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The Estimation of Cottonseed Hulls in Cottonseed Meal.

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THE DETERMINATION OF COTTONSEED HULLS IN COTTONSEED MEAL.

By G. S. Fraps, Ph. D.

The constituents of cottonseed meal and cottonseed hulls are considerably different. Cottonseed meal consists of protein, fat, raffinose, and pentosans, in addition to moisture and ash. Cottonseed hulls consist for the most part, of woody material. The proposed method for the estimation of cottonseed hulls in meal is based on the differences in the constituents of the two materials.

Preliminary Work.—It was our aim to secure some solvent which would dissolve as little as possible from the hulls and as much as possible from the meal. As preliminary work, we determined the quantity of residue left after extracting cottonseed meal with different strengths of sulphuric acid and caustic soda. Two grams of material after extraction with ether were boiled with two hundred cc. of solution, filtered, the residue washed, dried to constant weight, then ignited and weighed again. The loss on ignition gives the residue. The results with cottonseed meal are presented in the following table:

Table I.—Residue left after Extraction with Solvents.

	Per cent of Residue.
Sulphuric Acid of 0.5 per cent	20.65
" " 0.2 " "	28.79
" " 0.1 " "	41.71
Caustic Soda of 0.5 " "	11.30
" " 0.2 " "	10.90
" " 0.1 " "	11.75

Caustic soda has a much greater solvent action upon cottonseed meal than sulphuric acid. This was to be expected from the fact that cottonseed meal contains such a high percentage of proteids, which are soluble in alkalies. There is little difference in the action of the different strengths of caustic soda, but considerable in that of sulphuric acid.

METHOD ADOPTED.

The method adopted after much preliminary work is described as follows:

Extract two grams of the meal with ether on a hardened filter paper, transfer to a tall beaker and add 200 cc. of boiling water measured with a cylinder and 20 cc. fifth normal caustic soda measured with a pipette. Place a round bottomed flask with water on top of beaker to act as condenser, boil thirty minutes, filter on a thin layer of asbestos in a three inch hirsch funnel, wash thoroughly, transfer to a porcelain crucible and dry to a constant weight, weigh, ignite and weigh again. The loss in weight is the insoluble residue. In order to apply this method, it is necessary to know the quantity of insoluble residue yielded by cottonseed hulls, and by cottonseed meal of high purity.

INSOLUBLE RESIDUE IN MEAL AND HULLS.

Seventeen samples of meal were sifted to remove hulls as thoroughly as possible. The quantity of insoluble residue was found to be as follows:

Maximum	13.33 per cent
Minimum	8.22 " "
Average	10.46 " "

Sixteen samples of meals of high purity were selected. These meals had the following composition:

	Protein	Fat	Crude Fiber.
Maximum	52.50	12.09	6.73
Minimum	45.00	7.26	4.85
Average	48.66	9.12	5.71

On analysis they were found to yield the following amounts of insoluble residue:

Maximum	14.09 per cent
Minimum	9.75 " "
Average	11.38 " "

None of these samples were free from hulls. It appears probable that a meal free from hulls should not contain over 10 per cent of insoluble residue, estimated according to our method. While a meal containing ten per cent insoluble residue contains some hulls, a meal yielding ten per cent or less of insoluble residue is certainly of high purity.

Twenty samples of cottonseed hulls were subjected to analysis with the following results:

Maximum	77.87 per cent
Minimum	69.01 " "
Average	75.22 " "

It appears that hulls yielded, on an average, 75 per cent of insoluble residue.

ESTIMATING HULLS IN MEAL.

The following method, therefore, appears to give fairly accurately the percentage of hulls in cottonseed meal.

Determine the quantity of insoluble residue, by boiling with the weak caustic soda solution, as previously described. Subtract 10 per cent from the percentage found to be present, and add one third of the residue. The total is the approximate percentage of hulls in the meal, in excess of the quantity in meals of highest purity. Suppose, for example, 15 per cent of insoluble residue is present in a given meal, subtracting 10 per cent and adding 1-3 of the remainder gives us 6.66 per cent excess hulls present.

The quantity of hulls which should be allowed in meal is a subject for further study.

Credit is due assistant chemist, J. T. Cruse, for most of the analytical work referred to above.