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The Use of Microorganisms in Dairy Products (Butter)

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Abstract— Butter is widely used in cooking and baking, particularly by those who enjoy cakes and sweets. Butter is categorized as a dairy product which is made from fat and protein. Biotechnology knowledge is applied in the process of making butter because it involves microorganisms such as bacteria, yeast, fungi, marine diatoms and protozoa. The steps in the process of making butter include separating raw milk, skim, pasteurization, storage, evaporation, and drying. The neutralization of butter cream is vital in lowering the acidity of cream, which prevents unpleasant odors.

Keywords—butter, dairy product, neutralization, biotechnology

3.1 Introduction to Industrial of Biotechnology

Industrial biotechnology, the third wave in biotechnology, is one of the most exciting new solutions to pollution control, resource management and cost reduction. If developed to its full potential, industrial biotechnology can have a far greater global impact than health care and agricultural biotechnology. Industrial biotechnology enables businesses to operate at low costs while still protecting the environment. Drugs can take up to a decade for a full review, but industrial processes can go from lab study to commercialization in two to five years.

Biotechnology's integration into industrial processes is not only changing how we manufacture products, but it's also resulting in the creation of new ones that were unimaginable a few years ago. Product improvements have been combined with pollution control since the beginning of the biotechnology manufacturing process. For example, biotechnology solved the problem of phosphate water pollution caused by phosphate in washing detergents by using enzymes that are more effective at removing dirt, allowing the pollution material to be replaced with a non-polluting bio-based additive [1].

Since then, industrial biotechnology has produced enzymes for both every day and industrial use, such as meat tenderizers, contact lens purification fluids, making culture, and medicine development. Interestingly, the enzyme has advanced into a biocatalyst, which can boost performance and make complex biochemical reactions go faster and easier. Industrial biotechnology research enhances and improves existing biochemical pathways in the manufacturing sector. Biotechnology is advancing in the Industrial Revolution as a result of a number of related developments such as genomics, proteomics, and bioinformation. This technique can be applied to a wide range of microorganisms, including bacteria, yeast, fungi, marine diatoms, and protozoa [1].

A. Introduction to Production of Butter

Butter is made from the fat found in milk. It is typically made with sweetened and salted cream [2]. It's also possible to make it from acidulated or bacteriologically soured cream. Cream that stands and sour naturally had been applied to make butter in the 19th century. The cream from the top of the milk was skimmed and poured into a wooden tube and butter was made by hand in butter churns. [2]. However, the method is highly susceptible as it is frequently harmed by foreign microorganism infection. [2]. Years of experience and expertise in hygiene, bacterial, and thermal treatment, as well as rapid technological development of cutting-edge machines, have helped to make the butter industry what it is today [2]. The business cream separator was introduced at the end of the 19th century, and the continuous churn was available by the middle of the twentieth century [2].

B. History of Butter

Butter is about the same age as Western Civilization. It was also used for medical purposes in ancient Rome. In India, Lord Krishna was given tins full of Ghee by Hindus. Butter is the food that is served during the celebration, which is first described as a feast of meat, milk, and a creamy yellow propagation that Abraham and Sara gave to three visiting Angels as stated in the Bible. Even though many of the earliest records of butter users come from Roman and Arab sources, people in the Mediterranean continued to use oil for cooking. Butter appears to have been the fat alternative for the tribes of northern Europe. By the 12th century, northern Europe's butter processing industry was booming. According to records, Scandinavian merchants export large quantities of goods each year, positioning their economy as a global leader.

C. The Process of Making Butter

The continuous butter-making machine is now the most widely used piece of equipment to make butter. A fluid milk dairy can provide the cream, or a butter manufacturer can separate it from whole milk. The cream must not be rancid or oxidized, and it must be sweet, with a pH of at least 6.6 and a titratable acidity of at least 0.12 [4]. When the butter is separated by the butter manufacturer, the whole milk is heated in a milk pasteurizer before passing through a splitter. The cream is refreshed and poured into a tank, where a total contain is measured and adjusted if necessary. Skim milk is pasteurized and cooled in a separator before being pumped into storage. It's usually meant to be dried and condensed [3]. For the intermediate storage tank, the cream is pasteurized at 95° C or higher. The high temperature is necessary to kill microorganisms and enzymes that are harmful to the preservation of butter. The cream should be ripened to a pH of 5.5 at 21 degrees Celsius, then to a pH of 4.6 at 13 degrees Celsius. Lactis diacetyl lactic acid is used in this formula. Between pH 5.5 and 6.6, the most flavoring development is observed. The stronger the acid production taste, the higher the temperature during the maturation process. Mature butter will not be washed or salted. [3].

The cream goes through a controlled cooling system in the aging tank to give the fat the crystalline structure it needs. The iodine value test determines how unsaturated an oil or fat is. With a low iodine value, such as when the unsaturated fat proportion is low, the procedure can be tweaked to produce butter with good consistency [5In general, the time required for aging is between twelve and fifteen hours. The churn or continuous butter is pumped to the tank via a heat exchanger plate that brings the cream to the proper temperature [4]. The cream is heavily agitated during the churning process to split the globes fat, which coagulates the fat into butter grains while the remaining fat content and buttermilk content decrease [6].

