

Dry Fractionation: A Cutting-edge Technology for Green Chemistry

Dr. Véronique Gibon
Consultant, Artemis Lipids by VG - Namur
Belgium
artemislipids@hotmail.com

The most fascinating property of oils and fats is their ability to form crystals. Fractionation is a modification process based on crystallization. Drivers for fractionation are quality improvement or design of new products with specific compositional characteristics. Competing technologies are dry fractionation, solvent fractionation and detergent fractionation; dry fractionation is today the best environmentally friendly process consisting in selective crystallization of the highest melting point molecules followed by separation into solid and liquid fractions. Crystallization is usually conducted under shear (high or low); for few special cuts, crystallization in static mode is recommended. In many cases, dry fractionation is a batch process; some crystallizers are currently designed for operating in continuous mode. If crystallization is well conducted, separation becomes a child's play. Powerful controls aim to improve selectivity or to optimize cycle times and yields; as well, seeding promotes proper crystallization of batch operations and is the basic principle of the continuous process. Continuous fractionation is particularly adapted for a large range of products and helps boost product yields in many applications. Although centrifugation technology has evolved in recent years, the membrane press filter remains today the most robust, with squeezing pressures up to 15 bars for commodity fats or 30 bars for special products. Dry fractionation is applied in the food (triglycerides) or in the oleochemical (fatty acids, methyl esters) sectors, with many applications. Palm oil is the most fractionated edible oil worldwide. Substitutes for hydrogenated products with steep melting profiles can be obtained in two steps ; such super stearin cuts are also desired for HMFS (OPO fats) through enzymatic interesterification. High-quality hard palm mid fractions are produced in three steps ; they can be used as direct ingredient for CBE, with fractionated exotic fats or enzymatic concentrates. For palm kernel oil, single fractionation is possible so as to produce a stearin with CBS properties without post-hydrogenation. Dry fractionation is sometimes called winterization when the goal is to improve cold resistance. It is the first step in fish oil processing for high omega-3 concentrates by enzymatic process ; it is also used in single or double step to dewax or to winterize rice bran oil. In oleochemistry, fatty acids or esters are regularly fractionated after splitting and (fractional) distillation ; oleins and stearins particularly enriched in unsaturated and in saturated fatty acids/esters have various applications. Solvent (acetone) fractionation nevertheless remains applicable for few applications where dry crystallization has still limitations today.