

A NOTE ON AN IMPROVED METHOD OF ANALYSIS FOR DETERMINING FAT ACIDITY IN CORN GRITS

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Fat acidity is used as an indicator of potential rancidity in corn grit products. Using the official AACC method (1) for determining the fat acidity value (mg KOH/100 g of grits, dry basis), the analyst uses standardized KOH to titrate the free fatty acids in a benzene extract of the grits and attempts to match the phenolphthalein end point to the same color as an artificially prepared standard solution of potassium dichromate and potassium permanganate. The standard color end point was designed to maximize uniformity between analysts. However, color perception differences and the inability to exactly match the sample extract to the dichromate/permanganate color introduce two potential sources of error into the analysis. The improvement described in this note eliminates the errors due to the above conditions.

Since AACC 02-03 is the current standard method of analysis, the improved method was correlated against it. In order to eliminate sample differences, a common extract was prepared by shaking 40 g of ground corn grits with 100 ml of benzene in a glass-stoppered flask for 0.5 hr. The resulting benzene extract was filtered through rapid filter paper and 25-ml aliquots taken for assay by each method of analysis. To the sample aliquot analyzed by the official method, 25 ml of alcohol/phenolphthalein (0.04%) was added and then it was titrated to the color standard end point using 0.0178N KOH dispensed from a 2-ml capacity buret.

To the sample aliquot analyzed by the improved potentiometric (pH) method, 25 ml of alcohol (no phenolphthalein) was added. It was titrated with the KOH to

TABLE I
Comparative As-Is Fat Acidity Values vs. Oleic Acid in Extract

Sample	Fat Acidity ^a	Oleic Acid ^b
1	3.94	1.13
2	6.61	1.71
3	6.70	1.46
4	6.73	1.62
5	8.01	2.20
6	7.61	2.14
7	7.12	2.25
8	7.06	2.17
9	9.32	3.54
10	7.52	2.62
11	8.47	2.96
12	6.67	2.56
13	14.17	5.95
14	15.27	6.50

^amg KOH/100 g corn grits.

^bmg oleic acid/25 ml extract.

a pH 10 end point (upper limit of phenolphthalein transition) using a Beckman SS-3 pH Meter with a combination electrode (No. 39142).

In both methods of analysis, the solutions were stirred continuously by means of a magnetic stirring bar. With the pH method, the electrode had to be rinsed with distilled water and then dried after each titration to assure rapid response. The use of separate, standard glass and reference electrodes was not satisfactory for the titration.

Table I shows the comparative results of analysis by both methods on common extracts from 14 different corn grits samples. The column headed "Fat Acidity" contains the fat acidity value obtained by the official method. The column headed "Oleic Acid" contains the corresponding value for the amount of oleic acid in 25 ml of the benzene extract. That result was obtained from the equation:

$$X = \text{amount of oleic acid in 25 ml extract} = (S - B) \times N \times 282.47$$

S = ml of KOH needed to titrate the sample of 25 ml extract + 25 ml alcohol

B = ml of KOH needed to titrate the blank of 25 ml of benzene + 25 ml alcohol

N = normality of KOH

282.47 = meq of weight of oleic acid

A correlation coefficient of 0.97 was obtained over the range of the fat acidity values.

After determining the mg of oleic acid in 25 ml of extract by the pH method, the corresponding fat acidity value for the official method as-is or grits as received (Y) was determined by referring to the regression equation $Y = 1.82X + 3.19$.

The official method fat acidity value/100 g of grits (dry basis) was found by:

$$\frac{Y \text{ (as-is fat acidity from regression equation)} \times 100}{(100 - \text{moisture content of grits})}$$

The comparative analysis results of the official and pH method agreed to within ± 1 mg of KOH for the range of values tested.

Literature Cited

1. AMERICAN ASSOCIATION OF CEREAL CHEMISTS. Approved methods of the AACC. Method 02-03, approved April 1961. The Association: St. Paul, Minn.

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