

New Processing Technologies from the Buffalo Milk



Buffaloes are the second largest source of milk supply in the world. In India nearly half of the milk processed by the organised dairies comes from buffaloes as they are better converters of local feeds into milk than local cows. The excess fat in buffalo milk is usually skimmed off to pay for the processing and distribution of milk enabling the consumer to get their milk at the same price that is paid to the producers. Buffalo milk fat has less cholesterol and more tocopherol – which is a natural antioxidant. Buffalo milk is richer in calcium and phosphorus and lower in sodium and potassium than cow milk. The peroxides activity in buffalo milk is much higher than in cow milk which accounts for the natural preservability of buffalo milk. Almost all dairy products including condensed milk, long life milk, milk powder, infant milk foods, fermented milks, etc can be made from buffalo milk without any changes in the equipment. However, some minor changes in process parameters are required for the manufacture of condensed milk. While buffalo milk is ideal for making mozzarella cheese, some changes are required for the manufacture of cheddar and other cheeses. Buffalo milk is a better tea/coffee whitener and makes richer firmer curd and yogurt.

Buffalo milk has several technological advantages over cow milk, owing to better physicochemical constituent as compared to cow milk. Its rich flavour and taste are attributed to, amongst other properties, the higher fat content, larger micellar size of casein, smooth texture and richness.

Buffalo milk contains several enzymes which are physiologically significant. In buffalo milk, the alkaline phosphates activity is about one third of that in cow milk; peroxides activity is nearly 24 per cent higher than cow milk; and lipase activity is lower than cow milk. The thermal stability of buffalo milk lactoperoxidase is also higher than that of cow milk. The lactoperoxidase system which consists of three components – lactoperoxidase enzyme, hydrogen peroxides and thiocyanate, a substance that can be oxidized - is widely exploited for its bactericidal and bacteriostatic properties. Lysozyme is active at a wide range of temperature and is heat stable and acts as an antibacterial factor, particularly against gram negative organisms. It is also stable at low pH and resists gastric juices under in vivo situations.

Buffalo milk processing

Dense whiteness of buffalo milk is due to the higher opacity of casein micelles, higher levels of colloidal proteins, calcium and phosphorus, and absence of carotene. Therefore, UHT processed buffalo milk and cream are whiter and more viscous than their cow milk counterparts because of conversion of greater levels calcium and phosphorus into the colloidal form. Buffalo milk is, therefore, more aptly suitable for the production of tea and coffee whiteners than cow milk.

Dried milk products prepared from buffalo milk exhibit higher levels of undenatured protein when processed under similar conditions. This is because proteins of buffalo milk, particularly the whey proteins, are more resistant to heat denaturation as compared to the cow milk proteins. The reconstitution behaviour of dried milk products made from buffalo milk is in general, not very different from those made from cow milk. However, dried buffalo milk may be preferred over dried cow milk for applications where higher levels of undenatured whey proteins would be more desirable.

Buffalo milk has higher fat and solids content and so, is commercially more viable than cow milk for the manufacture of fat and solids-based milk products, such as butter, ghee and milk powders. Bigger fat globules of buffalo milk facilitate quicker separation and maximum recovery of milk fat. Curd tension in buffalo milk being nearly 1.5 times that of cow milk, the former could be a better raw material for preparing textured products. Yoghurts made from buffalo milk are naturally thick set without having to add milk proteins or gelling agents.

Similarly, traditional fermented products such as dahi and Lassi are best appreciated when made from buffalo milk because it is thick and rich and is more suitable for acidification owing to its higher buffering capacity (0.042) than that of cow milk (0.035) at pH 4.9-5.1. Traditional Indian sweets made from khoa and chhana are also best made with buffalo milk that has higher solid content and desiccates with lesser energy requirement.

The contribution of buffalo milk production to the world dairying by Asia is 96.79 per cent. India is recognized as the world's top producer of buffalo milk followed by Pakistan, China and Italy. Buffalo is the backbone of Indian Dairy Industry.

