• Cottenseed Protein Products . .

(Continued from page 188A)

It was found that agitation of the solvent-damp marc at either atmospheric or reduced pressure with application of heat to supply heat of vaporization, served to distill the volatile solvent and part of the water at low temperatures (e.g., 70–150 F). The amount of water removed in this preliminary step depends on the particular solvent combination used and whether or not an azeotropic mixture is formed which causes removal of at least part of the water with the organic solvents (3). This portion of the solvent mixture can be recovered by condensation in conventional equipment. Further drying to reduce residual moisture which may be as much as 20% by weight of the wet protein mixture, down to 10% or below to form a dry meal requires application of the techniques previously described.

For example, 8 lb of marc (derived from extraction of 4 lb of raw cottonseed meats with a mixture of acetone, hexane and water in the volume proportion of 53:44:3), which contained 70% of total volatile matter by weight, were added to the mixing chamber. The volatile matter consisted of 9% water, which included the natural moisture of the meats, and 91% of acetone-hexane mixture. The steam jacket had been preheated to 250 F and was maintained at this temperature throughout the drying operation. The constant boiling mixture of similar composition but with less water than the extraction solvent distilled at 120 F which was the temperature of the agitating marc. A plastic doughy mixture containing 18% water remained. This was dried in the same way as for the water mixtures described previously. In some instances the blades of the mixer jammed as before unless alkali or acid was added. The behavior of the wet marc in presence of the added chemicals was quite similar to the watery mixture.

Figure 5 shows data for the aqueous mixture without added chemicals.

Figure 6 shows data for the acidic mixture. Figure 7 shows data for the alkaline mixture.

The granular meal discharged from the acidic and alkaline mixtures after drying had a moisture content of 8–10% and no odor of residual solvent.

Experiments were next performed on desolventizing and drying at atmospheric pressure. A charge of 8 lb of the same marc was treated with H_3PO_4 as in the previous example. This time, however, instead of applying vacuum to the chamber after removal of the volatile organic solvents by distillation, 2 lb of meal previously dried in the presence of added H_3PO_4 were fed back to the moist, plastic mass while stirring continued. In about 1 min the mixture granulated. Mixing was continued for 30 min while a gentle stream of air from an electric fan was passed over the agitating mixture. The dry meal was discharged as before and found to contain 9% moisture with no odor of organic solvent.

Another 8 lb batch of marc was treated with NaOH, desolventized and dried at atmospheric pressure in the same way, by adding 2 lb of alkali-treated meal to reduce the moisture below the critical tough plastic stage.

While the experiments described were performed to study the behavior of wet vegetable protein under mechanical processing conditions, the information obtained can be applied to large-scale oilseed protein processing. Desolventization of the meal is a necessary step in all oilseed extraction processes. Residual traces of solvent are an ever-present problem. In some commercial hydrocarbon solvent extraction methods the final meal is sparged with steam to sweep out these traces. In the experiments with aqueous-solvent-extracted raw oilseed meals reported in this paper, the sparging (or steam-distillation step) is coincidental with removal of added water in the drying operation. Conceivably the information which may be derived from the data reported here could be useful in planning research on larger-scale experiments in oilseed processing. For example, after a brief time of residence of the solvent damp meal in agitative distillation equipment, the granulated water-damp meal could be further dried in conventional rotary, screw or belt-type drying equipment normally used commercially for such purposes (4). Commercial mixers of the type described in the foregoing are available in sizes which will handle up to nine-ton batches.

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• New Literature

A new bulletin, "Industrial Applications of Microwave Energy" is available from the Varian Industrial Microwave Operation. The bulletin is a compilation of five papers presented at the Varian Industrial Microwave Seminar held recently. The papers discuss microwave applications in the food and pharmaceutical, plastics, wood, paper, and chemical fields. The bulletin has over 100 pages of information on current and future uses of microwave energy in the processing industries. Copies can be obtained from Marketing Manager, Varian Industrial Microwave Operation, 301 Industrial Way, San Carlos, California 94070.

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