The Up-Grading of Inedible Tallow Through Centrifugal Purification[1]

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PROBABLY NO INDUSTRY in the past 10 years has had the "rug pulled out from under it" so effectively as the inedible rendering industry. The rapid rise of synthetic detergents over-night created a major marketing crisis. The inedible renderer saw one of his major markets, the domestic soap manufacturer, declining in importance. He has however countered this situation in a number of ways. The industry has sought new outlets for its product, produced a better product, and through automation reduced operating costs. We believe that the centrifuge is playing a significant role in the last two steps.

One of the most important methods of producing inedible tallow and grease in this country is through the standard dry-rendering system. Such an operation utilizes hogging or size reduction of the fat-bearing material, followed by cooking in a dry melter. This is a jacketed tank, agitated and normally operated under vacuum. A relatively high steam pressure is maintained in the jacket, and high temperatures are utilized to drive off all the moisture from the ground fat. The dry melter is normally operated batchwise, producing after one or two hours' cook a material containing liquid fat and dry protein, normally referred to as "cracklings."

The mixture of free fat and cracklings may be passed to a screen or percolator where the free run or relatively clear tallow is drained off. Solids may then be automatically or manually passed to an expeller or, in some cases, hydraulic press. The expeller press is frequently found in large-size operations. The press discharges a cake low in fat content; however the press also recovers a fat stream containing, particularly with expellers, relatively large amounts of fines. The tallow or grease produced by such a dry-rendering system, both from the percolator box or from the expeller or press, then is normally passed through a series of settling tanks. During the settling the quality of the tallow frequently becomes downgraded because of the presence of entrained moisture, in some cases, as well as high temperatures.

During the era of a seller's market, tallow and grease could be sold after relatively short periods of settling, provided the moisture and insolubles present together with the nonsaponifiables were below the normal specification of 1%. However the creation of a buyer's market brought about more stringent specifications on the clarity of the finished tallow, particularly with reference to the presence of fines. This condition, plus the pressure of high tallow inventories, required through extended settling times, as well as the not insignificant problem of tank cleaning, brought about a desire on the part of the industry to find a quick, continuous operation.

The general demands of the inedible rendering industry required that a solution be found to the purification problem which eliminated prolonged settling, produced a high-grade product, and utilized only relatively inexpensive self-cleaning, low-maintenance equipment.

The centrifuge manufacturer quickly advanced the answer as the extremely rugged and dependable solid bowl self-cleaning centrifuge of the Super-D-Canter type. A cut-away of a typical unit is shown in Figure 1. In this type of centrifuge, solids are deposited under centrifugal force against the bowl wall and are continually removed by a screw conveyor, operating at a differential speed as compared with that of the rotating bowl. The centrifuge is self-cleaning and easily maintained, and it can handle large amounts of solids.

While this unit in the initial stage was operated with some success, it was found quickly that it would not under normal circumstances produce the clarified tallow that was being required. This was particularly the case when operated on tallow produced from expeller operations where the percentage of fines was extremely high. The centrifuge readily removed large amounts of coarse cracklings but approximately 0.4% of fine-insoluble material remained in the clarified fat. The centrifuge appeared to be classifying out the more coarse fraction but permitted the fine fraction to carry through with the clarified fat. In operation it represented an ideal piece of equipment, particularly since it could be utilized in various sizes to handle capacities from 1,500–5,000 lbs./hour, but, in effect, it just would not produce an acceptable product due to too excessive fines.

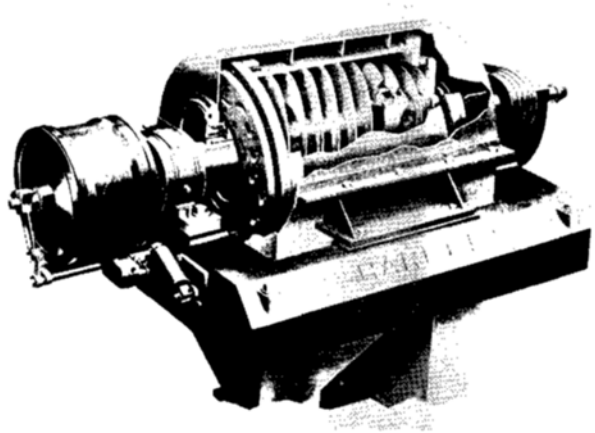


FIG. 1. Cut-away view of Super-D-Canter showing details of an internal conveyor for continuous solids-removal.

