

# The Application of Fluid Mixers in Edible Oil Processing

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**EDIBLE OIL PROCESSING**

**Background**

Edible oils fall into two categories:

1. Vegetable oils which are obtained by processing soybeans, olives, coconuts, corn, peanuts, sunflower seeds, cotton seeds, sesame seeds, flax seeds and safflower seeds.
2. Animal oils and fats which are rendered from the trimmings of freshly slaughtered animals.

**Vegetable Oil Processing**

Vegetable oils are recovered by grinding, cooking, expelling and pressing, or by solvent extraction of the raw materials. The oils are filtered and put in

- (A) **CRUDE OIL STORAGE - WITH FOOTS.** (Foots are the solid fragments of crushed seeds that pass through the filter.) These tanks will be equipped with side entry mixers to keep the foots in suspension and ensure a uniform feed to down-stream equipment. Mixer selections are given in Table I. These tanks are often built with heating pipes. Agitation below these pipes will be reduced, resulting in solids settling and the need for periodic cleaning.

The next process step is called refining. In

- (B) **BATCH REFINING** the oil is treated with a 20% caustic solution to react the fatty acids. This results in the formation of soft soaps which are decanted off. Too much agitation will emulsify the mix resulting in long separation times. Use gear drive portable mixers at 1 HP/1000 gallons, or small top entry mixers at 0,6 HP/1000 gallons.

Some refining is done in continuous "packaged" systems built by suppliers of continuous separations equipment.

The oil now goes to

- (C) **REFINED OIL STORAGE.** These tanks provide surge capacity in the system. Lower power levels are used than for crude oil with foots. See Table I for recommendations.



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Oils are sometimes blended before further processing.

- (D) **BLENDING** may be done in small tanks with portable mixers at 0.3 - 0.4 HP/1000 gallons for 20 - 30 minute blend times. Larger tanks will use side entry mixers at 0.2 - 0.3 HP/1000 gallons.
- (E) **BLEACHING** of the refined oil is accomplished by intensive mixing with 0.5 -2.0% bleaching clay. Use 4 HP/1000 gallons with side entry mixers or 2 - 3 HP/1000 gallons with top entry mixers using radial turbines.

Oils are modified by

- (F) **HYDROGENATION** to reduce the degree of un-saturation, raise the melting range, improve color and flavor and enhance the resistance to oxidation. Historically "Iodine Value" has been the method to measure unsaturation. Chromatography is slowly replacing I.V. as an analytical tool.

Hydrogenators are usually tall tanks with cooling coils and multiple impellers operating at relatively high speeds (-100 RPM). The principal catalyst is nickel on Kieselguhr. The hydrogen feed is closely controlled because of the highly exothermic reaction. Mixer power levels will range from 3-10 HP/1000 gallons with Rushton turbines for primary gas dispersion and axial impellers to promote heat transfer and to reincorporate hydrogen from the vapor space by vortexing.

Vegetable oils have a specific gravity of-0.92 at room temperature and 0.81 at 350°F. Viscosities range from 105 CPS at 50°F to 35 CPS at 100°F and 3 cps at 350°F.

#### Animal Oil Processing

The primary mixing application for animal oils will be storage tanks. Use the same power levels as for (C) Refined Oil Storage. Viscosity and specific gravity values are higher than for vegetable oils, but temperatures are usually higher as well. SG factor and viscosity factor of 1.0 are safe for loading calculations.



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TABLE I		
VOLUME GALLONS	CRUDE OIL STORAGE W/FOOTS	REFINED OIL STORAGE
10,000	SXT (3 HP)	SFRG(1.5HP)
15,000	SXT (3 HP)	SFRG (2 HP)
20,000	SXT (5 HP)	SFRG (3 HP)
30,000	SXT (5 HP)	SFRG (3 HP)
40,000	SXT (7.5 HP)	SXT (3 HP)
50,000	SXT (7.5 HP)	SXT (5 HP)
60,000	SXT (7.5 HP)	SXT (5 HP)
80,000	SXT (10 HP)	SXT (5 HP)
100,000	SXT (10 HP)	SXT (7.5 HP)
150,000	SXT (15 HP)	SXT (7.5 HP)
200,000	SXT (15 HP)	SXT (10 HP)
300,000	SXT (20 HP)	SXT (10 HP)
500,000	-	SXT (15 HP)
750,000	-	SXT (20 HP)



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TABLE II - SUMMARY				
REF	OPERATION	IMPELLER	EQUIPMENT	RECOMMENDATION
(A)	Crude Oil Storage, with Foots	FOIL	Side Entry	Per Table I
(B)	Batch Blending	FOIL	Portable Top Entry	1 HP/1000 Gallons 0.6 HP/1000 Gallons
(C)	Refined Oil Storage, Animal Oil Storage	FOIL	Side Entry	Per Table I
(D)	Blending	FOIL	Portable, Small Tanks Side Entry, Large Tanks	0.3-0.4 HP/1000 Gallons 0.2- 0.3 HP/1000 Gallons
(E)	Bleaching	FOIL RADIAL	Side Entry Top Entry	4 HP/1 000 Gallons 2-3 HP/1000 Gallons
(F)	Hydrogenation	RADIAL & AXIAL	Top Entry	3-10 HP/1000 Gallons