

Paper No.: 13

Paper Title: FOOD ADDITIVES

Module – 32: Dairy Ingredients in Food Applications – II (Snacks, Processed Meats, Functional Foods)

32.1 Introduction

Dairy ingredients are commonly used in the manufacture of various food items. Several bioactive peptides derived from enzyme hydrolysis of fractionated casein and whey proteins have been developed as functional food ingredients.

Dairy - derived ingredients have distinct functionality and nutritive profiles suitable for use in bakery foods, infant formula, nutritional and dietetic drinks and bars, chocolate and confectionery products, snacks, sauces, dressings, and processed meats. Furthermore, certain biopeptides form the basis of nutraceuticals with purported health benefits including sports performance enhancement, blood pressure control, anti - anxiety effects, and sleep - inducing ability.

This module includes applications of dairy ingredients in Snacks, Processed Meats and Functional Foods.

32.2 Application of Dairy Ingredients in Snacks

Snack foods may be described as foods consumed at parties and in between meals. Their flavour may be savory or sweet. Snacks include a wide array of foods including cookies, candy, cakes, pies, pizza, potato chips, tortilla chips, corn puffs and curls, nuts, pretzels, popcorn, puffed cereals, granola bars, dried fruit, fruit leather products, hot dogs and other meat snacks, yoghurt, cereal tubes with cheese filling, cheese crackers, cracker sandwiches with cheese filling, cheese potatoes, cheese cubes, etc. Dairy ingredients form an integral part of many snack items.

The primary application of dairy – derived ingredients in snack foods is for seasonings, because they enhance colour and flavour. Dry cheese and whey powder blends used as seasonings are significant sales items for ingredient suppliers.

Cheese Crackers

Cheese crackers usually are made from fermented dough of acidic character to augment cheese flavour. The formulation of cheese crackers resembles that of soda crackers except that the fat and moisture of cheese must be accounted for. Comminuted natural cheese (blend of cheddar, Swiss, blue and other cheeses), enzyme - modified cheese, or a cheese substitute is incorporated into the dough along with 0.25% paprika and a little cayenne pepper for colour and flavour attributes. Sometimes a premix of ground cheese and shortening is held in the fermentation room for 24 hours and incorporated into the fermented dough. The dough is baked and salted.

Potato Chips

For the manufacture of potato chips, washed potatoes are destoned and peeled, cut into a manageable size, sliced, and rewashed. The slices are fried at 182 °C to 193 °C until the moisture is reduced to less than 1.5%. They are then salted or dusted with cheese or dairy seasonings prior to packaging.

Tortilla Chips and Corn Chips

The process for fried corn chips is similar to that for tortilla chips. A softer corn is generated by prolonged cooking in additional water; the resulting masa contains 50% to 52% water. The texture of the masa is coarser than tortilla masa. The masa is extruded, cut into pieces, and fried at 205 °C to 210 °C. The corn chips are then cooled and coated with seasoning and salt.

Corn chips contain 34% to 40% oil, whereas tortilla chips contain 22% to 26% oil. Corn chips have a little more salt (1.5% vs. 1%), and the moisture content of both should be 1% to 1.2%

Collets

Collets are puffed, second generation snacks, popularly named cheese curls and cheese balls that are extruded and then either fried or baked. They are made from corn meal which is continuously fed into the extruder, accompanied by a small quantity of water.

The mixture is subjected to heat and pressure in the barrel, and the extruder auger transports the meal through the extruder. Water in the corn meal dough is turned into vapor from heat generated by friction, creating high pressure in the system. As the stream is forced between two rotating heads, a sudden pressure release results in the formation of a rope with a puffed texture. The rope is cut into the appropriate length with a rotating knife; the snack shape may be cylindrical or ball - like. The moisture content after extrusion ranges from 8% to 10%. These extruded collets are then fried in vegetable oil or baked. Prior to seasoning application, the collets are further dried for 4 to 6 minutes at 149 °C. The dried collets are sieved to remove the fines and coated with cheese seasoning.

Cheddar cheese is a popular seasoning. The typical composition of a cheese slurry consists is 58% to 66% collets, 24% to 30% vegetable oil, 5% to 9% dry cheddar cheese powder, 3% to 4% dry acid whey, 1% to 4% cheese flavour concentrate, and 0.2% to 3% salt.

Cheese Seasonings

Dairy - and cheese - based seasonings contribute desirable colour and flavour to many snack items. Sour cream, onion or garlic, and cheese flavours are popular in coated nuts, crackers, potato chips, and extruded and puffed snack items.

In addition, nacho, ranch and barbeque flavours are widely accepted flavours in which whey and other dairy ingredients constitute significant building blocks. Dry whey powders may

constitute as much as 5% to 30% of cheese powders and blends, and up to 50% of cheese seasonings.

