

Butter manufacturing and ripening and neutralization of cream

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BUTTER

Butter is obtained from cream by means of churning and working with the addition of salt. Butter is finally packed in wholesale containers or retail package. It is generally used as a spread and a condiment, as well as in cooking applications such as baking, sauce making, and frying. It generally has a pale-yellow colour, but varies from deep yellow to nearly white. Butter – a water-in-oil emulsion, comprising of more than 80 percent milk fat, but also containing water in the form of tiny droplets, perhaps some milk solids-not –fat, with or without salt. Butter texture is a result of working/kneading during processing at appropriate temperature, to establish fat crystalline network that results in desired smoothness. Basically, butter contain butter fat, water and curd, the last consisting of casein, lactose and mineral matter

Chemical composition (%) of Butter

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Fat	Moisture	Salt	Curd
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80.2	16.3	2.5	1.0
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According to FSSAI (2006), butter means the fatty product derived exclusively from milk of cow and / or buffalo or its products principally in the form of an emulsion of the type water-in-oil. The product may be with or without added common salt and starter cultures of harmless lactic acid and/ or flavour producing bacteria. The table butter shall be obtained from pasteurized milk and / or other milk products, which have undergone adequate heat treatment to ensure microbial safety. It shall be free from animal body fat, vegetable oil and fat, mineral oil and added flavour. It shall have pleasant taste and flavour free from off flavour and rancidity. It shall conform to the following parameter given the Table provided that where butter is sold or offered for sale without any indication as to whether it is table or desi butter, the standards of the table butter shall apply.

Parameter	Table Butter	Desi Cooking Butter
Moisture	Not more than 16.0 percent m/m	-
Milk Fat	Not less than 80.0 percent m/m	Not less than 76.0 percent m/m
Milk solids not fat	Not more than 1.5 percent m/m	-

Common salt	Not more than 3.0 percent m/m	-
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Butter is usually classified into two main groups, mainly Sweet cream and cultured or sour cream butter. Butter can also be classified according to salt content: unsalted, salted and extra salt.

Butter consists of unaltered fat globules and moisture droplets embedded in a continuous phase of butterfat. The structural properties are dependent on the proportion of liquid to solid in a continuous phase. The flavour of the fat is due to diacetyl and to a lesser extent to butyric, acetic, propionic and formic acids, acetaldehyde and acetone. Butter produced from curd contains much more diacetyl than when the raw material is fresh cream but the amount can be increased by the addition of culture.

Manufacturing process

Receiving milk /cream

Cream must be of good bacteriological quality without taste or aroma defects. Cream containing antibiotics or disinfectants is unsuitable for the manufacture of acidified butter. Strict hygiene is essential in all stages of the production process. The raw materials chilled to 2 – 4°C immediately on arrival at the dairy should be stored at the temperature until pasteurized.

Preheating of milk

For efficient fat separation

Neutralization of cream

- a. To avoid excessive fat loss in butter milk
- b. To guard against production of an undesirable off flavour
- c. To improve keeping quality of the product.

Standardization of cream

Fat in cream adjusted to 35 -40% for exhaustive churning

Pasteurization/ Vaccination of cream

Cream is pasteurized at a high temperature usually 95°C or higher, normally without holding time. Pasteurization treatment kills microorganisms, inactivate enzymes and to make the cream a better substrate for the starter bacteria and control of oxidative deterioration.

Cooling and ageing of cream

It is needed for proper fat crystallization and to ensure desirable body and texture in butter.

Rapid cooling of cream to a low temperature tends to produce a harder butter than slow cooling. Rapid cooling causes a larger proportion of the total fat to solidify than slow or stepwise cooling. Furthermore, rapid cooling causes the formation of numerous small fine crystals, which entrap some of the liquid phase. Both these factors contribute to increase the hardness. Under Indian condition, the optimum temperature for the cooling and ageing of cream should preferably be 5 -10°C.

Ripening

The purpose of ripening is to sour the cream and to crystallize the fat. It is needed for production of desirable flavour and aroma in butter; also facilitates exhaustive churning, i.e. a low loss in buttermilk.

Traditionally cream for ripened cream butter is fermented by selected lactic acid bacteria, which produce lactic acid from lactose and diacetyl (principal flavouring component in ripened cream butter) from citric acid.

Diacetyl and volatile acid are water soluble and are present mainly in the serum of cream. The serum if incorporated into butter from cream transfer some of the flavour compounds to butter, but most are partitioned into the buttermilk. Also, the butter is washed with water after removal of buttermilk; there is further loss of flavour constituents. The addition of culture to butter after draining the buttermilk and washing avoid the loss of flavour compound.

Adding colour

To satisfy the consumer demand, butter colour should have the following properties: It should be harmless, free from off-flavour, concentrated and oil soluble. Butter colours are generally manipulated with food colouring in the commercial manufacturing process, most commonly annatto or carotene.

Churning process

Cream is subjected to strong mechanical forces in the buttering machine. Part of the fat globules membranes are removed due to higher shear stress until fat crystal penetrate and destroy the membrane. At the same time fat globules are pushed together in the space between the beater and the wall of the buttering machine. The liquid fat passes through the membrane and the fat globules agglomerate. Intact fat globules, solid fat and serum droplets are entrained and grainy products with nearly the same grain size are formed by the tumbling movement of the liquid. The churn is stopped and the buttermilk is drained from the churn. After draining, the butter granules are flushed with a small amount of water to remove cream milk serum (butter milk). After washing, the water is drained. After a short initial working, the free water is drained and the butter is salted to give a final salt concentration of 1 to 2.5%. Working is then continued to distribute the salt and moisture uniformly throughout the butter.

Washing

It is common practice to wash the butter after churning to remove any residual buttermilk and milk solids.

Working

Working is meant to render the butter grains into a continuous mass, to finely disperse the moisture in the butter and to regulate the water content. Working release fat liquid (about 50 – 95% of total) at room temperature. The liquid phase forms the continuous phase in which fat globules, fat crystals, membrane materials, water droplet and small air bubbles are dispersed.

Salt may be added to improve the taste, flavour and shelf life, as it acts as preservative and increase overrun.

Packing and storage

Packing is for protecting butter against contamination and mutilation, loss in weight and flavour deterioration. For long storage, butter is kept at 10 to 20⁰F or below temperature

Texture of butter

Since the body of the butter is markedly affected by temperature, it is necessary to define the temperature at which any particular characteristics are desired. Butter should be judged at a product temperature between 40 and 50⁰F. In this range of temperature its body should be firm, waxy and composed of closely knit granules. The water and air in proper amount must be uniformly distributed and closely bound by triglyceride super structure. The butter must cut clean when sliced and be readily spreadable when placed in the mouth; it should not appear greasy or salty and must not contain undissolved salt granules. Variation in the body and texture of butter are caused by the changes in composition of triglyceride and by modification of manufacturing procedure. The triglyceride of milk fat is made up of fatty acids. Some of which cause them to have a high and other to have a low melting point. To overcome these difficulties in the firmness of milk fat, the butter maker must pay close attention, to the heat treatment of cream, the cooling and holding temperature, the temperature of churning and washing and length of the working time of the butter.