

## Syllabus for Dairy Technology PGQP08 (xii)

### **Milk production management and Dairy Development**

- Indian and exotic breeds of dairy animals; Management of dairy animals; milking procedure and practices for quality milk production; Dairy farm records and their maintenance; Milk secretion and milk let-down.
- Socio-economic and geographical features of Indian dairying; annual milk production and per capita availability
- Five-year plans and dairy development; co-operative dairy organizations, Anand pattern and perspectives; Operation Flood-I, II, III programmes; Dairy development Corporations, Co-operative Dairy Federations.

### **Introduction to Dairy Microbiology**

- Milk production hygiene and critical risk factors affecting microbiological quality on-farm;
- Microorganisms associated with raw milk and their classification based on growth temperature– psychrotrophs, mesophiles, thermodurics and thermophiles; Mastitis milk: Microflora of mastitic milk and its importance in dairy industry
- Good Hygiene Practices (GHP) during milk production operations
- Collection and transportation of milk;
  - a) Organization of milk collection routes
  - b) Practices for collection of milk, preservation at farm, refrigeration, natural microbial inhibitors, immunoglobulin, lactoferin, lysozymes, lactoperoxidase (LP) systems.
  - c) Microbial quality of milk produced on farm
  - d) Chemical tests for grading raw milk.
  - e) Microbiological tests for grading raw milk; Microbial metabolites and their role in spoilages - souring, curdling, gassiness, ropiness, proteolysis, lipolysis, abnormal flavour and colour; Antimicrobial systems in raw milk; Food poisoning, food infections, toxi-infections and other milk borne diseases and their control; isolation and identification of conventional and emerging dairy pathogens; detection of microbial toxins, drug residues in milk and their public health importance.

### **Unit operations**

- Fluid mechanics- properties of fluids, Bernoulli's equation and its applications, hydraulic systems; Types of Pumps: Sanitary pumps, Standards for Centrifugal and Positive Rotatory Type of pumps; Refrigeration and air-conditioning; Heat-transfer and thermodynamics; mechanical separations; engineering of mechanics; theory of machine; strength of materials; materials of fabrications.

### **Market Milk**

- Chemical composition of various food of plant and animal origin,
- Structure and functions of food constituents additives, preservatives, flavours and antioxidants, composition and physio-chemical and nutritional properties of milk and colostrum, effect of heat processing on nutritive value;
- Chemistry of milk, constituents, nutrients and milk products; Milk collection and RMRD activities, clarification and storage, Homogenization, pasteurizer, Bactofugation, thermization, sterilization, UHT Processing. Toned, doubled toned, reconstituted, recombined, flavoured, homogenized vitaminised, sweet acidophilus milk, sterilized milk, etc.;
- Principles of thermal processing: kinetics of microbial destruction, thermal death curve, Arrhenius equation, D value, Z value, F<sub>0</sub> value, Q<sub>10</sub> value. Factors affecting thermal destruction of micro-organisms.
- Bacteriological aspects of milk processing - Thermization, pasteurization, boiling, sterilization, UHT, bactofugation, and membrane filtration. Defects in market milk.

### **Dairy Engineering**

- Sanitization : Materials and sanitary features of the dairy equipment; can washers, bottle washers; CIP cleaning and designing of system.; Mechanical Separation: Fundamentals involved in separation; Sedimentation; Principles involved in filtration, Principles of centrifugal separation, different types of centrifuges; clarifiers, processors, cream separator, self-desludging centrifuge, Bactofuge;
- Homogenization: Classification, single stage and two stage homogenizer pumps; Pasteurization: Batch, flash and continuous (HTST) pasteurizers, Flow diversion valve;
- Different type of sterilizers: in bottle sterilizers, autoclaves, continuous sterilization plant, UHT sterilization;
- Filling Operation: Principles and working of different types of bottle filters and capping machine, pouch filling machine (Pre-pack and aseptic filling bulk handling system, Mixing and agitation :
- Theory and purpose of mixing; Materials and sanitary features of the dairy equipment; Aseptic packaging and equipment; Computerization and Automatic Process Controls in Milk Processing.

