Manufacturing and storage of khoa

ABSTRACT

Khoa is a traditional dairy product which is produced in India by both organized and unorganized sector. It is the base for various traditional sweets manufactured in India. Apart from the traditional method of manufacturing khoa many methods were developed recently for the manufacture and storage of it. In the present essay I had mentioned about various technologies available for manufacture and storage of khoa.

INTRODUCTION

According to the National Dairy Development Board, India the annual production of milk during the year 2007-2008 is 104. 8 million tonnes.

India has two types of sectors for the marketing of milk and its products, one is “ organized sector” and another is “ unorganized” sector. The unorganized sector accounts for 88% of total milk production in India and it includes marketing of raw milk and traditional products such as locally manufactured ghee, fresh cheese, and sweets. The organized sector accounts for 10-12% of total milk production in India and it includes the dairy cooperatives and organized private dairies which produces Western-style dairy processed products based on pasteurization. The share of organized sector in the total milk production handling is increasing by the years (FAO, 2002). In India out of all dairy products consumed traditional products account for over 90 percent. In order to protect the surplus milk from spoilage simple processes were developed to produce products like curds (yoghurt-like fermented product), Makkhan (butter), Khoa (desiccated milk product), Chhana and Paneer (soft cottage cheese-like cultured product) and Ghee (clarified butter)

(FAO, 2001). And nearly 7% of milk produced in India is converted to khoa (ICMR, 2000).

KHOA MANUFACTURING PROCESS

In India khoa is traditionally manufactured by continuous boiling of milk in a shallow iron or stainless steel vessel to remove moisture and the process continues till the total solid level is attained in the range of 65 to 72% (Pal and Raju, 2006). As per the Prevention of Food Adulteration (PFA), India (1955) rules, khoa sold by whatever variety or name such as Pindi, Danedar, Dhap, Mawa, or Kava which is obtained from cow or buffalo (or goat or sheep) milk or milk solids or a combination there of by rapid desiccation and having not less than 30 per cent milk fat on dry weight basis. The Bureau of Indian Standards has given the requirements for three types of khoa, viz. Pindi, Danedar and Dhap in terms of total solids, fat, ash, acidity, coliforms and yeast and mold counts (Indian Standard (IS): 4883, 1980). A minimum fat level of 5. 5 in buffalo milk is required to achieve the PFA standard. Khoa has been categorized into three major groups i. e. Pindi (for Burfi, Peda), Dhap (Gulabjamun) and Danedar (Kalakand) on the basis of composition, texture and end use.

KHOA MANUFACTURING PROCESS CHEMICAL ASPECTS

Khoa contain 75-80% moisture, 25-37% fat, 17 -20% protein, 22-25% lactose, and 3. 6-3. 8% ash (Aneja et al. 2002). The milk is subjected to high heat temperature during the manufacture of khoa which initiates number of physico-chemical changes resulting in characteristics sensory, textural and structural properties in khoa. The continuous heating will reduce water activity, inactivates various milk enzymes and destroy pathogenic and spoilage microorganisms apart from development of desirable flavors and texture. The heating process promotes the denaturation and coagulation of milk proteins and the process is more rapid due to frothing and incorporation of air by continuous stirring (Sindhu et al. 2000). The disruption of fat globule membrane and subsequent release of free fat that account for 44. 8-62. 8 percent of total fat in khoa occurs due to vigorous agitation during heating process of milk (Mann and Gupta, 2006). Adhikari et al. (1994) has studied the interaction between milk macromolecules during heating of buffalo milk using Transmission Electron Microscopy (TEM) and observed casein-casein, casein-whey protein and casein-lactose interaction with gradual heating of milk. The khoa made with buffalo milk and milk of high total solid will have more brown colour in the end product and this is due to browning reactions (Gothwal and Bhavdasan1992). Patil et al. (1992) has investigated khoa microstructure using scanning electron microscope (SEM) and revealed that khoa consists of larger protein granules made up of partially fused casein micelles and non-micellar proteins. They also observed reduction in the size of protein granules and inter-granular space during working or agitation of khoa manufacture process and it also resulted in large amount of fat globules membrane fractions.

