Butter, Its Commercial Aspects and a Diagnosis of Its Defects

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AMERICANS consume one billion six hundred million pounds of butter annually. They eat it at the rate of seventeen to nineteen pounds per capita, which in poundage and cost greatly exceeds any other fat. Butter is the most used spread for bread and the most flavorsome fat. Although it has unique dietetic value, the majority of consumers do not select it for this reason, but for the reason that they like its taste. For this reason the grading of quality and the price of butter depend more on flavor than on any other factor.

The first requirement is that taste and smell be clean and free from foreign taint. But this is a negative requirement and to rise above this level butter must have a characteristic pleasing taste called flavor and smell called aroma. These are butterlike in character, very difficult to describe, and the only adequate way to gain a conception of them is to taste and smell a good specimen of fine butter.

We hear much of "I like this, but I don't like that," "Some persons like one thing and others like another." Is, then, butter quality a personal preference without national and international standards? Indeed not. There is a well recognized national and international standard of quality. Good butter in Chicago is also good butter in New York, London, and Berlin. Poor butter is poor butter everywhere. I do not mean that cities and provinces do not have minor preferences and dislikes. They do have them. But if they really want to buy butter they will accept the better quality from any of the countries that have a reputation for making good butter. Butter is an article of international commerce.

The next point of preference for butter is its plasticity, or convenience in handling and spreading at room temperature. This feature is called body by the butter scorer. It should be compact, free from cavities, free from large drops of water, or oozing water. This defect is called leakiness. For sale in tubs the cut surface of butter should not be dry and lusterless like cheese, but should sparkle with a few small droplets of moisture about the size of pinheads When bored with a trier it should cohere in a smooth solid plug without raggedness in the plug or adhesion to the back of the trier. This plug, if not too cold, should have some degree of cohesion and elasticity without being brittle or crumbly. The brine or moisture must be clear, not milky.

Practically all the energy and vitamin value of butter is in the fat and the other 20% of non-fatty constituents has little energy. In theory, the pure fat would supply all physiological requirements. But butter fat without water would be like bread without water and air cavities, or apples without water. The art of buttermaking has combined the fat, water, and curd in such manner that it best suits the consumer's esthetic sense.

Color is an essential and distinctive character. Butter is the only edible fat in large volume that has a naturally yellow color. The degree of yellow may vary according to feed or season and according to market or buyer's preference. The color must be uniform and free from mottles or streaks. There should be no specks such as curd or foreign matter.

Butter is made with or without salt as the buyer may desire. Salting must be uniform and free from grit. The percentage is as the buyer wants, usually below 3%, and rarely above. Considerable butter is salted only 1½%. The presence of salt accentuates flavors, especially the bad ones. I think it reduces aroma somewhat.

The package should be uniform and clean.

Keeping quality and hygienic quality are not on the commercial score card. Nevertheless, they are very important and it is dependable keeping quality that elevated butter from the chaos of thirty years ago to the standard article of today sold on the futures market, stored for time of need, or sold on track at the factory. Pasteurization made dependable by mechanical and bacteriological control produced this keeping quality and hygienic safety. Far in advance of other dairy industries, the creamery pioneered and voluntarily adopted pasteurization. Intelligent control of acidity is the other element of keeping quality. The average acidity of satisfactory butter is 0.02% to 0.05% expressed as lactic acid. At acidities around 0.10% or higher the fat is unstable. At acidities below 0.02% the proteins are unstable and they putrefy rapidly at the neutral point or below.

Although the great majority of consumers choose butter because of its taste appeal, it affords the largest and most palatable supply of vitamin A and contains some vitamin D. It is also the most digestible of all commercial fats.

The manufacture of butter is an art as well as a science. The judging of butter quality is largely an art. Art is therefore very important in diagnosing butter defects. A keen discriminating sense of taste and smell and intuition from familiarity with butter are great helps. The more a chemist is a detective the better he can diagnose causes of butter defects.

Hereunder is a list of butter defects in two groups, one according to taste, and the other according to sight. The approximate relative prevalence of these defects is indicated by order and number, the nearer to the top of the list and the smaller the number, the greater the prevalence.

TASTE AND SMELL

Biochemical

1 Neutralizer
2 Greasy
3 Sour
3 Old Cream
4 Cheesy
5 Fetid
6 Tallowy
7 Metallic
7 Woody
12 Rancid

20 Fishy
21 Musty
22 Too Salty
23 Yeasty
24 Bitter

Feed and Absorbed

1 Onion
2 Oils
2 Weeds
5 Food

SIGHT AND TOUCH

A *Color*
1 Mottles
2 Streaks
3 Too much or too little
4 Mold
5 White Specks
6 Green Specks
7 Yellow Specks

B *Body*
Grain
Texture
1 Dry and Sticky
2 Loose and Spongy
3 Leaky
4 Mealy
5 Greasy
6 Milky

C *Salt*
1 Uneven
2 Gritty

The first consideration in diagnosing a defective flavor is the character of the taste and smell. These often indicate the cause of the bad flavor, or they indicate what farther tests to make. The acid test of butter detects

two important fundamentals. A chemical or bacteriological test for pasteurization reveals whether poor keeping quality was caused by weak pasteurizing or no pasteurizing.

A texture that feels mealy in the mouth may be caused by crystallized fat, particles of lime, or of curd. Crystallized fat melts in the mouth or between fingers. Whether grit or white specks are lime particles or curd is ascertained by removing the fat and treating the particles with weak acid. Lime dissolves in weak acid, usually with effervescence; curd does not.

