



DRY-GUD-009	Dairy
Revision: 1.0	Buttermaker Exam Study Guide
Approved: 27Nov2021	Wisc. Stat. and/or Wis. Admin. Code: Statute 97, ATCP 65, 69 & 82

SUBJECT: Buttermaker Exam Study Guide

Scope

The purpose of this training manual is to acquaint a Buttermaker license applicant with the topics covered in the Wisconsin Buttermaker Exam.

An applicant’s practical experience, review of this manual and careful reading of the regulations listed below will prepare an applicant to pass the licensing exam with a score of 70% or above.

This manual was prepared cooperatively with the University of Wisconsin –Madison, Center for Dairy Research and the Wisconsin Department of Agriculture, Trade and Consumer Protection.

Definitions

97.17 Buttermaker and cheesemaker license. (1) In this section the terms “buttermaker” and “cheesemaker” mean a person employed or who may be employed in a butter or a cheese factory who has charge of and supervision over the actual process of manufacturing butter or cheese, and shall not include a person employed in a butter or cheese factory for the purpose of assisting in the manufacture of such product. This section shall not affect a person making up a product produced on the person’s farm, nor shall it be unlawful for a licensed cheesemaker employed in a licensed cheese factory to make butter or whey cream butter for the use or consumption only of the patrons thereof. (2) No person shall engage as a buttermaker or cheesemaker unless the person has a license from the department. The license shall be issued by the department under regulations that the department shall prescribe relating to the qualifications of applicants for licenses. The qualifications shall include the applicant’s record in operating and keeping in sanitary condition the butter or cheese factory in which the applicant has been employed.

Guidance

QUALIFICATIONS

A buttermaker license application under sub. (2) shall include documentation approved by the department to show that the applicant meets at least one of the following requirements:

- (a) The applicant has held a buttermaker license in this state within 10 years prior to the current license application.

(b) Within 10 years prior to the current license application, the applicant has worked directly in buttermaking operations for at least 24 months under the direct personal supervision of either a buttermaker licensed in Wisconsin or a buttermaker with similar credentials outside of Wisconsin.

(c) The applicant has done all of the following within 10 years prior to the current license application:

1. Worked in buttermaking operations for at least 18 months under the direct personal supervision of a licensed buttermaker.
2. Successfully completed a department-approved course in buttermaking from an accredited post-secondary educational institution.

(d) The applicant has done all of the following:

1. Obtained a 4-year or greater degree, with a food science or equivalent major, from an accredited post-secondary educational institution.
2. Worked in buttermaking operations for at least 12 months, under the direct personal supervision of a licensed buttermaker, within 10 years prior to the current license application.

(e) The applicant holds a cheesemakers license in this state and has done all of the following:

1. Completed a department-approved buttermaking course.
2. Completed 40 hours of work in buttermaking operations under the direct supervision of a licensed buttermaker.

(f) Within 5 years prior to the current license application, the applicant has completed at least 120 hours of on-the-job training in the complete process of buttermaking under the direct supervision of a licensed buttermaker, and has completed department-approved courses in all of the following subjects:

1. Buttermaking.
2. Production of safe dairy foods.
3. Hazard analysis critical control point (HACCP) process control.
4. Principles of milk pasteurization.
5. Dairy sanitation.

EXAMINATION

An applicant for a buttermaker's license, other than a renewal license, shall pass a written examination in order to qualify for the license. The license examination shall test the applicant's knowledge of buttermaking and related matters, and may include questions related to any of the following:

ATCP 69.01(4)(a)

(a) Laws related to buttermaking, including standards of identity, composition standards, food safety standards, labeling requirements and related matters.

(b) The fundamentals of buttermaking, including all of the following:

1. Preparation and care of equipment.
2. Composition control.

3. Preparation and use of starter.
 4. Pasteurization of milk and cream.
 5. Problems of acidity control.
 6. Common butter defects and methods of overcoming them.
 7. Yeast, mold and bacterial control methods.
- (c) Relevant arithmetical problems related to dairy plant operations, butter production, plant efficiencies, and dairy product values.
- (d) Practical working knowledge related to all of the following:
1. Testing milk and cream for bacteria, sediment and acidity.
 2. Grading milk and cream.
 3. Analysis of butter composition.
 4. Judging butter samples.
 5. Fundamentals of pasteurization.

EXAM STUDY MATERIAL

Federal Definition of Butter:

- Defined by “an Act of Congress
- Public Law 519 of the 67th Congress
- “By act of Congress, approved March 4, 1923, that for the purpose of the Food & Drug Act of June 30, 1906, butter is the food product usually known as butter, and which is made exclusively from milk or cream, or both, with or without common salt, and with or without additional coloring matter, and contains not less than 80 per cent by weight of milkfat, all tolerances having been allow for.”

