proved to range between $7 and $8 per annual ton of product. Operating continuously for the past two years since construction (at varying percentages of capacity), total processing costs have averaged 0.75c per pound of fatty acid product.

This plant design is presented to demonstrate that a small scale and marginal operation, such as soap stock conversion, can be carried out both economically and competitively when preceded by sound engineering analysis.

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Note on the Use of Calcium Hydroxide in the Preparation of Peanut Protein

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STUDIES at the Southern Regional Research Laboratory (1, 2, 5, 6) on the preparation of peanut protein have stressed the use of sodium hydroxide as a preferable means of peptizing protein in hexane-extracted peanut meal although the effects of other materials have been reported (3). In the course of investigating the mechanical dewatering of meal residue, calcium hydroxide, a lower-priced material, was used to replace sodium hydroxide. The information obtained on the yields of protein with use of calcium hydroxide is noted here for its scientific interest. Protein so prepared is reported to be suitable for spinning (4).

Preliminary Peptization Studies

The range of protein solubilities with calcium hydroxide was studied in laboratory peptizations to provide information needed for pilot-plant production. Hexane-extracted peanut meal, previously described (6), was ground to pass a 60-mesh screen and was peptized at various pH's at a solution-to-meal ratio of 40 to 1. Distilled water at room temperature (approximately 80°F.) was used. As shown by analytical data in Table I, the nitrogen solubility was practically a constant at about 88% between the pH range of 7.2 and 9.5. This solubility compares with 88.1% for sodium hydroxide solutions at pH 7.5.

TABLE I

Meal Analyses

Moisture,[1] %	3.58
Lipids,[1] %	1.85
Total nitrogen[1]	
As is, %	9.44
Dry, %	9.79
Nitrogen solubility	
NaOH dispersion[1,2]	
As is, %	82.2
Ground, %	88.1
$Ca(OH)_2$ dispersion[2]	
As is, %	84.0
Ground, %	87.8

[1] Previously reported (5).
[2] Determined at pH 7.5, 40:1 solution-to-meal ratio for 3 hours at room temperature (approx. 80°F.).

Pilot-Plant Preparation of Protein

Experimental. In the pilot plant work 100 lb. of meal at approximately 85°F. was peptized at pH 7.5 with calcium hydroxide in solution with tap water, with a solution-to-meal ratio of 15 to 1. Average analysis of the tap water (6) by the New Orleans Sewerage and Water Board over the period of experimentation were in parts per million: Na_2CO_3 as $CaCO_3$, 34.2; chlorides as Cl, 14.5; sulphates as SO_4, 44.2; dissolved solids on evaporation, 147.8; calcium as Ca, 17.8; magnesium as Mg, 5.2; and total hardness as $CaCO_3$, 65.5. The undissolved solids were separated by means of a continuous, horizontal solid-bowl centrifuge (6).

To investigate the possible contamination from formation of calcium salts, the clarified liquor was divided into two equal portions, and the protein was precipitated from one portion by use of sulfur dioxide and from the other by the use of hydrochloric acid, adjusting the pH to 4.5 (2). The precipitated protein was recovered in a solid-bowl, vertical centrifuge and dried at 125°F. (6).

TABLE II

Data on Protein Recovery and Dewatering of Residual Meal

	Run No. 1[1]	Run No. 2	
Meal, lb.	241	100	
Solution-to-meal ratio	15:1	15:1	
Peptizing agent	NaOH	$Ca(OH)_2$	
Spent meal recovery			
Feed rate to centrifuge, g.p.m.	7.2	7.6	
Moisture in spent meal, %	82.5	84.5	
Protein recovery			
Precipitant	SO_2	HCl	SO_2
Protein,[2] basis of original meal, %	35.8	34.4	36.6
Nitrogen in protein, m.f.b., %	16.68	16.76	16.55
Nitrogen, % of original nitrogen	61.0	58.9	61.9
Calcium in protein, m.f.b., %	.01	.025	0.05

[1] Protein produced from portion of same meal and using identical method described previously (5).
[2] Yield = Protein, m.f.b./Meal, m.f.b.

Results. Table II shows the data on protein recovery and on the dewatering of the residual meal. Yields of protein obtained from calcium hydroxide-peptized protein were equal to those obtained from sodium hydroxide-peptized protein (5). While obviously there

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is more calcium in the proteins produced with use of the calcium hydroxide, it is not excessive. The protein obtained from the hydrochloric acid precipitation was darker than that from the sulfur dioxide precipitation. However alkaline solutions of these proteins showed no visual differences. Apparently there is color, possibly from the skins or degraded organic matter, in the protein prepared by hydrochloric acid precipitation which is similar to an indicator, changing with an acid or basic condition.

Rates of settling (1) of protein curds from calcium hydroxide-peptized solutions were faster with sulfur dioxide than with hydrochloric acid and were as rapid as the rates obtained with sulfur dioxide to precipitate protein from sodium hydroxide-peptized protein solutions.

There was practically no difference in the degree of peptization whether distilled or tap water (6) was used. After peptization in the pilot plant, meal residue separated by the horizontal centrifuge could not be pressed.

Summary

It was shown in laboratory peptizations that between the pH range of 7.2 and 9.5, nitrogen solubility obtained with calcium hydroxide solution was a constant and was practically equal to the value obtained with use of sodium hydroxide solution at pH 7.5. Pilot-plant yields of protein and settling rates of protein curds from calcium hydroxide-peptized solution with the use of sulfur dioxide to lower the pH were equal to those obtained previously from sodium hydroxide-peptized solution. This information may be of interest in any instance in which it is advantageous to use the lower-priced peptizing material.

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ABSTRACTS . . . . . E. S. Lutton, Editor

• Oils and Fats

R. A. Reiners, Abstractor

Synthesis of fatty acids by Clostridium kluyverii. H. A. Barker (Univ. of California, Berkeley). *Harvey Lectures*, Ser. **45**, 242-59(1949-50). Isotopic, enzymic, and quantitative analysis studies are reviewed which relate to the fatty acid synthesis by the anaerobic bacterium, *Clostridium kluyverii* which requires for its growth, in addition to water and salts, only ethanol, biotin, p-aminobenzoic acid, and either acetic, propionic, butyric, or valeric acid; and which contains a reversible enzyme system which converts almost 100% of the substrate to fatty acids up to C_8 and C_7 acids, by adding a C_2 unit into the COOH end of the synthesized fatty acid. (*Chem. Abs.* **46**, 11314)

Tung oil. II. Polymerization of tung oil. C. Chin (Univ. Formosa, Taihoku). *J. Chem. Soc. Japan*, Ind. Chem. Sect. **53**, 281-3(1950). Tung oil, α- and β-eleostearic acids, and their methyl esters were polymerized by heating in CO_2, and the products were separated by fractional distillation *in vacuo*. The principal products were dimers of the acids. Polymerization of tung oil is chiefly caused by the dimerization of eleostearic acid. (*Chem. Abs.* **46**, 11716)

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