The cream was separated into two fractions: butter and buttermilk. During traditional churning, the machine stops processing when the grains reach a certain size, and then absorbs the butter milk. The draining of the buttermilk is also continuous. The butter is worked to a continuous fat phase with a finely dispersed water phase after drainage. Usually, after churning, the butter was washed to remove any remaining butter milk and milk solids [4]. To achieve the best taste and shelf life, salt is added as a preservative. In the case of batch processing, if butter must be salted, the salt content is dispersed over the surface. In the continuous butter making process, a salt slurry is added to the butter. In this aqueous phase, salt is dissolved, and the effective salt content of the water is estimated to be 10% [7].

The butter must be vigorously worked after the salting process to ensure a consistent distribution of salt. Among the characteristics that are measured are the color of the butter, the taste of the butter, and the consistency of the preservation [7]. In addition, salt and water are used to make a standard butter granule mixture.

Working is required to achieve a homogeneous blend of butter granules, water, and salt. As you work, fat transforms from globular to free fat. Water droplets shrink in size during the working process and should not be evident in properly worked butter. Overworked butter, depending on how strong or soft it is, is too brittle. A small amount of water can also be added to control moisture content..

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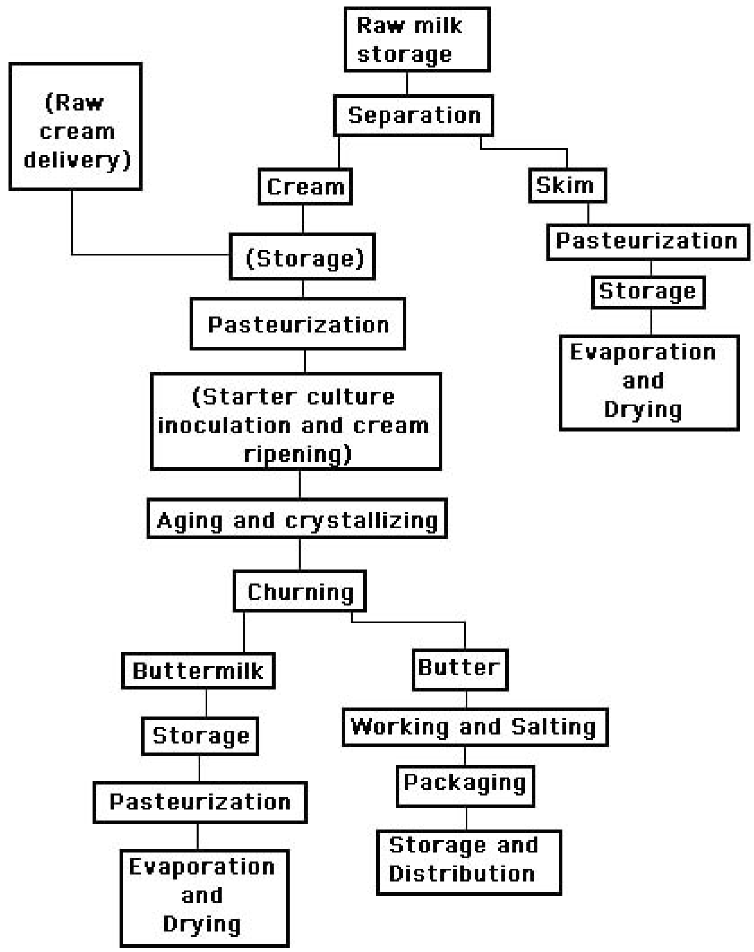

Figure 1: The overview of the butter making process [5]

Temperature control is critical for maximizing yield. After the butter is ready, it is discharged into a packaging unit and stored in a cold location [3]

D. The Butter's Chemistry

Butter is a dairy product made by separating the fat globules from the buttermilk from churned or fermented milk. Butter can be made from the milk of a variety of animals, including sheep, goats, buffalo, and yanks, but the most common is cow's milk. Emulsion of a heavy cream is made of tiny droplets of one liquid dispersed in another liquid. In heavy cream, the minor fats are typically stored in water. The fat globules are pushed together as the milk is churned. They are striking each other with a lot of energy in a fixed position. The size of the fat collection grows with each additional globule. After extensive churning, the fat globules form a piece of butter. So, what's left is a watery soap with a few floating butter grains. Press the butter and knead it into a firm mass to extract any remaining pockets of butter or water [5]. The butter milk is drained, labelled, and stored for later use.

During the fermentation process, bacteria convert milk sugar to lactic acid, which produces additional aroma compounds. This can make the substance appear butteries and enhance the flavor of the product. Butter culturation is now widely used in pasteurized milk, which is fermented by additional Lactococcus and Leuconostoc bacteria. After the cream is skimmed from the milk, it is referred to as fat-free milk. The whole milk available on the market right now has been homogenized to allow the milk and cream to mix. Most dairy products have been pasteurized to eliminate all harmful bacteria and other microbes. Sweet cream butter refers to butter made from fresh pasteurized milk. Raw cream butter refers to butter that is fresh or grown. While pasteurized cream butter can last for months, raw cream butter has a shelf-life of about ten days.

E. Biotechnology in Production of Butter

Butter was an important part of the diet in many countries around the world. Butter is a high-fat milk product made by churning cream and combining granules into a large, dense mass. Until the mid-nineteenth century, most of this commodity's production was done on a small scale on the farm.