Wisconsin Chapter 97.01 (1r) “Butter” means the clean, non-rancid product made by gathering in any manner the fat of fresh or ripened cow’s milk or cream into a mass, which also contains a small portion of the other milk constituents, with or without salt or added coloring matter, and contains not less than 80 percent of milk fat. Renovated or process butter is the product made by melting butter and reworking, without the addition or use of chemicals or any substances except milk, cream, or salt, and contains not more than 16 percent of water and at least 80 percent of milk fat.

Butter and Cream Standards and Handling:

- A uniform distribution of salt in the micro-environment of butter is more unfavorable to bacterial growth and such salt retards growth of microorganisms in butter.
- Salt and moisture can vary considerably from results obtained by analyzing micro portions within each batch of butter.
- Wisconsin law requires milk and cream to be cooled and held at 45°F (7°C) or lower until pasteurized.
- The minimum milkfat in sweet or whey cream for buttermaking is at least 18%.
- The most desirable milkfat content in cream for churning butter is 35% - 40%.
- Temperature range of pasteurized cream during tempering is 45°F to 55°F.

- Churning temperature range for butter is 45°F to 55°F.
- The temperature of the butter when it exits the churn should be no higher than 55°F.
- The pasteurized cooled cream is held to temper for 18 to 24 hours.
- Milkfat is a mixture of a number of different fatty acids.
- The melting point of milkfat is higher during winter.
- Butterfat content of butter shall be minimum of 80% and control of the milkfat content from 80.1% -80.3% is satisfactory.
- No antibiotics are allowed in cream offered for sale.
- The standards for cream procured for butter making and for other manufacturing purposes are not higher than those for milk.
- Cream purchased by dairy plants does not need to be graded.
- Butter made with goat and/or sheep milk is not allowed to be graded under Wisconsin grading standards.
- The amount of butter, which exceeds the amount of fat present in cream is called overrun. The average overrun for butter is 122% - 123%.

Pasteurization:

- Cream for buttermaking must be pasteurized at a temperature of at least 165°F for at least 30 minutes in a vat or at least 185°F for at least 15 seconds in an HTST.
- When purchasing pasteurized cream from another dairy plant, it is necessary to re-pasteurize the cream before using it for buttermaking.
- Pasteurization will not remove off-flavors from cream.
- The presence of yeast or mold in butter does not indicate improper pasteurization.
- Pasteurization does not destroy all bacteria.
- The psychrotrophic microorganisms responsible for rancid and fruity flavor defects are easily killed by pasteurization.
- The phosphatase test is of value to public health because milk heated sufficiently to give a negative phosphatase test also has been heated sufficiently to destroy any pathogenic microorganisms that may be present. The enzyme phosphatase is destroyed by proper pasteurization, giving a negative phosphatase test.
- A phosphatase test must be conducted by a dairy plant after breaking a DATCP applied seal on the pasteurizer.
- Each pasteurization chart must include the name of the Dairy Plant but does not need to include the Wisconsin Dairy Plant license number.

Buttermaking Operations:

- A licensed dairy plant shall not legally manufacture and offer for sale human food which has not been properly protected against flies, filth, and other contamination, or unsanitary conditions.
- It is essential to remove all milkstone from buttermaking equipment because milkstone will support bacterial attachment and growth.

- Steel wool and metal sponges may not be used to clean dairy equipment.
- Foreign matter, dirt, oil, insects, and rodents found in cream automatically place the product in an adulterated classification and the cream must be rejected.
- Always sanitize the butter churn prior to use.
- Resale of rejected cream or milk is a violation of state law unless it is sold for anhydrous milkfat or butteroil manufacturing.
- Butter spoilage may be caused by water.
- Municipal water approved by health authorities is not always satisfactory for washing butter.
- During the buttermaking process some foam on the surface of sweet cream is expected.
- Using a cold-water wash will not correct the damage done by churning at high temperatures, which is contrary to a false popular belief that the damage can be corrected.
- Hot water should not be added to the cream if the churning temperature is too low.
- Washing butter in the churn is not required.
- Butter starter culture may be used in the manufacture of salted or unsalted butter.
- Reworking or “microfixing” butter may have a detrimental effect on the flavor and body of the finished product.
- A positive displacement pump is the best choice for pumping cream.
- Butter in the batch churn should be tested for moisture before being removed from the churn.
- A leaky body defect in butter is not always preventable.
- Using wash water at 45°F or less does not aid in preventing crumbliness and stickiness.