Cheese powders for snacks normally are developed specifically to satisfy the needs of snack manufacturers, and the custom design includes the spectrum of flavour notes. Frequently, salt is added to provide flavour and to act as a carrier of other flavours. It also functions as a flavour enhancer and modifier. The original dried cheese blends were essentially dehydrated cheese manufactured by spray drying cheese slurry. Cheese seasoning may contain different levels of cheese. Cheese powders with high levels of cheese may contain greater than 90% cheese; blends may contain less than 50% to 70% cheese.

Cheese and Dairy Sauces

Sauces derived from cheddar and other types of cheese constitute a significant but specialized business for ingredient suppliers. Their popularity is due to their convenience of use for food preparation in food service and fast food operations. Main applications include preparation of sandwiches, omelettes, nachos, pasta dishes, and as toppings for potatoes and vegetables. There are wide variations exist in cheese sauce flavours, including mild and aged cheddar and Mexican food flavours such as salsa, nacho, and jalapeno.

Dairy Salad Dressings

Spoonable and pourable dairy dressings displaying rich creamy mouth feel are based on buttermilk or cultured milk. Regular salad dressings contain 30% to 80% fat, and mayonnaise is 65% fat. Dairy - based dressings may contain 0% to 12% fat. They must to be refrigerated in storage distribution and use. Flavours include blue cheese, creamy thousand island, avocado, creamy garlic, creamy Italian, and creamy French. Production of the dairy base involves formulation of the base preparation similar to that of cultured buttermilk. Stabilizers and emulsifiers are added to the cultured base, followed by pasteurization and homogenization. The base is then blended with salad bases to obtain the dressing.

32.3 Application of Dairy Ingredients in Processed Meats

Dairy ingredients are used as extenders in meat products. During manufacture of processed meat products, a key objective is the formation of a stable heat - induced gel (emulsion) in which water and fat are bound to yield a palatable and attractive product. Dairy ingredients can be used as functional ingredients in the manufacture of processed meat, poultry, and seafood. In these cases, lactose and milk proteins are generally used.

The application of dairy ingredients is determined largely by the degree of comminution of meat in the formula. Hams and bacon do not contain comminuted meat during processing. Sausage, bratwurst, hamburgers, meat patties, meatballs, and chicken nuggets are obtained from coarsely comminuted meat. Frankfurters, hot dogs, bologna, meat loaves, and liver sausages are derived from finely ground meat.

Lactose

Lactose use in processed meats limited to pasteurization treatment enhances the intensity and brightness of colour. In sausage manufacture, lactose at the 1% to 2% level assists in controlled browning (Maillard reaction) after frying or microwave heating. In the fermented sausage process, lactose (1% to 3% usage level) furnishes the carbohydrate necessary for the growth and

production of lactic acid by starter cultures. Lactobacilli and Pediococci grow well when lactose is present in the medium. The resultant reduction in pH discourages the growth of undesirable organisms and exerts a preservative effect.

In the manufacture of reformed hams, lactose use varies from the 0.5% to 2% level. It improves the water - holding capacity in pumped ham and other coarse or non-comminuted meats. In the finished meat product, lactose (1.2%) along with salt (2% to 3%) and phosphate (0.3% to 0.5%) helps in extraction and swelling attributes of meat protein. Lactose at the 2% to 3% usage level masks the bitter after taste associated with salt and phosphate. Lactose also masks the strong liver taste associated with liver – based patés and spreads. Lactose enhances the

cured colour of ham, and it improves the sliceability and yield of cooked ham, cooked sausages, and liver products.

Lactose - containing products such as whey and non fat dry milk (NFDM) are functionally inferior because they contain too much calcium, which interferes with the binding properties of meat proteins.

Milk Proteins

Milk protein contributes to the stability of the emulsion. Milk protein or milk protein hydrolyzates can be used at the 0.8% to 1.6% level. Sodium caseinate is widely used because it competes favorably with meat proteins for absorption at the oil - water interface to stabilize fat in the emulsion. Other important functional properties of sodium caseinate in meat systems are that it does not gel on heating, the denatured form improves functionality, and it does not contribute to the development of viscosity. The addition of milk proteins in frankfurters decreases the ingredient cost and increases the yield. Nonfat dry milk (NFDM) at the 2% level boosts the overall quality (better sliceability, colour, and flavour) of cooked turkey deli breast meat.

