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Food Processing, Food Spoilage and their Prevention: An Overview

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ABSTRACT- Fruits and vegetables are important sources of human life. It should be safe and consists of good shelf life, which can improve the level of consumption of fruits and vegetable among society. The processing is such a great parameter which analyses the quality of food. Today fruits and vegetables are susceptible to the growth of microorganism which may be air borne, soil borne, and water borne disease. Enzymes offer the potential for many exciting applications for the improvement of foods. There is still, however, a long way to go in realizing this potential. Economic factors, i.e. achievement of the optimum yields and efficient recovery of desired protein are the main deterrents in the use of enzymes. The changing values in society with respect to recombinant DNA and protein engineering technologies and the growing need to explore all alternative food sources may in time make enzyme applications more attractive to the food industry.

Key-words- Bacterial contamination, Enzyme, Enzymes, Food poisoning, immobilization, Perishable foods, Screening

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INTRODUCTION

Fruit and vegetables are an important source of health benefits due to their content of fiber, vitamins and antioxidant compounds. However, for the antioxidant compounds many changes occur during harvesting, preparation and storage of these fruits. During harvesting, pronounced loss of the microbiological and antioxidant qualities [1]. The preservation against oxidation in food during processing and storage has become an increasing priority in the food industry. The oxidation is the most important cause of food deterioration after contamination. The main reasons are enzymatic browning by the enzymes such as oxidoreductases, polyphenoloxidase (PPO) and peroxydase (POD). PPO catalyzes two reactions; the first, a hydroxylation of monophenols to diphenols, which is relatively slow and results in colourless products. The another oxidation of diphenols to quinines, is rapid and gives colored products [2].

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Site of reactions are take place in the vacuoles and the enzymes are present in the cytoplasm in the presence of oxygen. Cutting, shock, and loss of firmness lead to the starting of browning reactions which induce losses or changes of flavor, odor and nutritional value [3]. The role of these methods is either to inactivate PPO or to avoid contact between the enzyme and its substrate, either by adding antioxidants or by maintaining the structural integrity of the food. To prevent oxidation by chemical controlled atmosphere and coating treatments [4].

Food spoilage is a metabolic process that causes foods to be undesirable or unacceptable for human consumption due to changes in sensory characteristics. Spoiled foods may be safe to eat, i.e. they may not cause illness because there are no pathogens or a toxin present, but changes in texture, smell, taste, or appearance cause them to be rejected. Some ecologists have suggested these noxious smells are produced by microbes to repulse large animals, thereby keeping the food resource for themselves [5]. Food loss, from farm to fork, causes considerable environmental and economic effects. Fresh produce and fluid milk each accounted for nearly 20% of this loss while lower percentages were accounted for by grain products (15.2%), caloric sweeteners (12.4%), processed fruits and vegetables (8.6%), meat, poultry and fish (8.5%), and fat and oils (7.1%) [6]. Some of this food would have been considered still edible but was discarded because it was perishable,

past its sell-by date, or in excess of needs. There are also environmental and resource costs associated with food spoilage and loss. If 20% of a crop is lost, then 20% of the fertilizer and irrigation water used to grow that crop was also lost. Shelf life of a food is the time during which it remains stable and retains its desired qualities. The wide array of available dairy foods challenges the microbiologist, engineer, and technologist to find the best ways to prevent the entry of microorganisms, destroy those that do get in along with their enzymes, and prevent the growth and activities of those that escape processing treatments. Troublesome spoilage microorganisms include aerobic psychrotrophic Gram-negative bacteria, yeasts, molds, heterofermentative lactobacilli, and spore-forming bacteria. Psychrotrophic bacteria can produce large amounts of extracellular hydrolytic enzymes, and the extent of recontamination of pasteurized fluid milk products with these bacteria is a major determinant of their shelf life. Fungal spoilage of dairy foods is manifested by the presence of a wide variety of metabolic by-products, causing off-odors and flavors, in addition to visible changes in color or texture [5,6].

Chemical treatments will be presented by underlining the main action of each molecule (antioxidants, acidifying, agents of firmness or chelating Enzymes are proteins that act as catalysts in all living organisms- microorganisms, plants, animals, and humans. Catalysts are compounds that increase the rate of chemical reactions in biological systems. Very small quantities of enzymes can increase the rate of reactions up to ten million times. Enzymes operate within a narrow set of conditions, such as temperature and pH (acidity), and are subject to inhibition by various means.