Figure 2: 3D Model Butter Churn [6]

It wasn't until 1879 that the centrifuge cream separator gained popularity. Thanks to Babcock's fat test method in 1890 and Gerber's fat test method in 1892, as well as the introduction of artificial colding and pasteurization around 1980, mass processing of butter grew quickly. Prior to 1970, most of the world used batch processing to make butter. In addition, the continuous method to achieve better production efficiencies have been implemented since World War 11. The main aspect of churning is to develop cream emulsion by mechanical stirring, regardless of the production method used. Butter and other fat spreads must be classified according to the emulsion types as well.

F. Preparation of Cream

Both sweet and cultivated cream can produce commercial butter. Very little butter can be produced in India and the United states, while cultivated butter is common and significant in Europe and Canada. However, most creamers prefer to make butter from the sweet cream because it contributes to sweet butter milk which is of better financial value than sour buttermilk.

G. Preparation of Cream

The cream must be neutralized to produce high-quality butter. It is clear from this activity that the neutralization of the cream can reduce the acidity of the cream. The presence of high acidity churning can cause fat loss, which can be prevented by neutralization. As most of the cord is converted to butter milk, the casein curdles, causing high fat losses in pasteurized soul cream due to the entanglement of fatty globules [3].

a) The Purpose of Neutralization

1) Neutralization reduces the acidity of the cream

to 0.14-0.16 %, allowing pasteurization to proceed without the risk of curdling.
2) Unwanted aromas caused by a high acid cream can be avoided by pasteurization at a high temperature.
3) To change the consistency of high acidity milk. Salted-acid-butter develops a fish flavor during commercial storage at -23 to -29 oC.

To obtain the desired quality product, precise sour cream neutralization is required. Several factors influenced the neutralization process:
1) Accuracy in testing
2) Precision in testing
3) The amount of neutralizer
4) Process of neutralizer mixing