NFDM can be used at the 3% to 5% level in bologna, liver sausage, cotto salami, and meat loaf, and at the 9% to 12% level in corned beef loaf and roast beef loaf. Evaporated milk can be blended in sweet and sour meatballs at the 18% to 19% level. In smoked sausage, use of 2.5% NFDM and 1.25% whey protein concentrate (80% protein) increases the water - holding capacity and yield and provides better emulsification and enhanced adherence attributes.

Whey products contain high - quality protein and calcium. Their use may improve the nutritional status of meat products such as bologna, reduced - fat sausage, and roast beef. Whey protein concentrates optimized for emulsification can facilitate fat distribution in processed meat products and their use improves salt tolerance.

Furthermore, whey protein acts as a stabilizer of the emulsion. In lunch meat and sausage, whey ingredients function as adhesion agents in binding meat pieces after chopping and blending with other ingredients. Gelation of whey protein, induced by further heating and salt treatment, entraps more water in the matrix and creates a strong gel network. Accordingly,

moisture is held tightly and syneresis is prevented, and the yield of meat products is increased. The water - binding functionality of denatured whey protein improves the texture of meat products in that they are perceived to be more moist and fresh. Surimi, pressed ham, and bacon are application areas of the whey protein ingredients.

32.4 Application of Dairy Ingredients in Functional Foods

Functional foods may be defined as foods containing significant levels of biologically active components which impart health benefits beyond basic nutrition. They are also referred to as wellness foods, healthful foods, or nutraceuticals. It is now scientifically accepted that foods play a role in the prevention of diseases such as cancer, coronary heart disease, atherosclerosis, stroke, diabetes and liver ailments.

Dairy Ingredients as Functional Ingredients

Milk has been described as nature's nearly perfect food because it provides vital nutrients including proteins, essential fatty acids, minerals, and lactose in balanced proportions. Milk and milk products are recognized as important constituents of a well – balanced and nutritionally adequate diet. Milk and dairy foods complement and supplement nutrients available from grains, legumes, vegetables, fruits, meat, seafood, and poultry. The dairy industry has provided the consumer with choices of low - and fat – free ingredients.

Bioactive Peptides

Functional peptides are generated during digestive processes in the body and during the fermentation processes used in fermented dairy foods. They arise from casein and whey proteins. These peptides are inactive in the native proteins but assume activity after they are released. They can be absorbed in intact form to exert various physiological effects locally in the gut or they may have a systemic effect after entry into the circulatory system. Casomorphins and lactophorins derived from milk proteins are known to be opioid agonists, whereas lactoferroxins

and casoxins act as opioid antagonists. The opioids have analgesic properties similar to aspirin. Casokinins are antihypertensive (lower blood pressure), casoplatelins are antithrombotic (reduce blood clotting), immunopeptides are immunostimulants (enhance immune properties), and phosphopeptides are mineral carriers. Casein phosphopeptides may aid in bioavailability of calcium, phosphorus, and magnesium for optimum bone health. They also may be helpful in preventing dental caries and may have a role in secretion of entero hormones and immune enhancement. The role of casein peptides in regulation of blood pressure is showing promise. Conversion of angiotensin - I to angiotensin - II is inhibited by certain hydrolyzates of casein and whey proteins. Because angiotensin - II raises blood pressure by constricting blood vessels, its inhibition causes lowering of blood pressure.

This ACE - inhibitory activity would therefore make dairy foods a natural functional food for controlling hypertension. Several whey products containing discreet bioactive peptides are commercially available. The glycomacropeptide (GMP) released from κ - casein as a result of proteolysis may be involved in regulating digestion as well as modulating platelet function and thrombosis in a beneficial way. Consequently, it may be a significant ingredient of satiety diets designed for weight reduction. Furthermore, this peptide may inhibit binding of toxins in the gastrointestinal tract. As an active ingredient, the GMP is commercially available as a fractionated whey product.

Probiotics

Probiotics are food or supplements containing concentrates of defined strains of living microorganisms that exert health benefits beyond inherent basic nutrition upon ingestion in certain doses. This definition stresses the importance of ingestion of several hundred millions of live and active microbial culture. Various strains exert health benefits but specific strains are important if health claims are made.

Supplementation of probiotics with prebiotics can be create very effective functional foods. For example, fructo – oligosaccharide (FOS) and galacto - oligosaccharide (GOS) are exclusively used by a few strains of *Bifidobacterium bifidum* and *Lactobacillus acidophilus*.

Thus, a combination of FOS or GOS along with these cultures is likely to induce the proliferation of these cultures in preference to other microflora in the gastrointestinal tract.

Looking to the functionality of probiotic bacteria, milk and milk products can be used as a probiotic delivery system to the human body. Probiotic Yoghurt is the leading category followed by Probiotic Ice Cream and frozen desserts, fermented milk and beverages, cheese and other milk products.