### **Fat Rich Milk Products**

- Composition and processing of cream, butter, ghee, butter oil, low fat spreads; spoilage of ghee and use of antioxidants, test for the quality of butter, ghee, adulterants, neutralizers and preservatives, their detection, heat stability of milk; Microbiological quality of cream and butter.

### **Condensed and Dried milk**

- Definition, legal standards and manufacturing: Condensed milk, sweetened condensed milk, evaporated milk, dried milk like skim milk powder (SMP), whole milk powders; Heat stability of milk and condensed milk; Dried Milks: Manufacture of and heat classified powders, Physio- chemical changes taking place during manufacture of dried milks, Physical properties of dried milks, milk during manufacture and storage, their causes and prevention, PFA, BIS and International Standards for dried milk Principles of evaporation, drying. Atmosphere concentration, Vacuum Pan, Fluidization. Care of Vacuum Pan, Atmospheric Drum Dryer. Spray Dryer principles of dairy plant layout and design, Functional Design, space requirement of Milk Plant; Processing of infant food; Microbiological quality of concentrated dairy products, dried milks, infants milk foods; physio-chemical changes in the manufacture and storage of milk powder, lactose, crystallization and its significance. Defects in condensed and dried milk.

### **Fermented milk products**

- Microbiology of dairy starters; Classification, Metabolism of Lactic Acid Bacteria and diacetyl production, production of antibacterial substances by lactic starter cultures;
- Preservation, propagation and quality control of dairy starters and their inhibition by antibiotic residues, detergents, sanitizers, bacteriophages etc.; chemistry and microbiology of milk fermentations, chemistry of rennin coagulation of milk and changes occurring during ripening of cheese, cheeses and application of probiotic concept in dahi, yoghurt, Kefir, Kumiss, Bulgarian milk, cultured buttermilk, leben, Yakult, cheddar and processed cheese; Role of starter culture in relation to cheese quality; rennet substitutes. Manufacture of different varieties of cheese: Cheddar, Gouda, Swiss, Mozzarella, Cottage; Accelerated ripening of cheese. Microbiological defects in cheese.

### **Traditional Dairy products**

- Indigenous dairy products: Khoa and its related products like Burfi, peda, Milk cake, Kalakhand, Gulabjaman, Rabri and Basundhi; Channa and its based sweets like Rasogolla, Sandesh, Ras-malai; Paneer; Srikhand; Misti dahi; Kheer and Payasam; Factors affecting the microbiological quality of these products during production, processing, handling, storage and distribution; physicochemical changes during the manufacture of indigenous milk products, and its chemical and microbial standards (legal specifications)

### **Ice-cream and Frozen milk products**

- Definition, classification and composition of ice cream and other frozen desserts; Stabilizers and emulsifiers-their classification, properties and role in quality of ice-cream; Technological aspects of ice cream manufacture; Effect of process treatments on the physio-chemical properties of ice-cream mixes and ice cream, Processing and freezing of ice-cream mix and control of over run, Packaging, hardening, storage and shipping of ice-cream, Defects in ice cream; food safety & legal standards

## **Dairy By-products**

- Dairy by-products in India and Abroad; Whey and its related Product like fermented whey beverages, WPC, Deproteinized and demineralized whey; butter milk and ghee residue, By-products from skim milk like casein, casein hydrolysates, etc.; Lactose; Nutritional characteristics of byproducts

## **Packaging and sensory of milk and milk products**

- Sensory evaluation and judging of milk and milk products, types of packaging materials and their properties, Packaging of milk and dairy products; packing forms and operations, problems in food packaging, recent advances in packaging dairy and food products. Modern Packaging Techniques: Vacuum Packaging, Modified atmosphere packaging (MAP), Eco-friendly packaging, Aseptic Packaging (AP), Intelligent Food Packaging. Nutritional labelling of food products

## **Quality assurance of dairy products**

- Dairy plant hygiene and sanitation - Microbiology of air, water, equipments, packaging materials, personnel, disposal of dairy waste; quality (ISO 9001:2000) and food safety (HACCP) system and their application during milk production and processing; Microbiological standards for milk and milk products - PFA, BIS, Codex/ ISO standards (ISO 22000:2005).