More viable commercially

Buffalo milk is commercially more viable than cow milk for the manufacture of fat-based and SNF-based milk products, such as butter, ghee and milk powders because of its lower water content and higher fat content. Most significantly, the lower cholesterol value should make it more popular in the health conscious market.

UHT processed buffalo milk and cream are intrinsically whitener and more viscous than their cow milk counterparts, because of conversion of greater levels of calcium and phosphorus into the colloidal form, buffalo milk is, therefore more suitable for the production of tea and coffee whiteners than cow milk. Higher innate levels of proteins and fat render buffalo milk a more economical alternative to cow milk for the production of casein, caseinates, whey protein concentrates and a wide range of fat-rich dairy products.

Fat-rich dairy products

Due to high fat content and larger size fat globule, the buffalo milk cream churns more readily than the cow milk cream. Buffalo milk butter has a higher overrun which increases with increase in the fat content of cream. Many approaches such as:

- a) thermal treatment to cream;
- b) ripening of cream
- c) salting of butter
- d) addition of low melting butter fraction and
- e) oil to improve the spreadability of butter have been suggested.

Concentrated and dried milk products

Technologies have been developed for manufacture of a variety of condensed and dried milk products using buffalo milk. In addition to regular products, processed have been developed for making infant milk foods and other dehydrated and formulated products like dried ice-cream mix, dried cream, butter powder, dahi powder, Shrikhand powder, khoa powder, tea and coffee completer, mango milk powder and chocolate milk powder, etc.

Preparation of infant milk foods from buffalo milk by modifications in chemical composition and by addition of certain additives has also been advocated. With the advancement of technology, it is now feasible to prepare infant milk foods from buffalo milk that reasonably correspond to human milk with respect to its compositional and biochemical characteristics.

Cheese made from buffalo milk displays typical body and textural characteristics. More specially, where chewing and stringing properties are specially desired as in the case of mozzarella cheese, buffalo milk is technologically preferable over cow milk. Certain traditional cheese varieties, such as paneer in India or pickled cheeses from the Middle-East countries are best made from buffalo milk. The yield of buffalo milk cheddar, swiss, cottage, mozzarella and many other cheeses is higher. The sensory qualities of cottage and mozzarella cheese are superior. In Italy, fresh and Pasta Filata cheeses, especially the mozzarella and Borelli cheeses, are traditionally prepared from buffalo milk.

Cheese spreads are gaining popularity due to their mild flavour and ease of use. Spreads have been successfully prepared from buffalo milk cheddar cheese. A process was standardized for the manufacture of spreads from buffalo milk cheese by evaluating blends of emulsifying salts and chakka. Buttermilk solids in different forms can be successfully employed in processed cheese spread making for economy and superior functionality.

Fermented milk products

Buffalo milk has been used for the production of a wide range of fermented milk products such as Dahi, Lassi, Chhach, Mishit Doi And Shrikhand.

Ethnic Dairy Products

Dahi from buffalo milk is superior in body and texture due to higher total solids, protein and fat contents. Similarly, the quality of buffalo milk paneer is superior to that of cow milk paneer.

Among traditional dairy products khoa occupies a prominent place. Use of preconcentrated milk, roller dried whole milk powder, application of reverse osmosis, application of inclined scraped surface heat exchangers (ISSHE) are among several innovations in khoa technology. The quality of khoa made from buffalo milk is superior to that from cow milk, which has moist surface and sticky and sandy texture.

Kheer, payasam, basundi, rabri are some heat-desiccated delicacies prepared traditionally. Standardized processes for making basundi and rabri on commercial scale have been developed. Mechanization in manufacture of khoa-based sweets has yielded promising results. Some of these products like peda and gulabjamun have shown considerable export potential due to improved product quality. All these products can be well prepared by using buffalo milk.