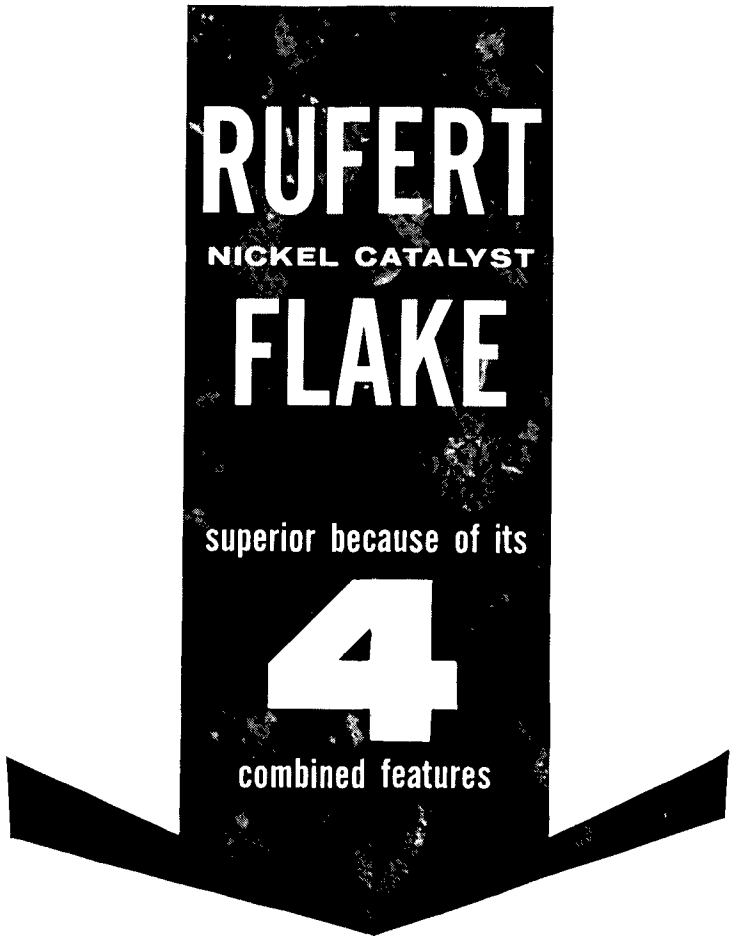
The renderer wished to produce a tallow equivalent to that produced from prolonged settling, that is, not only low in moisture but extremely low in insolubles content. The inedible renderer found that his customers were utilizing a filtration type of test to determine the fines present. Such tests normally determine the amount of fines present as the volume of liquid fat measured, say, in cubic centimeters, that will pass through a filter paper in a given period of time.[2] Thus a sample of tallow having a filtration rate of 40–42 would have substantially greater clarity than one which would only pass 20–25 cubic centimeters in the given period of time.

In the use of standard settling tanks to meet the filtration requirements, frequently a wash of either a brine or trisodium phosphate content was utilized. These washes, when mixed with the oil, would collect and wet the solids and assist in their sedimentation. This type of operation was quickly adapted to the Super-D-Canter. However, since the Super-D-Canter could not discharge a separated water layer but discharged only a solid phase and clarified-fat phase, it was important that the amount of treat be rigidly controlled and the degree of mixing between the treat and the oil phase be sufficient to provide complete contact. Tests with water of approximately 0.3% treat were somewhat effective. Brine also was tested; however the most satisfactory operation was obtained with low treats of 10% and 20% TSP solutions.

As shown in Table I, the effect of the TSP treat on the reduction of the filtration rate was substantial. The trisodium phosphate treat not only had an effect on the

[1] Presented at the 33rd Fall meeting, American Oil Chemists' Society, Los Angeles, Calif., September 28-30, 1959.

[2] One test method filters at 230° F., using an Eaton-Dikeman No. 617 paper.



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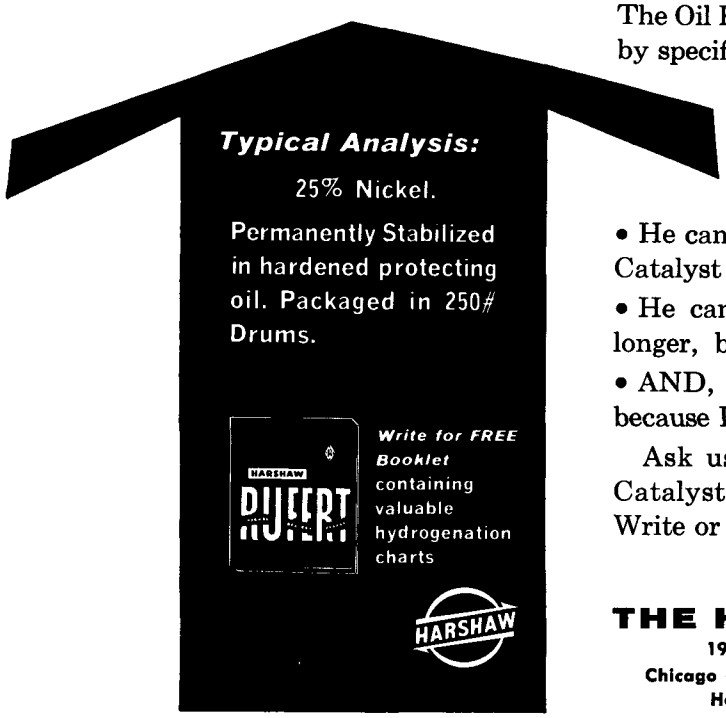