b) Factor Effect Process of Neutralization

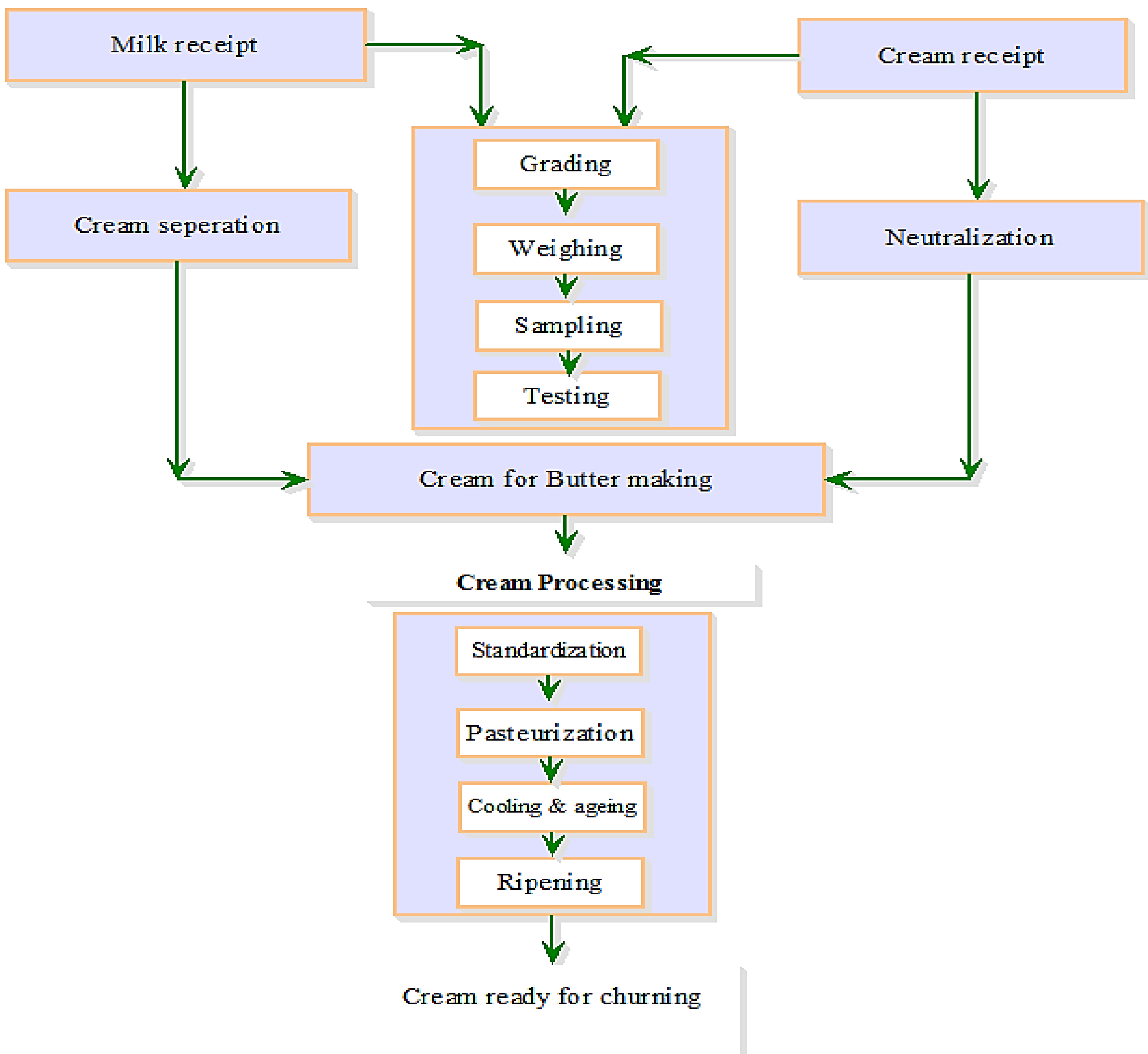

Figure 3: The cream preparation flow diagram for the processing of butter

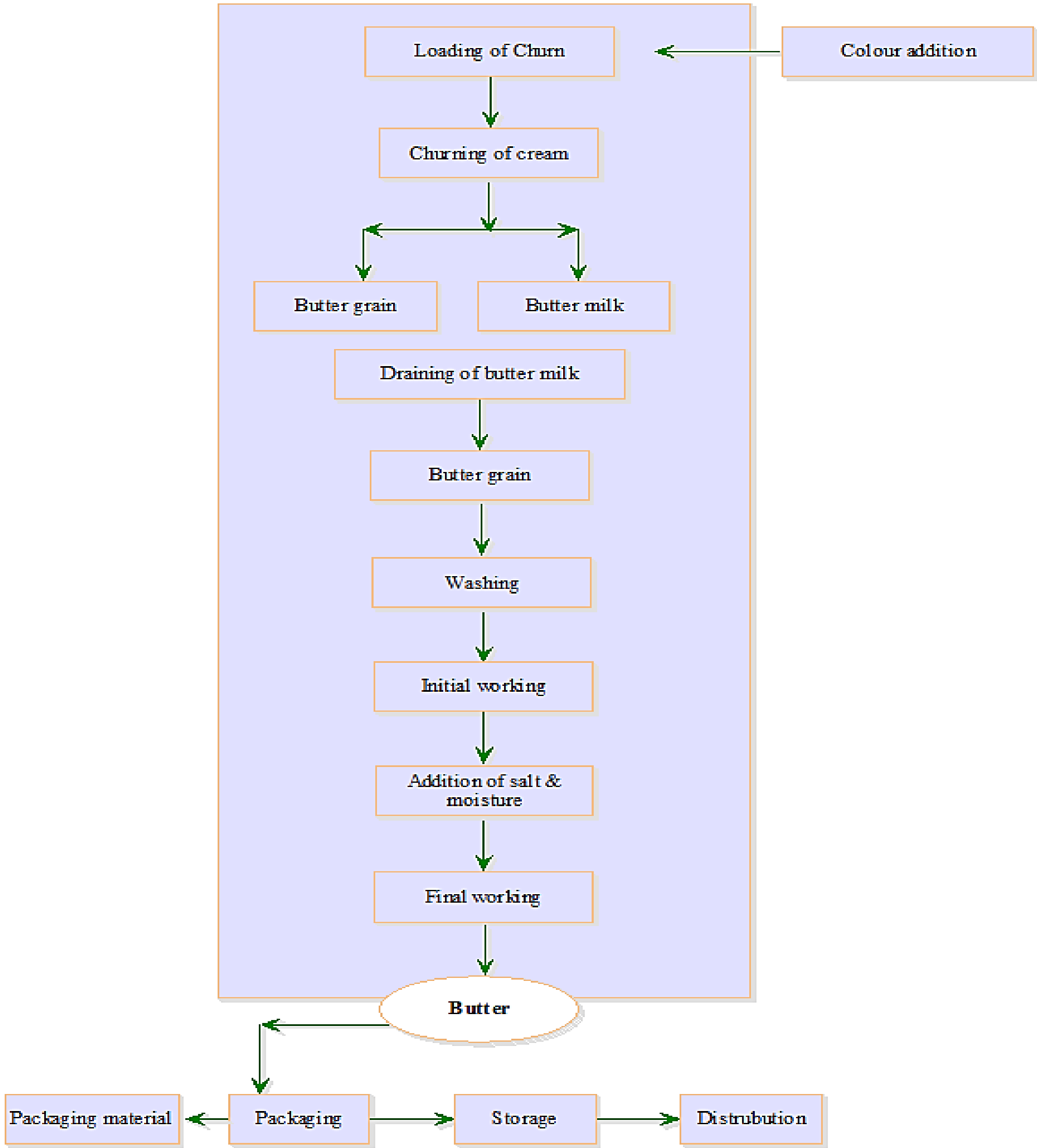

Figure 4: The manufacturing of butter flow diagram [8]