FACTORS AFFECTING KHOA QUALITY

Type of milk: Buffalo milk is generally used instead of cow milk for the manufacture of khoa due to its higher yield, softer body and smooth texture. The khoa manufactured from cow milk have dry surface, yellow colour, sticky and sandy texture (Pal and Gupta, 1985).

Amount of free fat: An optimum amount of free fat is necessary for desirable body and textural properties of khoa(Boghra and Rajorhia , 1982).

Total solid level: There is significant positive correlation between total solid level milk and instrumental hardness, gumminess and chewiness of khoa (Gupta et al., 1990).

Working of Khoa: The formation of large lactose crystals can be reduced through working of khoa when compared to un-worked khoa and working results in no perceived sandiness upon storage.

EQUIPMENTS USED IN KHOA MANUFACTURING PROCESS

Khoa is generally manufactured by halwais in jacketed kettles, which has several disadvantages like poor and inconsistent quality and limited shelf life of about 5 days at 30°C (International Conference on Traditional Dairy Foods, 2007). Most attempts made for up-gradation of the technology of khoa are directed towards mechanization of the process and developing continuous khoa making plants (Aneja et al., 2002). Agrawala et al. (1987) has developed mechanized conical process vat for preparation of khoa. It consists of a stainless steel conical vat with a cone angle of 60° and steam-jacket partitioned into 4-segments for efficient use of thermal energy and less heat loss.

Due its batch type of operation, it is suitable only for making limited quantities of the product. National Dairy Development Board (NDDB) which is situated at Anand (Gujarat), India has developed an Inclined Scraped Surface Heat Exchanger (ISSHE) for continuous manufacture of khoa (Punjrath et al., 1990). Concentrated milk of 42 to 45% total solids is used as feed in this machine and its inclination permits the formation of a pool of boiling milk critical to formation of khoa. Thin Film Scraped Surface Heat Exchanger (TSSHE) system has developed by Dodeja et al. (1992) at NDRI for the continuous manufacture of khoa and it consists of two Scraped Surface Heat Exchangers (SSHE) which are arranged in a cascade fashion. In this machine milk is concentrated in first SSHE to about 40-45% Total Solids and finally to khoa in the second SSHE. But feed for this unit is buffalo milk and thus rendering it suitable for organized small and large dairies and entrepreneurs which is not in the case of Inclined Scraped Surface Heat Exchanger.

The capacity of both TSSHE and SSHE is about 50 kg khoa per hour and many organized dairies have adopted these continuous khoa making machines. Three-stage continuous khoa manufacture unit has been developed by Christie and Shah (1992). It has three jacketed cylinders placed in a cascade arrangement which helps in easy transfer of milk from one cylinder in to other and it works as heat exchanger. The heat exchangers are installed with a mechanism of providing inclination and the slope allows the movement of the contents in longitudinal direction. The unit has a variable pulley drive which helps in speed adjustment and it is highly bulky requiring too much flooring area. (Pal and Cheryan, 1987) and (Kumar and Pal, 1994) have implemented Reverse osmosis (RO) technique for the manufacture of khoa from cow milk and buffalo milk respectively. This process comprises pre-concentration of milk (2. 5-fold for cow milk and 1. 5-fold for buffalo milk) using RO process followed by desiccation in a steam-jacketed open pan for the manufacture of khoa.

The final product obtained by this membrane process was found to be identical to the conventionally prepared product. This process saves energy during the initial concentration of milk. In order to make this process continuous jacketed pan should be replace with SSHE. Different workers incorporated whey solids in the form of whey protein concentrate (WPC) in the milk and reported that increased addition of WPC in the milk resulted in large granulation in khoa and increased yield (Dewani and Jayaprakasha, 2002).