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TABLE I

The Effect of the Preconditioning of the Centrifuge Feed on the Clarity of Effluent

Treatment of the feed	Kerosene insolubles	Moisture	Rate of filtration [a]	Lovibond color 1 in. Tubes	FFA
	%	%			%
None	0.40	0.18	25	70y–12.1r	1.4
4% Water treat	0.22	0.25	33	70y–12.1r	1.4
4% Treat of 10% trisodium phosphate solution	0.15	0.27	39	35y– 3.5r	0.9
Feed	3.0	0.44	15	70y–12.1r	1.4

[a] A value of 42 would be maximum.

removal of fines, but to some extent it neutralized the fatty acid present. Again, it also had, as shown in the table, a significant effect on color. Abnormally high solid content feeds, particularly those with large amounts of fines from the expeller, necessitated substantially higher TSP treats. As a rule of thumb, it is normally estimated at 1.0% of treat for 1.0% of insoluble solids present. The effect of increasing the percentage of TSP in the treat also provided for an increase of density difference between the wash and the oil and more rapid separation.

An operational problem occurs in the handling of this type of system in that frequently, because of lack of operator control or the variation in the type of feed, the amount of treat becomes excessive. Under such a circumstance a flash system, capable of removing up to 0.3% of moisture, may be utilized. A typical, complete treating system, as shown in Figure 2, provides for the automatic operation without operator attention and tallow product having a combined moisture and solids content of less than 0.5%. Such a system, as shown in the flow diagram, utilizes a small-size Super-D-Canter with a capacity of approximately 1,500–2,500 lbs./hour.

The operation of the solid bowl Super-D-Canter has been quite satisfactory in a large number of installations. Of particular interest are those operations processing poultry grease. Here the problem of large amounts of fines becomes extremely serious since the protein fraction obtained from the processing of poultry tends to break up and become extremely fine. The operation of the Super-D-Canter in such installations has been quite satisfactory and has been able to produce grease of extremely low insolubles-content.

The problem of purifying inedible tallow and greases however is not limited to material produced only from dry rendering. Frequently the inedible renderer wishes to handle fat streams containing substantial amounts of water, either from wet-rendering systems, solvent extraction, or trap grease, etc. Such material also may require a wash of various types. In this case, where the feed contains substantial amounts of moisture, another type of centrifuge is required. The use of the disc centrifuge in these cases, particularly the self-cleaning unit, has been quite satisfactory. Of particular interest is the self-cleaning disc unit containing hydrostatically operated valves. This unit, utilizing valves which will open or close as either solids or emulsion builds up in the bowl, can be operated either as a clarifier unit to handle feeds with small percentages of water or as a separator for extremely large amounts of water in the feed. In the installations that have been made, the unit is normally preceded with a self-cleaning screen (40–60 mesh) of the SWECO type to remove large over-size particles. The centrifuge has been effectively used with a wash, either a TSP or brine wash, to chemically treat the oil. The centrifuge in this case will discharge clarified oil having but 0.1% or so of moisture and a negligible solids-content. Filtration rates of clarified oil from such a unit would be close to the theoretical.

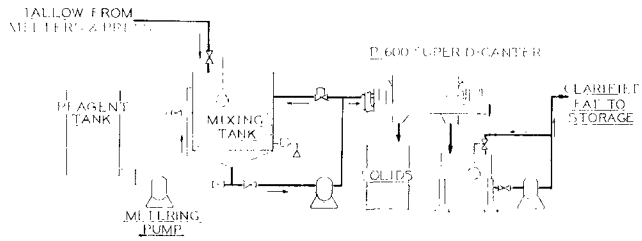

FIG. 2. Super-D-Canter purification system for inedible tallow.

While the self-cleaning disc machine is utilized to a great extent to handle feeds containing both water and solids, it also has found application in the neutralizing or light refining of various types of oils produced in the rendering plant. The unit contains the hydrostatically operated valves which will discharge either emulsion, solids, or, in the case of refining, soapstock. Neutralized oils from feeds containing high amounts of fatty acids have been produced on production operation with this unit. The losses of oil in the soapstock discharging from the unit, while not the same as the loss obtained by the tubular unit, which employs high centrifugal force, has been comparable to that obtained from normal disc operation.

The ability of this type of disc unit to handle all types of feed in the rendering plant has made, in general, a very stable and worthwhile "work-horse" of the industry.

At the present time considerable interest is being displayed in the possibility of continuous rendering of inedible feed stock similar to that employed in the edible rendering industry. The utilization of high-speed size-reduction equipment, together with the new techniques in continuous cooking that are being advanced, will, we believe be utilized with continuous centrifugal separation to bring about the same advantages in reduction in operating cost and improvement in quality that has already been obtained in the edible-rendering industry through the use of centrifugal separation.

[Received December 21, 1959]

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