portive problem with her was one of supplying nutrition, particularly calories.

The one child to whom fat has been given was a four-year-old boy in whom the maintenance of an adequate caloric intake was the major supportive problem.

As is quite obvious, the clinical studies with intravenous fat are just beginning and at this time it is not possible to evaluate the results. It can be said, however, that fat emulsions have been prepared which can be given safely to man and which do not give rise to changes in temperature, pulse, blood pressure, or respiration.

Summary

Fat emulsions satisfactory for intravenous administration have an important role to play in parenteral nutrition. They offer an opportunity to provide adequate calories in a limited fluid volume. Fat emulsions given intravenously are utilized for energy requirements for growth and maintenance and are helpful in maintaining a positive nitrogen balance. They have been given successfully to man. They should play an important role in supportive and preventive therapy in pre- and post-operative care and in any disease characterized by serious weight loss or emaciation.

Financial aid to these studies over the last six years has come from the following: International Health Division of the Rockefeller Foundation; Williams and Waterman Fund of the Research Corporation; National Dairy Council; the Upjohn Company; the Nutrition Foundation inc.; and the Milbank Memorial Fund; and Cancer Research Grants Branch of the National Cancer Institute. The following companies have supplied us generously with various materials: Associated Concentrates inc.; the Upjohn Company; Merek and Company; Research and Development Board of General Foods; Sheffield Farms inc.; Corn Industries Research Foundation; Anheuser-Busch Company; Wilson Laboratories; Manton Gaulin Company; Swift and Company; Armour and Company; and Monarch Electrical Company. We wish to express our appreciation to all who have aided this research.

REFERENCES


Viscosity of Cottonseed Protein Dispersions

F. W. CHENG, Ministry of Economic Affairs, Republic of China, and JETT C. ARTHUR, JR., Southern Regional Research Laboratory, New Orleans 19, Louisiana

Introduction

In a previous publication (1) a method for dispersing cottonseed proteins in concentrations as high as 25% protein to produce dispersions which were viscous, tacky, and did not gel was described. The preparation of the dispersions was accomplished by the inclusion of triehloracetate ion in the alkaline dispersing mixture, thereby preventing gel formation. The viscosity of the cottonseed protein dispersions was found to decrease on aging the dispersion and to be dependent upon the concentration of alkali used in its preparation and upon the concentration of protein. The instability of viscosity of the dispersions made it difficult to utilize such dispersions for manufacture of fibers, films, adhesives, sizes, and related products because the "working life" was too short for industrial operations.

This publication describes the results of an investigation of the effect of various methods of preparing the meal and of preparing the cottonseed protein dispersions upon their viscosity characteristics.

Viscosity of Cottonseed Protein Dispersions

F. W. CHENG, Ministry of Economic Affairs, Republic of China, and JETT C. ARTHUR, JR., Southern Regional Research Laboratory, New Orleans 19, Louisiana

EXPERIMENTAL

Materials and Methods

Isolation of Protein. Cottonseed protein was isolated from oil-free meals which were obtained by three methods of solvent extraction: 1. removal of the oil by means of n-hexane (6), 2. removal of the oil by means of the mixed solvent flotation process (deglanding process) followed by a second extraction with n-hexane (2, 7), and 3. removal of the oil by means of isopropanol.2 The maximum solvent temperature reached during the preparation of the cottonseed meals was less than the boiling point of hexane. Cottonseed meal, prepared as described, was suspended in a 0.2 N sodium sulfite solution at pH 7.5 in the ratio of 10 liters of solution to 1 kilogram of meal. The suspension was stirred for 2 hours at room temperature, after which the extract was separated from the insoluble residue by centrifugation, in a solid basket centrifuge, and the protein was precipitated by the addition of gasous sulfur dioxide to the extract, lowering the pH to 4.0. The protein curd was washed several times with water and twice with acetone, after which it was air-dried at room tem-

1Presented at the 119th National Meeting of the American Chemical Society, April 19-23, 1948, at Chicago, Illinois.
2One of the laboratories of the Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration, U. S. Department of Agriculture.

1Meal supplied through the courtesy of W. D. Harris, Agricultural and Mechanical College of Texas, College Station, Tex.
perature (5). The analyses of the meals and protein used in this investigation are given in Table 1.

<table>
<thead>
<tr>
<th>Material</th>
<th>Nitrogen, %</th>
<th>Ash, %</th>
<th>Lipids, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isopropanol-extracted meal</td>
<td>11.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deglanded-hexane-extracted meal</td>
<td>9.33</td>
<td></td>
<td>0.69</td>
</tr>
<tr>
<td>Hexane-extracted meal</td>
<td>9.11</td>
<td></td>
<td>0.60</td>
</tr>
<tr>
<td>Protein</td>
<td>15.6</td>
<td>2.8</td>
<td></td>
</tr>
</tbody>
</table>

1 Calculated on a moisture-free basis.

Results and Discussion

The factors previously shown to affect the viscosity characteristics of cottonseed protein dispersions are the concentration of the protein, the amount of sodium hydroxide used to disperse the protein, the age of the dispersion, and the presence of specific anions (1). These factors have been more extensively investigated with results as reported here. In addition, it has been found that the method of removal of oil from the meal has a pronounced effect on the properties of the protein. The effect of method of oil removal and the effect of addition of reducing sugars to the dispersion was also determined.

Effect of Aging of the Protein Dispersion. The data in Figure 1 show the effect of aging of the dispersions on their viscosity for a period of time greater than 24 hours. The properties of the protein used in this investigation differ from previously reported proteins in that the nitrogen percentage is slightly lower and the ash content, slightly higher. All three of the dispersions of 20% protein concentration were prepared with protein isolated from deglanded cottonseed meal by use of sodium hydroxide and to prevent gelation contained 2.5% (based on the weight of protein) of trichloroacetate ion. The concentrations of sodium hydroxide used to effect deglanded meal. The viscosity obtained after 2 and 4 hours of aging is given for each concentration of protein. It is clear that the viscosity is very sensitive to small changes in protein concentration. The sensitivity is greatest when the dispersions are first made and decreases somewhat with their age.

Effect of Sodium Hydroxide Concentration. The effect of sodium hydroxide concentration on the viscosity characteristics was determined on dispersions prepared with protein made from hexane-extracted meal, isopropanol-extracted meal, and deglanded meal. In the case of the last two-named protein preparations, dispersions were tested at two concentrations of protein. From the results of this investigation, as given in Figure 3, it is clear that the viscosity of the dispersions decreased almost logarithmically with increasing sodium hydroxide concentration. The viscosities of 20% dispersions prepared from hexane-extracted meal and from deglanded cottonseed meal...