

—In describing the preparation of the acetoaminomethylisophthalic acid by oxidation of acetopseudocumidide, it is there noted that in one case (No. 3), when the oxidation was conducted at moderate temperature ($62-4^{\circ}$), some of this tribasic acid was isolated. It crystallized from water in regular glassy prisms, which fell to powder on drying. This powder melts with decomposition at $240-2^{\circ}$ (corr.), and is soluble in alcohol, and apparently insoluble in ether.

Subst. 0.2046; 9.79 cc. N_2 (16° and 772 mm. over H_2O).

Calculated for $C_{11}H_7O_6N$: N, 5.63. Found: N, 5.64.

Subst. 0.1989; 9.80 cc. standard KOH solution. Theory for anhydride of the tribasic acid, 9.80 cc.

The glassy crystals first obtained by crystallization from water were, therefore, probably the acid itself. Unfortunately, the amount of substance isolated was too small for further study, and experiments to secure more of it have so far proven fruitless. An oxidation carried out at laboratory temperature, and lasting 32 days in all, yielded only the mono- and dibasic acids. Attempts to oxidize the dibasic acid in various ways also proved failures, the acid being invariably either unchanged or else wholly destroyed with evolution of carbon dioxide.

3. Summary.

1. A number of new derivatives of 2,4,5,7-tetramethylbenzimidazole are described.
2. Propionopseudocumidide was prepared, and from it the benzimidazole and other new derivatives.
3. Oxidation of acetopseudocumidide gives mono- and dibasic acids. Only in one experiment was a small amount of tribasic acid isolated.
4. The structure of the acids so produced indicates that the methyl group in position 4 is first oxidized, then that at 2.
5. As both the mono- and the dibasic acid so obtained are of anthranilic type, they yield acyl anthranils and 4-quinazolones by the usual methods.

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[CONTRIBUTION FROM THE TEXAS EXPERIMENT STATION.]

UTILIZATION OF THE PROTEINS OF COTTON SEED BY MAN.

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Cotton seed meal has been used, to some extent, as a human food, for a number of years in the South. In Texas, at least, it is claimed to be used both by those who are too poor to buy sufficient meat, and by those who use it by preference, mixing it with wheat flour. Since cotton seed meal contains more than twice as much protein as meat, and since it can

¹ Under the general direction of G. S. Fraps, Chemist. Abstracted by the author from *Bulletin* 163 of the Texas Experiment Station.

be prepared in palatable form, and is enormously cheaper than animal foods, the utilization value of the proteins by man is of practical as well as theoretical importance.

We have been unable to find in the literature any mention of the digestibility of cotton seed meal by man. Mendel and Fine¹ reported the results of experiments on dogs with cotton seed flour, which is prime cotton seed meal, finely ground and freed, as much as possible, from hulls. They found that the proteins were utilized on an average 71.6%, as compared with 94% for fresh meat.

Experimental.

In the experiments here reported, the cotton seed meal was fed in a simple mixed diet of milk, butter, and bread made of corn meal and the cotton seed meal, or flour, to be tested. Three men were used in one trial and two in the others. In order to get a direct comparison with meat, two trials were made with chicken loaf, a canned meat product. While this substance apparently did not consist entirely of meat, the average utilization was practically the same as Atwater's average for animal proteins.

The cotton seed meal was ordinary commercial meal. It was sifted through a 20-mesh sieve before use. The cotton seed flour was made from prime meal by a roller mill process, was practically free from hulls, and was very finely ground. The sifted cotton seed meal contained 46.33% protein, and the flour contained 50.16% protein. The cotton seed meal-corn meal mixture used in the ration, contained corn meal, salt, and about 20% cotton seed meal or flour. The bread was made up with water.

The digestion trials were conducted in the usual manner. They lasted for two days each, charcoal being used as a marker. The amount of protein in the water-free bread, less the amount of corn meal protein in the water-free meal mixture, was taken as the amount of cotton seed protein fed. The following utilization values for proteins were assumed in the calculation: milk 97%, and corn meal 85%.

The results are summarized in the table on following page.

The utilization value of the protein of cotton seed meal varied from 74.7 to 80.2%, and averaged 77.6%. That of the cotton seed flour varied from 79.2% to 79.7%, and averaged 79.5%. We do not attach any significance to the difference of these averages. The average of the values of both the meal and flour is 78.6%. The protein of cotton seed meal and cotton seed flour seem to be equally available to man. The average utilization of the meat proteins was 96.6%. Since the proteins of cereals are utilized 85% and those of legumes 78%, cotton seed proteins are utilized equally as well as those of legumes, nine-tenths as well as those of cereals, and eight-tenths as well as those of meat.

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| | Proteins, Grams. | | | | | | | | | | Utilization value, Per cent. |
|---------------------------------|------------------|------------|-------|-------------------|--------------|-----------|-----------|------------------------------|----------------------------|------------------------------|---------------------------------|
| | Milk. | Corn meal. | Meat. | Cotton seed meal. | Total eaten. | Excreted. | Utilized. | Utilized from milk and corn. | Utilized from food tested. | Utilization value, Per cent. | |
| Cotton seed meal, man 1 | 132.4 | 10.6 | ... | 25.3 | 168.3 | 10.5 | 157.8 | 137.5 | 20.3 | 80.2 | |
| Cotton seed meal, man 2 | 142.6 | 38.6 | ... | 50.3 | 221.5 | 22.5 | 199.0 | 161.4 | 37.6 | 74.7 | |
| Cotton seed meal, man 3 | 123.6 | 37.0 | ... | 48.3 | 208.9 | 23.5 | 185.4 | 151.3 | 34.1 | 77.9 | |
| Cotton seed meal, average..... | | | | | | | | | | 77.6 | |
| Cotton seed flour, man 1 | 108.4 | 35.5 | ... | 47.2 | 191.1 | 19.5 | 171.6 | 134.0 | 37.6 | 79.7 | |
| Cotton seed flour, man 2 | 122.0 | 41.4 | ... | 59.6 | 223.4 | 22.3 | 201.1 | 153.9 | 47.2 | 79.2 | |
| Cotton seed flour, average..... | | | | | | | | | | 79.5 | |
| Meat, man 1..... | 96.3 | 23.5 | 101.5 | .. | 221.3 | 7.1 | 214.2 | 113.4 | 100.8 | 99.3 | |
| Meat, man 2..... | 85.0 | 35.8 | 95.0 | .. | 215.8 | 13.7 | 202.1 | 112.9 | 89.2 | 93.9 | |
| Meat, average..... | | | | | | | | | | 96.6 | |

These results are higher than those obtained by Mendel and Fine with dogs, relatively (in comparison with meat) about 5%, and actually, about 7%.

It is generally considered that man's utilization of concentrated foods is equal to ruminants, but it is interesting to note that ruminants utilize 88% of the proteins of cottonseed, whereas man utilizes only 78%.

Summary.

The utilization values of the proteins of cotton seed meal and flour are the same and average 78.6%. Experiments with meat, on the same men, showed that 96.6% of the proteins was utilized.

Cotton seed proteins are utilized by man equally as well as those of legumes, nine-tenths as well as those of cereals, and eight-tenths as well as those of meat.

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ON THE ACTION OF ACIDS UPON FRUCTOSE AND GLUCOSE.

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I. Introductory.

It has long been known that the two hexoses of invert sugar are more or less rapidly acted upon by acids. The effect is of no little importance in studies of sugar hydrolysis, for the velocity coefficient of the reaction