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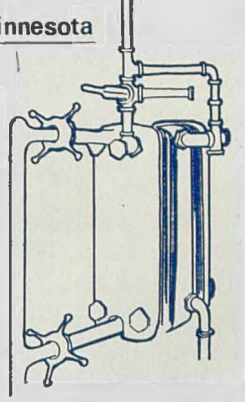
MINNESOTA DAIRY PRODUCTS PROCESSOR



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Extension Specialist Dairy Products

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MORE ON BUTTER COMPOSITION CONTROL

We have done some more work on the Kohman procedure as used in continuous buttermaking, and a few matters of interest are beginning to emerge. We will try to hit some high spots in this edition.

SENSITIVITY OF THE BALANCE

Moisture and salt analyses can only be as precise as the device used to weigh samples. We compared the Kohman with another Torsion balance (T-balance) which allows direct digital readout with a sensitivity of one milligram over the range of its capacity. Since sample weight per se might influence precision also, we compared results of 10-, 15-, 20-, and 25-gram samples. Four butter supplies were analyzed and five analyses were made on each sample at each weight level.

Table 1 summarizes results of the moisture analyses. The values reflect the variation that might be expected in moisture test. For example, if you are shooting for 16.4% moisture and you are testing a 10-gram sample using the Kohman balance, you will note that you must consider a deviation of $\pm$ 0.14%. On one sample (one test) you can only be sure that the true test lies somewhere between $\pm$ two deviations of 0.14%, or $\pm$ 0.28%. That is, a test that reads 16.4% moisture may in fact lie anywhere between 16.4 - 0.28 and 16.4 + 0.28 i.e., 16.12 - 16.68.

You may want to look at it this way: If your buttermaker makes a moisture test and finds 16.3%, more than likely he will adjust the beater speed up a fraction of a turn to increase moisture. The fact is, based upon that one reading, there is just as much chance that the test is 16.4% as 16.3%. He should not touch the machine at all. He should not touch the machine unless he gets a reading below 16.1% or above 16.7%, not unless you feel he can do a more competent job than our technician working in the quiet and luxury of an air-conditioned laboratory.

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Our smallest deviation was 0.06, noted on the T-balance at a 20-gram sample weight. Now, ± two deviations (2 x 0.06) is 0.12 or, for all practical purposes, 0.1%. Let us assume your target moisture is 16.5%. Now you could feel free to adjust the machine whenever a single moisture test fell below 16.4% or above 16.6% (16.5 ± 0.1). Better? You bet!!

THE SALT ANALYSIS

Four factors bear upon the ability to achieve accurate, precise salt analyses by the direct titration method. These are: (1) balance sensitivity, (2) sample weight, (3) strength of titrating solution (silver nitrate), and (4) indicator. Let us look at the first three first. We analyzed 1-, 5-, and 10-gram samples, using both balances, the same four butter supplies, and, for the 5- and 10-gram samples, "half" strength silver nitrate i.e., 2 mls of silver nitrate equivalent to 1% salt. The mean deviations for five replicate analyses are shown in Table 2. The values imply exactly the same meaning as did the values in Table 1. For every single test made, you can be sure that the true value lies somewhere between ± two times the deviation value.

Definite improvement in precision can be noted at larger sample weights, but 10-gram samples proved no more satisfactory than 5-gram samples. We got the best precision on the more sensitive balance using 5-gram samples. In this case we were using 0.4277 N silver nitrate and 6 drops of 5% potassium chromate indicator. The butter was melted in approximately 75 mls of warm water.

We got excellent precision BUT, after analyzing well over 100 samples in duplicate and comparing results with the average of triplicate tests by conventional Kohman salt analysis (as modified by the USDA) we found we were averaging 0.1% high in direct titration. Our accuracy was not what it should be. If salt is 0.1% high, the fat readings obtained by difference are being underread by 0.1%.

Come to find out, this finding is not new. There is reference in the literature that, using potassium chromate as the indicator, readings will average about 0.1% high. You can get around this by using another indicator. It it called dichloro-fluorescein. A 0.1% solution is made up in 70% ethyl alcohol. Use ½ ml (10 drops) on a 5-gram butter sample. The color goes from a whitish fluorescence to a sudden pink endpoint. For more information, consult the article by K. G. Weckel, Journal of Dairy Science 22:163. 1939.

Table 1. Mean deviation of five replicate moisture analyses at four different sample weights as measured on two different balances

Sample size (Grams)	Mean deviation Kohman	Mean deviation T-Balance
10	0.14	0.09
15	0.14	0.08
20	0.09	0.06
25	0.09	0.07

Table 2. Mean deviation of five replicate salt analyses at three different sample weights as measured on two different balances

Sample size (Grams)	Mean deviation Kohman	Mean deviation T-Balance
1	0.60	0.022
5	0.025	0.003
10	0.028	0.005

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