FOOD SAFETY AND QUALITY MANAGEMENT ISSUES DURING KHOA STORAGE

Due to higher nutrients and high water activity (. 96), Khoa is easily Susceptible to growth of bacteria. Staphylococcus aureus and Bacillus cereus are the main contaminating micro organisms in khoa and they cause many food-borne diseases. To prevent and reduce microbiological hazard from khoa HACCP should be applied. The microbial quality of Khoa is initially good during production time and it will gradually deteriorate during storage and marketing. The main Critical Control Point for the deterioration was identified as airtight packaging. This problem can be solved through changing the packaging material to muslin cloth which allows free air flow, reduced the microbial proliferation (ICMR, 2000).

METHODS TO INCREASE STORAGE LIFE OF KHOA

The storage life of khoa is only two to three days, under ambient conditions, and 15-20 days under refrigerated conditions (Ramzan and Rahman, 1973). Rancidity is one of the reason which deteriorates quality of khoa and it adversely a? ects storage life of khoa (Bashir et al., 2003). Addition of potassium sorbate e? ectively improves the storage life of khoa at higher temperatures. Jha and Verma(1988) have observed increased storage stability of khoa for 40 days by addition of potassium sorbate. Other workers also stated that the storage life of khoa can be enhanced by using di? erent types of food preservatives and antimicrobial agents (Wadhawa et al., 1993). At elevated temperatures the storage stability of freshly prepared khoa can be adversely a? ected. By measuring free fatty acids, peroxide value and iodine value we can determine storage stability of khoa. The free fatty acid, peroxide and iodine values for freshly prepared khoa were 0. 025%, 0. 38 meq/kg and 80, respectively. The increase in free fatty acid and peroxide value and decrease in iodine value are the indicators of development of rancidity in khoa during three months of storage at elevated temperature. By adding BHA and BHT we can retard the development of rancidity in khoa on storage. But, BHT will act comparitively better than BHA. Therefore, we can increase the storage stability of khoa by adding synthetic antioxidants like BHA and BHT at elevated temperatures (Rehman and Salariya, 2005).

CONCLUSION

Although so many technologies are developed for the production and storage of khoa, there is a still a need of investigation of chemical and physical aspects during manufacturing of khoa in order to understand factors responsible for quality. And all the known technologies of manufacturing of khoa should be transferred to small holder farmers who are the major contributors of milk production in India . So that they can increase their prices of products by producing products which will meet the modern quality standards.

REFERENCES:

- Adhikari. A. K., Mathur. O. N. and Patil. G. R. (1994). Interrelationships among Instron textural parameters, composition and microstructure of khoa and gulabjamun made from buffalo milk, Journal of Food Science and Technology, 31 (4) . pp. 279-284.
- Agrawala . S. P., Sawhney. I. K. and Bikram Kumar. (1987). Mechanized conical process vat. Patent No. 165440.
- Aneja. R. P., Mathur. B. N., Chandan. R. C., and Banerjee. A. K.(2002). Technology of Indian milk products, 1st Ed., Dairy India Year Book, Delhi. pp. 126-128.
- Bashir. N. Rehman. Z. U., Syed. Q. & Kashmiri. M. A. (2003). Effect of potassium sorbate on the physicochemical characteristics of milk concentrate (khoa) during different storage conditions. Pakistan Journal of Scientific Research, 55. pp. 103-109.
- Boghra. V. R. and Rajorhia. G. S. (1982). Utilization of pre-concentrated milk for khoa making, Asian Journal of Dairy Research. 1. pp. 6 -12.
- Christie. I. S. and Shah,. U. S. (1992). Development of a three stage khoa making machine. Indian Dairyman. 44 (1). pp. 1 – 4.
- Dewani. P. P. and Jayaprakasha. H. M. (2002). Effect of addition of whey protein concentrate on physico-chemical and sensory characteristics of khoa and khoa based sweets, Journal of Food Science and Technology. 39 (5). pp. 502 – 506.
- Dodeja. A. K., Abichandani. H., Sarma. S. C. and Pal. D. (1992). Continuous khoa making system design, operation and performance, Indian Journal of Dairy Science. 45(12). pp. 671 – 674.