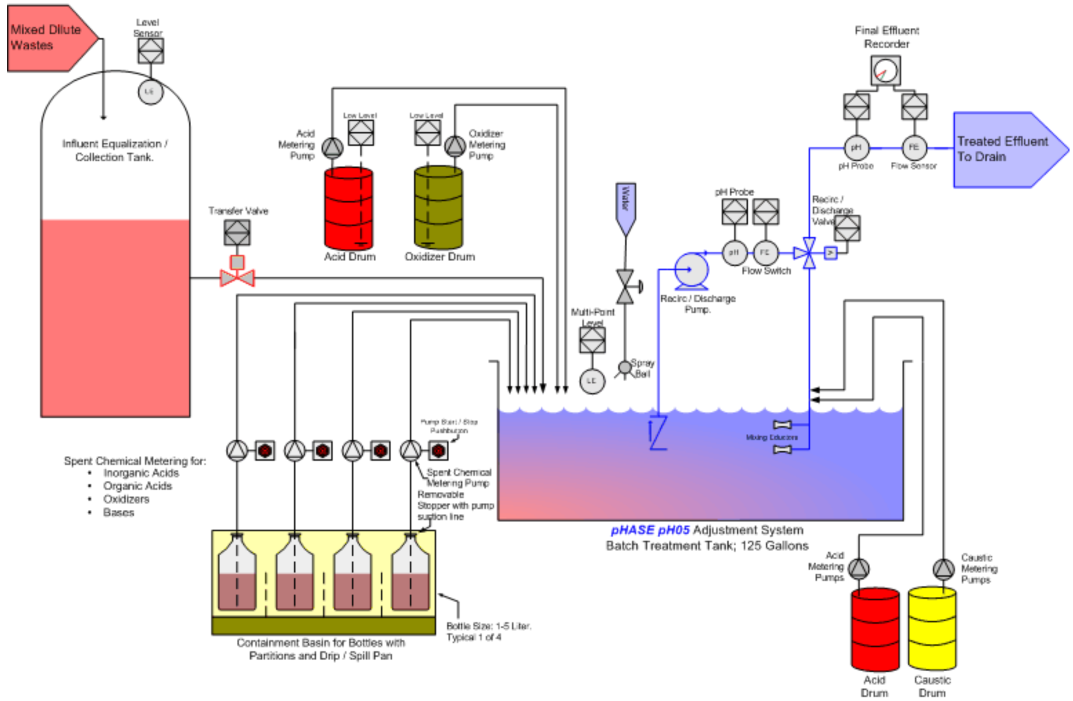

Figure 5: The neutralization system for the pH acid waste [6]

H Cream Maturation Effect on Butter Quality

Only through cream ripening or any other manufacturing process can enhance butter's aroma and flavor, and if the quality of the resulting butter does not deteriorate or be destroyed. The control of age deterioration due to bacterial causes and the influence on age deterioration due to chemical causes are two fundamental ways in which cream ripening affects the keeping quality of butter [7].

1) The Effect of Bacteriological

Cream maturation improves the quality of the butter because the preservation of quality is dependent on the absence of ageing caused by biological effects. The process of cream maturation aids in the control of bacterial deterioration in butter. Most aroma-damaging organisms in butter can cause problems, such as disrupting operations and preventing the fresh or desired flavor [6].

2) The Effect of Chemical

The chemistry stability of butter is not improved by ripening the cream. Salted cream's life is shortened as it ripens to a full aroma and flavour. The butter, which is aged and made of fully matured cream, develops an oily metallic and fishy flavor.

I Biotechnology in Challenge

Today, biotechnology plays an important role in a variety of fields. This is a broad field that encompasses a variety of technologies that convert natural idle into modified outcomes with higher potential and long-term product returns. The applications of biotechnology in scientific research and technological development for the benefit of humans and the environment are limitless. Chemical, food, medical and industrial biotechnological techniques are some of the other fields.

1) Developing Challenge of a New Products

The design and release of the desired product at the laboratory level is the first level of success. The pilot production of the product and statistical research on the industrial framework will be used in the investment. Biotechnology marketing, forecasting, and problem-solving challenges are critical to the most efficient and application of bio-modified commodities.

2) Marketing Challenge of a New Products

Time is the most significant obstacle to new product or technology innovation based on fundamental principles. Because of the many challenges and competition in the marketplace, the time it takes to introduce, prototype, and transform an idea into a useful invention is also a factor in the product's success. The product's success will be determined by the market. The product must also meet the needs of the customer and keep up with technological advancements. Technology is the foundation for the development of a commodity. The technical skills are dictated by the nature of the commodity. Experienced and hands-on skills in relocating and developing a new product are very closely related to skilled people.

3) Challenge in Policy

The newly designed innovative product must compete with the growing number of new products on the market. This forces researchers to create high-quality products to meet the needs of customers. The growth of a profitable and novel product should be protected and governed by intellectual property rights. Furthermore, the innovator has legitimately claimed the state of the art or concepts that attract more attention, as well as the business's economy.

J) Full Butter Production

Working butter has two purposes: to add humidity and withstand the acidic environment of bile and attach themselves to the duodenum's epithelium, where they will continue to grow before they can start providing health benefits.

Today, most probiotic dairy products now use lactic acid bacteria in their production, because of the benefits it can provide [14]. The bacteria is well-known for its non-pathogenic properties, as well as its acid and bile resistance. It can also make antimicrobial substances such as bacteriocins, an active protein, hydrogen peroxide, and organic acids on its own [15]. Lactobacilli bacteria, among other lactic acid bacteria, are the most used microbes in the food industry due to their characteristics and adaptability to a variety of environments. Lactobacilli bacteria are commonly used in the preparation and fermentation of dairy products, but they can also be found in a variety of other foods, including vegetables, meat, and sourdough bread [16].

Lactobacilli bacteria are in high demand in the food industry due to their popularity and health benefits for humans and animals. Lactobacilli bacteria can be obtained from natural ecological niches, such as animal milk, which are currently underutilized. Camels' milk is an excellent example, as it can be used to treat tuberculosis, asthma, and anemia [17]. For people who aren't used to the taste of commercial milk, camel milk can be used as a laxative.

K) Treatment of Butter

Even though cream treatment prior to churning is thought to be the most effective way of increasing butter production, attempts have been made to improve butter after it has been churned.

To improve the spread-ability, the mixture was churned at 50°C for a few hours. Aside from that, the current butter manufacturing method almost always eliminates the possibility of packing the butter almost immediately after it has been churned. The mixing process results in the formation of a crystalline butter structure, which allows for an easy breakdown [11].