Application of Enzyme in food production

The main source of enzymes, which is obtained from edible plants and the tissues of food animals, microorganisms have been used for centuries in food manufacturing. A natural enzyme, which is the mixture, isolated from the stomach of calves or other domestic animals that have been used in cheese making for centuries. Rennet contains a protease enzyme that coagulates milk, causing it to separate into solids (curds) and liquids (whey) and also wine enzyme.

Modern production of food Enzymes

The microorganisms are the most chief source of commercial enzymes. Although microorganisms do not contain the same class of enzymes such as plants or animals, a microorganism can usually be found that produces a related enzyme that will catalyze the desired reaction. For the enzyme production, it has microorganisms for the production of enzymes through natural selection and classical breeding techniques.

The branch of science, which provides the tools to have a genetic sequence from a plant, animal, or a micro-organism, from which commercial scale enzyme production is not adequate, to be transferred to a micro-organism that has a safe history of enzyme production for food use. Although the production organism is genetically modified (GM) the enzyme it produces is not. Enzymes produced through biotechnology are identical to those found in nature. In addition, enzymes produced by micro-organisms are extracted and purified before they are used in food manufacturing. GM microorganisms are useful from a commercial standpoint but would not survive in nature.

The safety of the source organism is the primary consideration in assessing an enzyme product. Food animals and edible plants have a history of safe use as sources of enzymes for the food industry. A microorganism used for food enzyme production must be well characterized and not produce any toxins, pathogens or antibiotics.

The safety assessment of an enzyme produced by a genetically modified microorganism expands on the approach above. In this case, Health Canada also reviews the technique used to transfer the genetic material along with the safety of the genetic material that has been introduced and expressed in the production microorganism. The genome of the production microorganism must be fully characterized for a safety review to be completed.

Canning can be a safe and personally rewarding way to preserve quality food at home. A canning favorite and special product to be enjoyed by family and friends often is a fulfilling experience and a source of pride for many people. Canning may not be the least expensive way of obtaining every type of food and costs of equipment, energy, and time must be considered.

However, the main objective of canning is to preserve the food by the application of heat so that it can be safely eaten at a later time. The safety of the consumer is the primary concern when food is canned. It is also important to achieve acceptable quality in the final product and to retain as much of the nutritive value of the food as possible.

The potential advantages of home canning are lost

1) When you start with poor quality fresh foods
2) When jars fail to seal properly
3) When food spoils
4) When flavors, texture, color, and nutrients deteriorate during prolonged storage in warm, bright light conditions.

How Canning Preserves Foods

The high percentage of water in most fresh foods makes them very perishable. They spoil or lose their quality for several reasons:

- Growth of undesirable microorganisms, like: Bacteria, molds, and yeasts
- Activity of food enzymes
- Reactions with oxygen
- Moisture loss

Microorganisms live and multiply quickly on the surfaces of fresh food and on the inside of bruised, insect-damaged, and diseased food. Oxygen (O_2) and enzymes are present throughout fresh food tissues. Proper canning practices minimize the effects of these microorganisms. They include:

- Carefully selecting and washing fresh food
- Peeling some fresh foods
- Hot packing many foods
- Adding acids (lemon juice or vinegar) to some foods
- Using acceptable jars and self-sealing lids
- Processing jars in a boiling-water or pressure canner for the correct period of time

When these practices are followed along with recommended methods, they control potential spoilage by removing oxygen, destroying enzymes, destroying and/or preventing the growth of undesirable bacteria, yeasts, and molds, and by helping form a high vacuum in jars. Good vacuums form tight seals which keep the food in the jars and keep air and microorganisms from reentering.

The most critical step in ensuring safety in canning is processing in a boiling-water bath or pressure canner. This is what destroys microorganisms and creates the desired vacuum for a good seal. Both a high temperature and sufficient time is required to be certain of adequate heat processing. This ensures that all parts of the food being canned have received enough heat to reduce the number of microorganisms to an extremely small level. A safe food with a long storage life is produced. The complete destruction of every microorganism would result in a product with unacceptable quality and little nutritional value. A best process is that which has a maximum effect on spoilage organisms and minimal effect on quality.

Fruits and vegetables are very important food commodities not only in India but all over the world. India, which is the second most populated country of the world, is still struggling to achieve self-sufficiency to feed about 800 million people. For this purpose, fruits and vegetables have got their specific importance to provide a balance and healthy diet to the people. India is the second largest producer of vegetables and fourth largest producer of fruits in the world. Though India is producing adequate quantities of fruits and vegetables, yet on account of losses in the field as well as in storage, they become inadequate.