Microbiology:

- Any of the standard microbiological methods used for the examination of milk may also be applied to the examination of cream.
- Lactose fermenting yeasts are troublesome in cream held for relatively long periods of time and may result in off flavors.
- A typical rancid flavor in cream is due to the lipase enzyme breakdown of milkfat to butyric acid.
- Bacteria will grow in milk or cream at 50°F or below.
- Molds grow in the absence of air and if present in the butter manufacturing process, can be controlled.
- Lypolytic bacteria are not responsible for an acid flavor defect in butter.
- Flavor defects from feed, sanitizer, and mold are of non-microbial origin.

Regulations:

- Violations of applicable Wisconsin laws and regulations may require the revocation of a buttermakers license. 93.06(7) (7) DENY, SUSPEND OR REVOKE LICENSES. Deny, suspend or revoke any permit, certificate, registration or license if the applicant therefor or holder thereof is not fit, qualified or equipped or has violated or failed to obey any applicable law, order or regulation, or has misrepresented or intentionally failed to disclose a material fact in making the application. In determining whether any person is fit, qualified or equipped, the department

shall consider, among other things, character and conduct, including past compliance or noncompliance with law.

- ATCP 65.28(7)(a)(a) A dairy plant operator shall clean and sanitize product contact surfaces of equipment and utensils to keep them at all times in sanitary condition. Sanitizing methods shall comply with s. ATCP 65.34. (b) Except as provided in pars. (c) to (f), a dairy plant operator shall at a minimum clean all product contact surfaces of equipment and utensils after each day's use, sanitize those surfaces before each day's use, and clean and sanitize those surfaces before any change in use that may cross-contaminate dairy products with major food allergens, as defined in s. ATCP 70.02 (29), or other contaminants.
- ATCP 65.44 Dairy plant records. (1) MANDATORY RECORDS. (i) Pasteurization records required under s. ATCP 65.66. Records under this paragraph shall be retained for at least 2 years.
- ATCP 65.926 Dairy plant license and grade A permit suspension or revocation. (2) The department may suspend or revoke a dairy plant license or grade A dairy permit for a violation of Chapter ATCP 65 which may include unsanitary conditions of the dairy plant or a health hazard.

Butter Grading:

- Butter is primarily graded organoleptically for flavor, which is by taste and smell, subject to disratings for body, color, and salt characteristics.
- Any butter in consumer size packages offered for sale at retail in Wisconsin must bear a Wisconsin Grade statement, unless the label bears the U.S. Grade statement.
- Bulk butter not sold at retail is not required to be graded.
- Persons packaging butter shall mark or code each consumer package or bulk container of butter and shall keep records from which the department can determine the name of the grader certifying the grade and the date of printing or churning.

Butter Testing:

- Only the Babcock, ether extraction, or another test method approved by the Wisconsin Department of Agriculture, Trade and Consumer Protection shall be used to determine the milkfat content of cream purchased by or sold to dairy plants.
- The Babcock test is a satisfactory analysis to accurately determine milkfat in milk, cream, and buttermilk. It is based on the use of sulfuric acid to digest the milk solids, but not the milkfat. The fat is separated by centrifugal force through the use of a centrifuge. Centrifuges used in testing must be equipped with both a thermometer and a tachometer.
- All glassware used for Babcock testing must be calibrated.
- Samples taken for a Babcock cream test must be large enough to allow for a retest.

- Cream samples are warmed to a temperature of 100°F (38°C + 1°C) before sulfuric acid is added. The volume of sulfuric acid added to an 18 gram sample of cream is 14 – 17 ml. Cream test samples are centrifuged three times; once for 5 minutes, once for 2 minutes, and once for 1 minutes (in that order). Babcock test bottles from the centrifuge must be placed in a water bath at a temperature of 117 to 120°F (48°C + 1°C). The level of water in the water bath must cover the fat column. Test bottles should be removed from the water bath after a minimum of 5 minutes, wiped with a clean cloth and the fat column measured with a divider (caliper). The upper meniscus on the cream test fat column is flattened by glymol (red reader) which is required to be used. The sample test bottle is held at eye level and read utilizing a magnifying glass and needlepoint divider.
- Charred material in the milkfat column in test bottles may be caused by the acid being too warm, acid being too strong, by using too much acid, or adding the acid too quickly. If charred material is present, the test must be rerun.
- The results of the test must be recorded and signed and dated by the tester. No erasures are permitted on the original fat test records. All dairy plant cream quality records are to be accessible to DATCP Sanitarians.
- It is not acceptable to have curd particles in the milkfat column when performing the Babcock test.
- 0.6% is an acceptable buttermilk fat test.
- The Modified Kohman Method is a sequential multi component gravimetric test, which calculates the moisture component of butter first.
- The Modified Kohman test measures moisture, salt, milkfat, and curd components of butter.
- Petroleum ether is used to extract the fat in the Modified Kohman Method.
- The sample and beaker should be room temperature and the hot plate at a temperature of 232° +/- 5°C for the modified Kohman Method.
- The hot plate used to evaporate moisture in the Modified Kohman test should have a temperature sensitivity of +/- 3°C.
- Four to six subsurface samples of butter should be collected within the batch churn or the butter hopper (of a continuous churn) when performing the Modified Kohman test.

