Small Scale Processing of Vegetable Oils

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ABSTRACT

Economic factors affecting small scale vegetable oil processing operations are discussed, together with the advantages and disadvantages of such systems.

Throughout the world, the refining of vegetable oils practically always includes deacidification, bleaching, and deodorization, but one finds some sensible differences in the equipment used to bring to market products responding to the needs of consumers.

The choice of equipment used will depend on a certain number of factors related to the quantity of raw material, its quality, available manpower and maintenance facilities, the quantities required to process daily, and, of course, the available financial resources.

Also, among the other factors to remember are whether or not refining is associated with the processing of the seeds, proximity of the raw materials, proximity to the consumers' market, state of transportation infrastructure, etc.

It is evident that the large factories are often very specialized and concentrate on a limited number of raw materials, which are uniform and homogeneous. They are often located, particularly in Europe, near large ports or where import resources are concentrated. They are equipped with higher technological, very automatic, continuous processes. The necessary investments are high, but the number of manufacturing personnel is very low.

When, on the other hand, as in the interior of France, the oil resources are numerous and changeable according to the conditions in the markets and the enterprise is close to the consumers' markets, it is necessary to have a flexible and adaptable process. The extent of the processing chains will therefore be in terms of needs.

Neutralization can be done in 3-10 ton batch tanks heated by serpentines. Soda washing is done by sprinkling on the surface while stirring the mass at a fixed temperature.

After the addition of salted water at the same temperature to make the soapstock heavy and facilitate separation, this mass will be transferred to a decanting apparatus, at the conical bottom of which, after decantation, one will draw off the soapstock contained in the lower part of the apparatus. The separation at the level of the oil/soapstock interface being critical, it will be obtained at the narrowest part of the bottom of the cone.

The ability of the operator is of great importance for the best separation and least loss of neutral oil. Yields obtained will be good enough on the whole, with some drawing-off coefficients that will be scarcely less favorable than in the more modern centrifugal installations, always depending again on the condition of loosening the soapstocks, i.e., heating them in the presence of a supplementary addition of salted water directly on the soapstock and letting them settle for 24 hr before recovering the oil which has come to the surface. In this case, the drawing-off coefficients can reach 1.7-1.8.

In this equipment, one can easily refine some lots of doubtful quality (because of deterioration of the raw materials) which could not be neutralized by continuous refining.

Regarding neutralization and degumming, it is, however, possible to use centrifugal equipment, thanks to the modular possibilities it offers.

Bleaching in the mixer under a vacuum will be followed by filtration on classic filter presses. One must remember that the period of contact with the clay will be longer and the draining of the clay used will not be as good as with continuous equipment using automatic filtration, but at the cost of less flexibility and heavier investment in the continuous system.

Deodorization can be done in big vacuum kettles—today generally stainless steel with a volume from 3 to 10 m^3 and a diameter of 2-3 m—heated by means of serpentines with steam or thermal fluid to 180-240 C. They allow treating between 3,000 and 6,000 liters of oil at a time. (Equipment up to 25 tons also exists.) The oil at a pressure of 1-6 mm will be held at high temperature, most often in the same container, and it will be sparged with steam, which removes taste, odor, and flavor compounds. Still in a vacuum, the oil will be cooled to a temperature of 35-50 C before being pumped to a finishing filter. The time of the operation will vary between 5 and 12 hr depending on the initial quality of the oil and the heat and vacuum available.

The description we have just made of the equipment is not exhaustive. One could cite the deodorization columns invented more than 50 years ago, yielding 2 tons/hr for a cost of ca. $25,000. Other apparatus with discontinuous action can be made equivalent to continuous systems by adding automatic equipment, notably motorized valves and baffles.

All these materials have in common very great flexibility and are very adaptable to the treatment of different products. Without that flexibility, the operation might be particularly difficult for the operator. With direct and constant control, the plant can process in a week 100-200 tons of oil which can be of four or five different types.

In terms of manpower, these batch plants are more exacting, and, of course, the number of workers required is much greater than in very automatic continuous factories. The batch installations will, of course, be less economical in energy.

However, the inconveniences and inefficiencies which these factories can suffer are compensated for by their ability to work with all the oils required by the local market while profiting from savings in transportation expenses on raw materials and on distribution. They can also produce products in a small quantity corresponding to specific needs, which isn't possible in large scale operations.

In developing countries where some social problems exist and manpower is readily available, costly efforts to improve productivity are not justified. Furthermore, refining equipment of small size is used chiefly on account of limited capital available. It should be emphasized that the equipment described here is relatively unbreakable and will not wear out, whereas the sophisticated equipment is more fragile and sometimes less trustworthy. How to operate if a main piece is completely broken down is a big problem in places where maintenance and repairs are not readily on hand.

Further, the limited technological complications inherent in these installations, the poor road infrastructure and therefore the high cost of transportation, and the small capital requirements will fully compensate for the inconveniences of the batch equipment or small size installation well-conceived in terms of local situations.

The flexibility of the small to average size factory will always justify its existence in many local areas—especially in developing countries with limited resources.