5.2 Advantage of Food Biotechnology

Probiotics are living microorganisms or microbials that have a significant advantage and benefit to the host by improving the microbial balance in the intestine. [11]. The journey of bacteria known as probiotics in the food system usually begins in the mouth and continues all the way to the lower intestinal tract. The probiotic bacteria have a unique ability to struggle and resist the low pH value in the stomach digestion process. The cellular "stress" begins in the stomach, which has a pH of 1.5 to 2. [12].

A. Prevent Infection of Bacteria

Lactic acid bacteria, particularly L*actobacilli lactis* (Figure 6), have been used to improve the health of living organisms in a variety of foods, including the dairy industry. Antibiotic resistance, acidic pH, bile resistance, polysaccharide and bacteriocin production in LACTOBACILLI plantarum strains found in commercial butter were investigated previously to select the best potential probiotic strains for use in the production of new probiotic butter from animal milk using starter cultures [19]. Probiotic bacteria will be isolated from a dairy product as well as the gastrointestinal tract of animals, which is the continuous passage from mouth to anus. The products produced by lactic acid bacteria during the fermentation process play a significant role in limiting pathogen movement and survival, improving the quality of living organisms [20]. The role of microbes in enhancing and strengthening the immune system of the host can be seen in the Bifidobacterium, which produces acetate that can protect the host from infection with Escherichia coli O-157 [21].

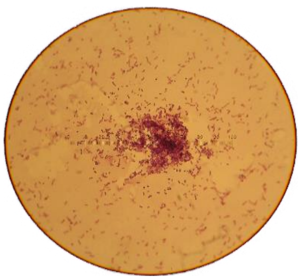

Figure 6: Lactobacillus lactis [10]

In addition, the Lactobacillus acidophilus is proven can constrain and limit the swimming movement of Salmonella and thus retard its multiplication and internalization [22.]. The ability of organisms to move or in other word the motility of the pathogen is a very crucial factor for infection by the majority of pathogenic species such as Helicobacter pylori, Salmonella enterica and Campylobacter jejuni [23]. Inhibiting and limiting the motility of pathogenic bacteria species can thus be an ideal strategy for protecting the host from bacterial infection.

During fermentation, Lactoccocus lactis produces acetate, which can disrupt the rotation and motility of the flagella, limiting Salmonella movement through the whole flesh of the host [24]. The decrease in the internal (intracellular) pH value of the cell also has a repressive effect on Salmonella movement. Flagellum is a tail-like appendage that sticks out from the cell body. The flagellum of Salmonella is then attached to a rotary nanomachine that can convert a proton influx into rotation [24]. With an increase in intracellular proton concentration, inward proton translocation is thought to be damaged. As a result, the rate of rotation of the flagellar motor slows down, as does the bacteria's external pH value [25-27].

The important factor in reducing the Salmonella motility is the presence of acetate produced. In the protonated form, acetate permeates to the cytoplasmic membrane of the bacteria. Protons are then transferred to the cytoplasm by the acetate. As a result of equilibrium, the internal pH of the bacteria approaches the external pH value. As a result of Lactobacilli lactis fermentation, Salmonella movement can be studied by observing its individual swimming ability in terms of speed. Figure 11 shows Salmonella cells in Lactobacilli lactis precipitation [28].

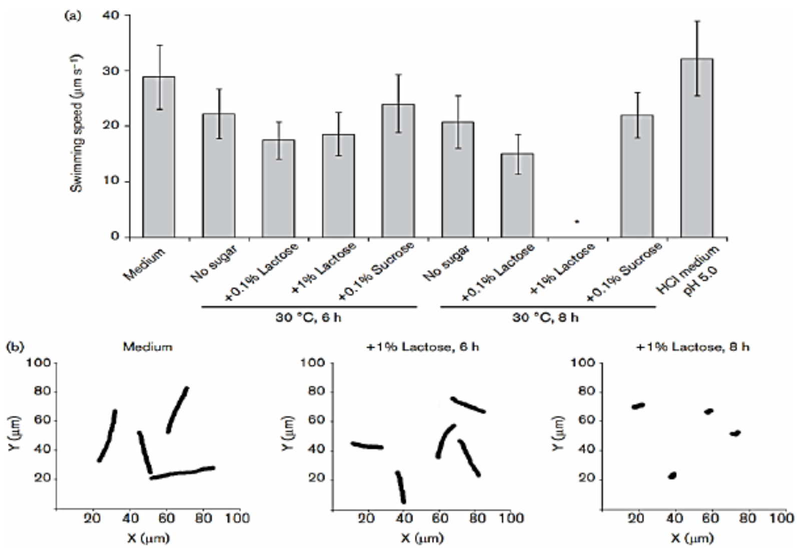

Figure 7: (a) Motility of Salmonella (b) Representative swimming trajectories of Salmonella cells

