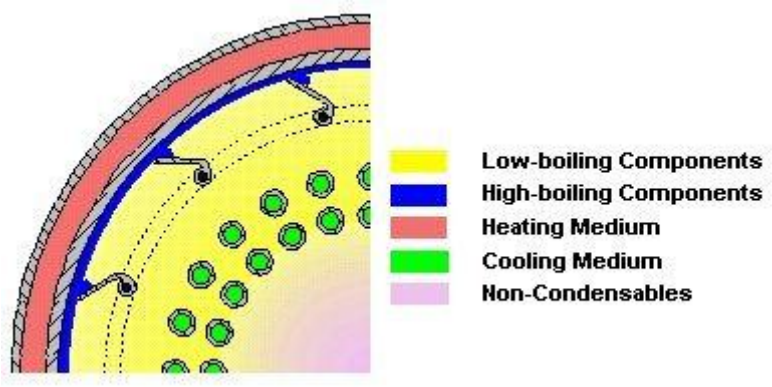

Fig. 1: Cross section of the Short Path Distillator

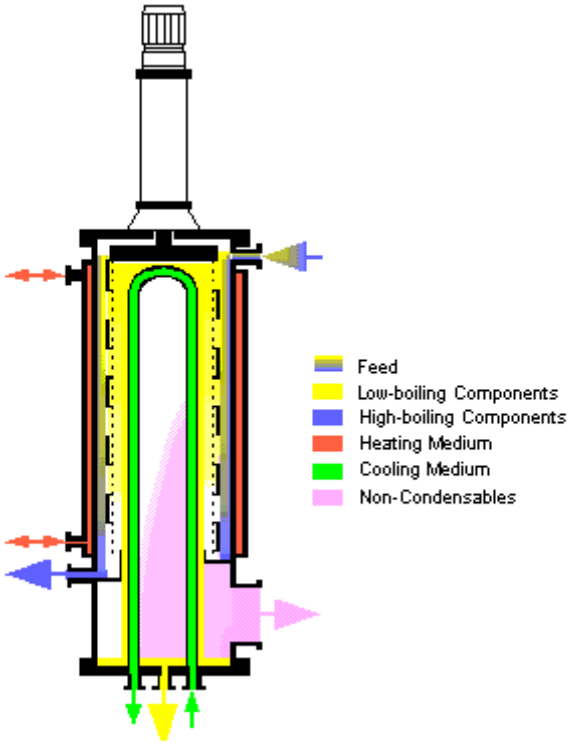

Fig. 2: Longitutinal section of the Short Path Evaporator Distillator

The wiper blades create a mechanically agitated, thin product film on the heating surface inside of the body. By means of gravity the product flows in a spiral path downwards, whereby the volatile portion of the product evaporates.

The vapour passes by the shortest route and with practically no pressure drop to the internal condenser where it is recipitated on the tubes. The non-volatile portion reaches the lower part of the evaporator and leaves it through the bottom product outlet. The residual vapours and inert gases flow through the vacuum nozzle to the vacuum system. (*Fig. 2*)

Application of short path distillation

The lipids lab is equipped with one KD 5 and KD 6 (Fig. 3) which are able to process from 200 g/h to 9kg/h. Through a few projects, our scientists and technicians have gained a lot of experience in preparation high purity free fatty acids, monoglyceride, diglycerides and triglycerides. From a mixture, we are able to achieve

- >98% triglycerides
- >95% diglycerides
- >96% monoglycerides
- >92% Fatty acids

Fig. 2: Pilot scale short path distillation KD-5

References7

1. AOCS Official methods
2. Xuebing Xu, **Short-Path Distillation for Lipid Processing, in** Healthful Lipids, eds. Oi-Ming Lai and Casimir C . Akoh, AOCS Publishing 2005.