Solutions for Your TOUGHEST MIXING Applications in FOOD

Refining of Edible Oils

SILVERSON
THE FIRST NAME IN HIGH SHEAR MIXERS
Refining of Edible Oils

Edible oils obtained from coconut, corn, cottonseed, olive, palm, peanut, soya bean and sunflower, etc. contain gums and other impurities which are removed by degumming, neutralizing and bleaching processes.

The Process

The basic principle of these processes can be summarized as follows:

Degumming

- Untreated oil is heated in an in-line mixer with acid, which reacts with phosphatides (gums) in the oil, making them hydratable.
- Water may be added to hydrate the phosphatides before removal in the separator.
- Oil may pass straight to neutralizing or bleaching without removal of gums ("acid conditioning").

Neutralizing

- Sodium hydroxide solution (caustic soda) is added to untreated, degummed or acid conditioned oil in an in-line mixer.
- Sodium hydroxide neutralizes excess acid and saponifies fatty acids in the oil.
- A washing stage may be carried out to remove residual soap.
- Spent water is separated.

Bleaching

- Degummed and/or neutralized oil is treated with water to form an oil/clay suspension.
- Impurities are adsorbed by the clay.
- Clay and adsorbed impurities are filtered.
- Bleached oil is stored or packed.

The wide range of oils processed by these methods leads to considerable variations in process requirements:

- Oils which tend to emulsify may be held in a vessel after mixing with the reagent to allow the emulsion to break before passing to the separator.
- In the degumming process the typical acid addition is 0.1 - 1%. Phosphoric acid is most commonly used, although citric acid is suitable for some oils.
- Process temperature is typically in the range of 120 - 160°F (50 - 70°C).
- Neutralization process temperature may be higher, up to 200°F (95°C).
- The strength of the sodium hydroxide solution varies according to the acid content and oil type.
- During bleaching, a filter aid such as diatomaceous earth may be added to prevent the finer clay particles from blinding the filter medium.
Edible oil refining is normally a high volume, continuous operation. The reagent additions are traditionally carried out using low shear static mixers or inline agitators, which can lead to several potential problems:

- The acid and sodium hydroxide solutions make up only a small fraction of the total product, and must be reduced to the smallest possible droplet size to ensure intimate contact with the oil. Low shear devices with a relatively short dwell time cannot easily achieve this.
- With the clay addition, conventional agitation cannot rapidly produce an agglomerate-free, homogeneous suspension.
- Poor dispersion of reagents reduces process efficiency, leading to increased chemical consumption and waste.

The Problem

The Solution

A Silverson High Shear mixer can be used for the acid, sodium hydroxide and clay additions. Easily fitted in place of the static mixer or inline agitator, the Silverson mixer can produce a fine dispersion of reagents in a single pass. This is achieved as follows:

**Stage 1**

The reagent is introduced to the oil just prior to the intake of the Silverson mixer. The ingredients are drawn into the rotor/stator workhead and vigorously mixed.

**Stage 2**

Centrifugal force drives the materials to the periphery of the workhead where they are reduced to a fine droplet/particle size in the gap between the rotor blades and the inner wall of the stator.

**Stage 3**

Further reduction in particle size follows as the mixture is forced out through the stator, increasing the surface area of reagent exposed to the oil. This accelerates the reaction, and maximizes the yield.
The Advantages

- Improved dispersion of reagents into the oil maximizes the surface area exposed to the oil, accelerating the reaction.
- Reduced chemical consumption and less environmental impact.
- Rapid processing times.
- Easily interchangeable workheads and screens allow the Silverson mixer to be adapted to optimize performance for processing a range of oils.

Silverson offers a range of machines suitable for the acid and sodium hydroxide additions, and the Silverson Flashmix for the clay dispersion:

**High Shear In-Line Mixers**
- Aeration free
- Easily retrofitted to existing plant
- Ideal for continuous processes
- Ultra Sanitary models available
- Multistage units available offering a greater degree of shear, resulting in finer particle size and faster processing times

**Silverson Flashmix**
- Designed for high speed dispersion of powders into liquids
- Minimized cleaning requirements
- Minimum operator input required