- FAO.(2001). Report on the FAO E-mail Conference on Small-scale Milk Collection and Processing in Developing Countries. Chapter 3, pp . 15.
- FAO. (2003). A Review of Milk Production in India with Particular Emphasis on Small-Scale Producers, pp. 6.
- FAO. (2002). Annex I: Critical issues for poor people in the Indian dairy sector on the thresold of a new era.
- Gothwal. P. P. and Bhavadasan. M. K. (1992). Studies on the browning characteristics in dairy products, Indian Journal of Dairy Science, 45 (3). pp. 146-151
- Gupta. S. K., Patil. G. R., Patel. A. A., Garg. F. C. and Rajorhia. G. S. (1990). Instron texture profile parameters of khoa as influenced by composition, Journal of Food Science and Technology, 27 (4). pp. 209-213
- http://nddb. org/statistics/milkproduction. html
- http://www. dairyforall. com/indian-khoa. php
- Indian Council of Medical Research (ICMR). (2000). Application of Hazard Analysis and Critical Control Point for improvement of quality of processed foods, Vol. 30, No. 5.
- International Conference on Traditional Dairy Foods. (2007). National Dairy Research Institute, Karnal (India), pp. 29.
- Jha. Y. K. & Verma. N. S. (1988). Effect of potassium sorbate on the shelf life of khoa, Asian Journal of Dairy Research, 7. pp. 195-198.
- Kumar. S. and Pal. D. (1994) . Production of khoa from buffalo milk concentrated by reverse osmosis process, Indian Journal of Dairy Science. 47(3). pp. 211 – 214.

- Mann. B. and Gupta. A.(2006). Chemistry of milk in relation to manufacture of traditional dairy products, In compendium of " Developments in traditional dairy products", Centre of Advanced Studies in Dairy technology, NDRI, Karnal. pp. 12-17.
- Pal. D. and Cheryan. M. (1987). Application of reverse osmosis in the manufacture of khoa: Process optimization and product quality, Journal of Food Science and Technology, 24(5). pp. 233 – 238.
- Pal. D. and Gupta. S. K. (1985). Sensory evaluation of Indian milk products, Indian Dairyman, 37(10). pp. 465-474.
- Pal. D and Raju. P. N. (2006). Developments in the manufacture of heat desiccated traditional milk desserts, In compendium of " Developments in traditional dairy products", Centre of Advanced Studies in Dairy technology, NDRI, Karnal. pp. 18-25.
- Patil. G. R. Patel. A. A., Allan-Wojtas. P. and Rajorhia. G. S. (1992). Microstructure and texture of khoa, Food Structure, 11: 155.
- Punjrath. J. S., Veeranjamlyala. B. Mathunni. M. I., Samal. S. K. and Aneja. R. P. (1990). Inclined scraped surface heat exchanger for continuous khoa making. Indian Journal of Dairy Science. 43(2). pp. 225 – 230.
- Ramzan. M., and Rahman. R. U. (1973). E? ect of storage time and temperature on the quality of cow milk khoa, Pakistan Journal of Science, 25. pp. 149-154
- Sindhu. J. S., Arora . S. and Nayak. S. K.(2000). Physico-chemical aspects of indigenous dairy products, Indian Dairyman, 52 (10). pp. 51-64.

- Wadhawa. B. K., Gandhi. D. N., and Goyal. G. K. (1993). Enhancement in the shelf life of khoa, Indian Food Packer, 47. pp. 5-53.
- Zia-ur Rehman and A. M. Salariya.(2005). E? ect of synthetic antioxidants on storage stability of Khoa – a semi-solid concentrated milk product , Food Chemistry 96 (2006) . pp. 122-125.