Fresh fruits and vegetables are perishable and highly prone to these losses because they are composed of living tissues. These tissues must be kept alive and health throughout the process of marketing. These are composed of thousands of living cells which require care and maintenance. Therefore, the reduction of post-harvest loss of fruit and vegetables is a complementary means for increasing production. It may not be necessary to considerably step up the production of fruits and vegetables with the growing demand if the post-harvest loss is reduced to a great extent. The cost of preventing losses after harvest in general is less than preventing a similar additional amount of fruit and vegetable crop of the same quality [7-8]. Products range from those that are readily spoiled by microorganisms to those that are shelf stable for many months, and the spoilage rate can be influenced by factors such as moisture content, pH, processing parameters, and temperature of storage.

Food, fruits and vegetables are also prone to microbial spoilage caused by fungi, bacteria, yeast and moulds. A significant portion of losses of fruits and vegetables during post-harvest period is attributed to diseases caused by fungi and bacteria. The succulent nature of fruits and vegetables makes them easily invaded by these organisms. Besides attacking fresh fruits and vegetables, these organisms also cause damage to canned and processed products. Many serious post-harvest diseases occur rapidly and cause extensive break down of the commodity, sometimes spoiling the entire package. It is estimated that 36 % of the vegetable decay is caused by soft rot bacteria. Similarly fruit rot in aonla and other soft fruits caused by fungi is also very destructive. As far as vegetables are concerned, naturally the source of infection is from the field, water used for cleaning the surface, contact with equipment and storage environment. The most common pathogens causing rots in vegetables and fruits are fungi such as *Alternaria*, *Botrytis*, *Diplodia*, *Monilinia*, *Phomopsis*, *Rhizopus*, *Pencillium*, and *Fusarium*, etc. Among bacteria Ervinia, *Pseudomonas*, etc. cause extensive damage. High temperature and relative humidity favour the development of post-harvest decay organisms. More acidic tissue is generally attacked by fungi, while fruits and vegetables having pH above 4.5 are more commonly attacked by bacteria, ego bacterial soft rot of potato caused by *Ceratocystis*, fimbriation, water soft rot of carrot by *Sclerotinia sclerotiorum* etc. In India, there is a vast scope for growing fruit and vegetable throughout the year in one or other part of the country because the climatic conditions are highly suitable for growing various types of fruits and vegetables. Fruit and vegetable is highly perishable but most important commodity for human diet due to their high nutritional value. They are the cheapest and other source of protective food supplied in fresh or processed or preserved form throughout the year for human consumption. Hence the national picture will improve significantly. Fruit and vegetable are available in surplus only in certain seasons and availability in different regions. In peak season due to improper handling practices, marketing, storage problems around 20–25% fruit and vegetable are spoilt in various stages. Fruit and vegetable are living commodities as they respire. Hence, proper post harvest management handling and processing is required in horticulture crops. A variety of fresh fruit and vegetable in India can be made available in plenty due to favorable agro-climatic situations. Hence there is no derth for raw material processing. Product profile being developed in India at present is limited to few fruit and vegetable like mango, pineapple, grapes etc. But there is a wider potentiality for processing of papaya, banana, jack, guava, aonla, carambola and other minor

fruits. Similarly there is a greater scope for processing cauliflower, carrot, bitter-gourd onion, garlic, watermelon, muskmelon etc. Proper handling, packaging, transportation and storage reduce the post-harvest losses of fruit and vegetables. For every one percent reduction in loss will save 5 million tons of fruit and vegetable per year. Processing and preservation technology helps. There are about 4000 small and large scale processing units in the country which process only about 2.5% of the total fruit and vegetable as against 40–85% in developed countries. Food spoilage microorganisms Chemical reactions that cause offensive sensory changes in foods are mediated by a variety of microbes that use food as a carbon and energy source. These organisms include prokaryotes (bacteria), single-celled organisms lacking defined nuclei and other organelles, and eukaryotes, single-celled (yeasts) and multicellular (molds) organisms with nuclei and other organelles. Some microbes are commonly found in many types of spoiled foods while others are more selective in the foods they consume; multiple species are often identified in a single spoiled food item but there may be one species (a specific spoilage organism, SSO) primarily responsible for production of the compounds causing off odors and flavors. Within a spoiling food, there is often a succession of different populations that rise and fall as different nutrients become available or are exhausted. Some microbes, such as lactic acid bacteria and molds, secrete compounds that inhibit competitors [9].