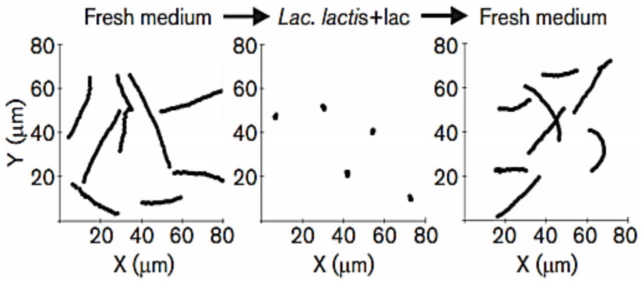

Figure 8: Reversibility of motility inhibition of Salmonella

The average speed of Salmonella cells in fresh TSY condition is 28.8 mms^{-1} (Figure 7a). Salmonella cell movement is restricted in the presence of Lactobacilli lactis, which has slowed by 23% in terms of speed, that is 22.2 mms^{-1}. Lactobacilli lactis precipitate was grown for 6 hours in a medium without sugar; however, lactobacilli lactis cannot be grown when sucrose is present [29]. After incubation and fermentation for 6 hours, Lactobacilli lactis precipitates containing 0.1 and 1% lactose significantly reduced Salmonella cell motility, lowering swimming speeds to 17.4 and 18.6 mms^{-1}, respectively. There was no movement of Salmonella cells from culture medium with Lactobacilli lactis fermented for 8 hours with 1% lactose, as shown in the Figure 7b. However, in an acidic HCl medium with a pH of 5.0, Salmonella motility was nearly identical to that of fresh TSY medium, which is 32.2 mm s-1 (Figure 7a). Based on the findings, it appears that the pH of the medium has no bearing on Salmonella movement. When the Lactobacilli lactis precipitant is replaced with fresh TSY media, the Salmonella cells almost fully recover their original swimming speed. It is, however, slightly weakened (See Figure 8). The similarities of the study can be compared to the reports showing inhibitory effects of Lactobacillus casei strain Shirota on Salmonella motility [29]. It is suggested that the Lactobacilli lactis precipitant only affects Salmonella movement by disturbing flagellar rotation. However, it does not through irreversible damage against morphologies

B. Preservation

Using microbial organisms, the taste and shelf life of an edible consumable can be improved. Fermentation is a method of extending the shelf e of foods by using microorganisms. Food ocessing engineering is the application of otechnology to transform an inedible raw aterial into a more valuable and edible product. rmented foods have been consumed for nturies all over the world. Lactic acid bacteria AB) from the Lactococcus lactis bacteria, for ample, are produced during fermentation and n be used to preserve food. [29]. Food security n be improved by increasing food accessibility d marketability, as well as reducing waste and suffering in the food chain. Food safety is a mandatory duty that guarantees that fermented and processed foods will not harm consumers [30]. A high-quality supply of safe food can help prevent nutrition-related diseases while also ensuring a steady supply of food for distribution [31]. Bacteriocins and some strains, as well as their use, can improve bacteria's preservation properties, reinforcing their importance in the food industry.

Lactic acid bacteria, or LAB, act as "immunizing" starter cultures in the milk fermentation process. Clear white milk is known for the natural habitats of lactic acid bacteria [32]. While milk fermentation technology is inexpensive and simple to use, large-scale use of lactic acid bacteria necessitates strict adherence to certain parameters, such as temperature, pressure, and humidity, to ensure that the bacteria can live as efficiently as possible. Lactic acid bacteria have a lot of potential as a starter for cultures that can balance the diversity of microorganisms in milk and dairy products. Using lactic acid bacteria in milk preservation and fermentation can undoubtedly improve the taste, quality, and shelf life of milk.

The main difference between untreated milk and fermented milk is its shelf life. Normal milk can only be stored for a few hours, whereas fermented milk can be stored for up to a year due to the presence of lactic acid bacteria as a preservative. Some other types of dairy products, such as cheese, can be stored for up to 5 years in the right conditions. Lactic acid bacteria have a long history of use and consumption in the dairy industry. While it is the cheapest method of fermentation, it is also more popular than unfermented food due to the food's organoleptic properties. Also, fermentation lowers the pH of the food, which inhibits the growth of microorganisms and pathogens that are potentially harmful to both the milk and the consumer. This technology needs to be researched and developed further to improve its efficiency and safety in low-resource rural settings.

5.3 Effect of food biotechnology on today society

a. Farmer (Individual)

The social landscape changes as technology advances. Because farming is such a difficult and long-term job, the traditional family farm is gradually disappearing. Farming is difficult to keep up with due to the unpredictability of the economy and weather. Today, food biotechnologies are at their pinnacle, and as the human population grows exponentially, the demand for healthy and sustainable food also increases. Traditional food preparation methods are inefficient and have a negative environmental impact by emitting a large amount of carbon dioxide into the atmosphere. Biotechnology has transformed living nature by enabling the enhancement efficiency necessary to fully meet human needs.

The industrial and agricultural sectors are unique in their own ways. The most significant difference between the two sectors is inflexibility in response to changing product demands. For example, the cost and price of automobiles deplete over time and need to be refreshed to stay ahead of the competition. If there are any technical changes, a company may lose some profits. In contrast, the quantity of demand for agricultural products continues to rise as the world's population grows. As the product grows, the cost of production in the agriculture sector can be reduced. The demand and supply for healthy, sustainable foods can be further met with the help of food biotechnology.

b. Labor (Community)

Adapting to food biotechnology has a lower impact on farmers than adopting other older mechanical and chemical technologies in the last 50 years [33]. Biotechnology can help to reduce the need for physically demanding jobs by making tasks simpler and easier to complete in a short period of time [34]. Furthermore, biotechnology can reduce not only the time and costs associated with it, but also the environmental footprint associated with a given level of production.

c. Digital Monitoring Technologies

The cow, as the source of milk, is the most important aspect of a good and sustainable dairy product. most large corporations have chosen to devote their full attention to the cow. The farmer must be able to recognize the frequency with which a cow becomes ill to get the most efficient performance. The fertility and amount of milk produced by each cow must also be carefully monitored by the farmer. This can assist the farmer in identifying and focusing on the most productive animals while giving the least amount of attention or consideration to the underperformers. For the ease in this category of process, farmers can always rely on sensors attached to the cow or to the milking line to collect the necessary data needed as shown in Figure 9.