Note: You must be able to read a Babcock test for a buttermaker's license. There will be a drawing of Babcock test bottles that you will have to read as part of the exam.

Butter Arithmetical Problems:

- Pounds of fat

$$\text{Pounds of cream} \times \% \text{fat} = \text{pounds of fat}$$
Example: 1,000 pounds of cream x 35% fat in cream = What is the pounds of fat?

$$1,000 \times .35 = 350 \text{ pound of fat}$$

Example: 90 pounds of cream x %fat in cream = 35 pounds of fat.

What is the % fat in the cream?

$$\frac{35 \text{ #'s fat}}{90 \text{ #'s of cream}} = 38.9\% \text{ fat in cream}$$

- Overrun

$$\frac{\text{Quantity of Butter made}}{\text{Quantity of Fat}} \times 100 = \% \text{Overrun}$$

Example: If 925 pounds of butter are obtained from 750 pounds of milkfat, what is the overrun?

$$\frac{925 \text{ #'s}}{750 \text{ #'s}} \times 100 = 123.3\% \text{ overrun}$$

- Pounds of Butter from Cream

$$\frac{\text{Pounds of cream} \times \% \text{fat in cream}}{\% \text{ fat in butter}} = \text{pounds of butter}$$

Example: $\frac{10,000 \text{ #'s} \times .395}{.801} = 4931 \text{ pounds of butter}$

- Salt to Add

Pounds of butter needed x % salt to add = Pounds of salt needed

Example: 4931 pounds of butter needed x .015 salt = 74 pounds salt to add

If 1.5% salt is required, how many pounds of salt must be added to 1000 pounds of butter.

$$1000 \text{ #'s} \times 1.5\% = 15 \text{ pounds of salt}$$

- Chlorinated wash water for butter

Proportionate ratio example:

It takes 1 ounce of chlorine in 1 gallon of water to get 50ppm.

How much chlorine is needed to make up 50 gallons of wash water at 10ppm.

$$\frac{1 \text{ ounce chlorine}}{1 \text{ gallon water}} = 50 \text{ ppm chlorine} = \frac{x \text{ ounce chlorine}}{50 \text{ gallon water}} = 10 \text{ ppm chlorine}$$

Multiply the cross numbers 1 x 50 and divide by 1 = 50 and divide by the ppm ratio of 5 to get 10 ounces of chlorine needed to make up 50 gallons of wash water at 10ppm.

Contacts

Wisconsin Department of Agriculture, Trade and Consumer Protection
 Division of Food and Recreational Safety
 2811 Agriculture Dr.
 P.O. Box 8911, Madison, WI 53708-8911

University of Wisconsin-Madison
 Center for Dairy Research
 1605 Linden Dr., Madison, WI 53706

Wis. Stats. 97- Food, Lodging, and Recreation
 Wis. Admin Code Chapter ATCP 69- Buttermakers and Cheesemakers
 Wis. Admin Code Chapter ATCP 65- Milk and Milk Products
 Wis. Admin Code Chapter ATCP 82 – Bulk Milk Collection, Sampling and Transportation
 Wis. Admin Code Chapter 85- Butter Grading and Labeling

Recommended Materials to Review

- Robert L. Bradley’s book “Better Butter II”
- Wisconsin CDR’s Buttermaker’s Short Course Binder
- Standard Methods for Babcock and Kohman butterfat tests

Document History

The most recent changes to this controlled document are listed at the top of the table:

Revision	Author	Change Description	Approval Date
1.0	James Pikka	New document.	27Nov2021

Approval

11/9/2021 8:32 AM Task Completed Sprecker, Troy S Task assigned to Sprecker, Troy S was approved by Sprecker, Troy S. Comments: Approved by Sprecker, Troy S

11/11/2021 9:45 AM Task Completed Pikka, James M Task assigned to Pikka, James M was approved by Pikka, James M. Comments: I have reviewed for comments and there are no further comments or edits that need to be made to this document. Thanks! Approved by Pikka, James M

11/27/2021 6:48 PM Task Completed Anderson, Timothy P Task assigned to Anderson, Timothy P was approved by Anderson, Timothy P. Comments: Approved by Anderson, Timothy P