Whether grit is sand or broken glass is determined by removing fat and examining the grit under microscope. Glass is sharply angular and colorless, while sand is less angular and shows some color.

Green spots on prints of butter are caused by copper or brass. If the spots are throughout the butter they probably come from verdigris from metal equipment. If the spots are only on the surface they may come from metallic scales in the lining paper.

There are two types of defects of texture—underworked and overworked. If the texture is crumbly and moist like cottage cheese, the butter is not worked enough. If the texture is dry, brittle and fractures comparatively straight, like soap, it is overworked.

A creamery laboratory checking manufacturing operations makes a great number of tests, and the number has increased as the industry has developed and as competition has become keener. The aim, therefore, is speed with enough accuracy to answer the object in view. The reader may not find my tests as accurate as he may desire for other purposes, but they are quite sufficient for checking factory operations and for making general diagnoses.

Yeast and Mold Count

Yeasts and milk mold (Oospora lactis) are always present in raw milk, cream, and other raw dairy products. These microorganisms are killed by pasteurization. A plate count of a pasteurized product, therefore, represents degree of efficiency of pasteurizing, or cleaning, and sterilizing.

Long experience has taught me that a count of 50 or less is as good work as some men can do. Less than 10 is excellent, 10 to 20 good, 20 to 50 fair, and over 50 poor.

The method of determining yeasts and molds consists in plating on agar of such acidity that ordinary bacteria are inhibited but yeasts and molds are allowed to develop. The acidity that is most favorable for yeasts is less favorable for molds—that is, a higher acid favors the molds.

After using for some years a method of acidifying by adding tartaric acid at plating or to the agar itself, I simplified the method by using sour whey. Starter or cultured buttermilk is heated in an autoclav until the curd is quite solid and the whey pours off clear. Two per cent of agar is added to the whey in flasks, and these are sterilized at 10 pounds pressure for 15 to 20 minutes—depending on size of flasks. A higher pressure or very long time weakens solidifying power. This sour whey agar has an acidity of 0.6%, expressed as lactic acid.

The determination is made by placing one cc of butter or of starter, and incubating three days at 70° to 80° F. or room temperature. Yeast colonies are easily recognized by smaller size, slimy consistency, and shiny surface. Mold colonies are very large, tough in consistency, and a velvety or papillated surface. Air molds are readily recognized by texture and color. Colonies of ordinary bacteria are seldom visible and very small.

Relative numbers of putrefactive germs may be determined by plating on sugar free gelatin.

A number of tests for acidity of butter has been proposed. A test employing a mixture of 100 cc alcohol and 25 cc's of ether as a solvent determines the total acidity in both the serum and the fat of the butter.

The following test determines the water soluble acids, is suitable for factory use, and affords data for the more important diagnoses, namely, whether butter is highly acid, neutral, or alkaline.

Weigh out 18 grams of butter into the usual moisture cup on the moisture scale. Wash into a beaker or resistance glass custard cup with 100 cc's of hot water, heat to boiling, add one-half cc of neutral phenolphthalein and titrate with N/20 alkali to a distinct pink color that remains for one minute or longer. Read burette and divide the reading by 4 to obtain percentage of lactic acid. A 5 cc burette is a convenience.

For factory use, weigh out 36 grams of butter, titrate with N/10 alkali, and divide reading by 4.

Butter made from sour cream usually has an acidity of 0.02% to 0.05%, but may be as high as 0.09% without suffering from high acid. Around the neutral point and in the alkaline zone, cheesy, putrid (fetid) and tallowy flavors soon develop. The margin of safety below 0.02% is narrow and off flavors soon appear. They are distinguishable near the neutral point and very pronounced at the neutral point and below.

I have observed a few cases where butter had a sour odor and unclean flavor at acidities as low as 0.02%. In these cases the interval between pasteurizing and churning was long. I have not observed this sour flavor in low acid butter from cream churned immediately after pasteurizing. The use of overripe or sharp flavored starter tends to impart a sourish character to low acid butter. The interpretation of the reading is more difficult than the test, and experience and judgment are helpful.

Keeping quality may be tested by keeping the butter in small jars (2 oz.) at 60° to 65° F. A poor keeper develops an off flavor in a few days, while a good keeper deteriorates one point and is still edible at the end of two weeks.

The number of consumers that can recognize a 92 score from a 90 score butter is small and form a trade class only in a few large cities. As a spread for bread butter should score at least 89. An 88 point butter has a pronounced off flavor and is suitable only for cooking. Cheesy, rancid, sour and neutralizer flavors disappear in cooking. Tallowy, fishy and mineral oil flavors do not so disappear.

The number of defects enumerated here may give the reader an exaggerated impression of the prevalence of butter defects. A butter laboratory is like a hospital—only sick people come there. The majority of butter is very good and only a small proportion is poor.

Olive Oil Chemists

"The International Society or Committee of Olive Oil Chemists" has been organized and the names of the present members are as follows: W. H. Dickhart, Chairman, New York Mercantile Exchange, New York; Dr. G. S. Jamieson, Department of Agriculture, Washington, D. C.; Dr. W. V. Cruess, University of California, Berkeley, Calif.; Prof. Stefano Fachini, Commissione Internazionale per Lo Studio Dei Grassi, Milano, Italy; Dr. Luigi Sarcoli, Il Segetario, Nazionale, Rome, Italy; Dr. H. Baud, Ministere De. L'Agriculture Chandieu, France; Dr. Daniel Mangrane, Barcelona, Spain.

The object of the committee is to suggest international Standard Methods for the analysis of Olive Oil and Olive Oil Products, also to ascertain new methods for detecting adulterations.