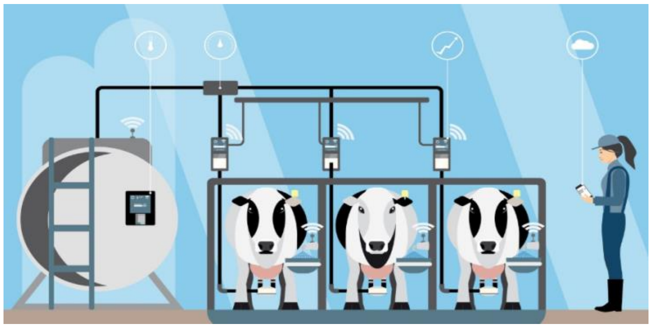

Figure 9: Digital Monitoring Technologies [34]

The Silent Herdsman Company, based in the United Kingdom, had developed a successful neck-collar monitoring system. The "Collar" can be used to detect any health issues as well as the optimal estrous cycle (reproductive hormones). Hundreds of dairy farms across Europe are currently using this technology. Farmers will spend less time on the farm inspecting each cow individually and more time preparing for the next step of the inspection with this product.

d. Dairy Biotechnology

Mastitis is the most common problem on dairy farms. Mastitis is a mammary gland infection that affects the udder of cows (Figure 10). If not treated as soon as possible, this infectious disease can be fatal. This inflammation is highly infectious and can be caused by a variety of pathogenic forms. This nasty infection has the potential to spread throughout the herd, reducing the volume of milk produced. The disease is so widespread that it affects one-quarter of all dairy herds every year. Mastitis is highly infectious, so a cow infected with it must be removed from the production line and treated with antibiotics before returning to the milking line; it's highly contagious, so one infected cow could spread the disease to other cows in the herd, severely reducing the dairy's overall output. The traditional method of detecting infection is by using a hospital pen on a regular basis, which can take anywhere from a few days to a week to produce results.

Biotechnology has emerged as a viable alternative to traditional antibiotics in the treatment of bacterial infections in dairy herds. Other biotechnologies in this category include genetic testing and editing. Prosper Animal Health is currently developing next-generation vaccines for bacterial diseases that affect any farm animal. It claims to be able to provide a more rapid and long-lasting immune response, resulting in healthier and more productive animals.

Figure 10: Mastitis on Cow [34]

Food biotechnologies promote the creation of new technology jobs in the agriculture and food processing industries. Farmworkers, particularly older generations, are, on the other hand, less likely to fully embrace new technologies or use research labs. Though labor control will be much easier with a fully equipped technology setup on the farm than with older mechanical and chemical technologies, food biotechnology does not necessitate a high level of technical expertise to operate.

e. Economy (Country)

Biotechnology adoption in the farm will significantly reduce production costs. Biotechnologies are expected to expand their use both off and, on the farm, [35]. The biotechnology helps in developing further appropriation by continuing to transfer certain processes from the farm directly into the industrial section. Butter that is produced from the farm, for example, can now be processed inside the factory. A number of new advanced processes have been developed in the substitution section, such as replacing margarine with butter in the presence of lactobacillus bacteria. With these innovations from within the farm, the cost of production can be drastically reduced, and the farmer's profit will skyrocket.

f. Environment

Biotechnologies have a number of goals, one of which is environmental protection. Scientists and researchers are constantly attempting to use biotechnology that is environmentally friendly to improve food production and make it more environmentally friendly. One example is that some food biotechnology is specifically designed to be resistant to farm pests and diseases. As a result, farmers can use fewer chemicals, such as pesticides and herbicides, while still producing a high-quality, long-lasting crop. Reduced use of chemical pesticides is good for underground water as well as for consumers who are concerned about harmful chemicals that may be trapped inside the product.

The farmer will also save money on the tilling and ploughing process by using the biotechnology crop. The crop itself is inherently able to resist herbicides. The crop uses rainfall and irrigation to improve its water absorption process, which benefits water use and conservation. Biotechnology also aids in soil erosion control, resulting in healthier soil. Without a doubt, biotechnology can assist in increasing crop yields while reducing water usage on the farm. Tilling is also avoided, which reduces the release of toxic gases such as carbon dioxide into the atmosphere. Because biotechnology can significantly increase crop yield, forestation can be reduced as the amount of land required to produce the same amount of product is reduced.

CONCLUSION

Today's scenario for new biotechnologies is similar to that of the lawn mower at its inception. that some people will dismiss such biotechnologies as too risky or unappealing in comparison to other options. It's also likely that new biotechnologies will compel existing technology and social relations, causing society to revolutionize. Within half a century, the "inevitability" of the process will become apparent. In short, biotechnology has enormous potential for increasing food production and improving food processing, thereby revolutionizing society in the face of global challenges such as the spread of infectious diseases, food insecurity, and environmental degradation.

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