Spoilage microbes are often common inhabitants of soil, water, or the intestinal tracts of animals and may be dispersed through the air and water and by the activities of small animals, particularly insects. It should be noted that with the development of new molecular typing methods, the scientific names of some spoilage organisms, particularly the bacteria, have changed in recent years and some older names are no longer in use. Many insects and small mammals also cause deterioration of food but these will not be considered here.

Yeasts are a subset of a large group of organisms called fungi that also includes molds and mushrooms. They are generally single-celled organisms that are adapted for life in specialized, usually liquid, environments and, unlike some molds and mushrooms, do not produce toxic secondary metabolites. Yeasts can grow with or without oxygen (facultative) and are well known for their beneficial fermentations that produce bread and alcoholic drinks. They often colonize foods with a high sugar or salt content and contribute to spoilage of maple syrup, pickles, and sauerkraut. Fruits and juices with a low pH are another target, and there are some yeast that grows on the surfaces of meat and cheese.

Yeasts spoilage Species

Zygosaccharomyces and related genera tolerate high sugar and high salt concentrations and are the usual spoilage organisms in foods such as honey, dried fruit, jams and soy sauce. They usually grow slowly, producing off-odors and flavors and carbon dioxide that may cause food containers to swell and burst.

Hansenii can grow at salt concentrations up to 24%, accounting for its frequent isolation from salt brines used for cured meats, cheeses, and olives example in salad dressings.

Saccharomyces sp. is used for their role in the production of bread and wine which spoil wines and other alcoholic beverages by producing gassiness, turbidity and associated with hydrogen sulfide and acetic acid. Some species grow on fruits, including yogurt containing fruit, and some are resistant to heat processing.

Dekkera/Brettanomyces is mostly involved in the spoilage of fermented foods, including alcoholic beverages and some dairy products. They can produce volatile phenolic compounds responsible for off-flavors.

Molds are filamentous shape fungi that do not produce a large numbers of fruiting bodies like mushrooms. Molds are very important for recycling dead plant and animal remains in nature, but also attack a wide variety of foods and other materials useful to humans. They are well adapted for growth in and through solid substrates, generally produce airborne spores, and require oxygen for their metabolic processes [10]. Most molds grow at a pH range of 3 to 8 and some can grow at very low water activity levels (0.7–0.8) on dried foods. Spores can tolerate harsh environmental conditions, but most are sensitive to heat treatment. An exception is *Byssochlammys,* whose spores have D value of 1–12 minutes at 90ºC. Different mold species have different optimal growth temperatures, with some able to grow in refrigerators. They have a diverse secondary metabolism of toxic and carcinogenic mycotoxins. Some spoilage molds are toxigenic while others are not. Spoilage molds can be categorized into four main groups: Zygomycetes are considered relatively primitive fungi, but are widespread in nature, growing rapidly on simple carbon sources in soil and plant debris, and their spores are commonly in present indoor air. Generally, they require high water

activities for growth and are notorious for causing rots in a variety of stored fruits and vegetables, including strawberries and sweet potatoes. Some common bread molds also are *Zygomycetes*. Some *Zygomycetes* are also utilized for the production of fermented soy products, enzymes, and organic chemicals. The most common spoilage species are Mucor and Rhizopus. Zygomycetes are not known for producing mycotoxins but there are some reports of toxic compounds produced by a few species. Penicillium and related genera are present in soils and plant debris from both tropical and Antarctic conditions but tend to dominate spoilage in temperate regions. They are distinguished by their reproductive structures that produce chains of conidia. Although they can be useful to humans in producing antibiotics and blue cheese, many species are important spoilage organisms, and some produce potent mycotoxins (patulin, ochratoxin, citreoviridin, penitrem). *Penicillium* sp. cause visible rots on citrus, pear, and apple fruits and

cause enormous losses in these crops. They also spoil other fruits and vegetables, including cereals. Some species can attack refrigerated and processed foods such as jams and margarine. A related genus, *Byssochlamys* is the most important organism causing spoilage of pasteurized juices because of the high heat resistance of its spores. *Aspergillus* and related molds generally grow faster and are more resistant to high temperatures and low water activity than *Penicillium* sp. and tend to dominate spoilage in warmer climates. Many aspergilla produce mycotoxins: aflatoxins, ochratoxin, territrems, and cyclopiazonic acid. *Aspergilli* spoil a wide variety of food and nonfood items (paper, leather, etc.) but are probably best known for spoilage of grains, dried beans, peanuts, tree nuts, and some spices. Other molds, belonging to several genera, have been isolated from spoiled food. These generally are not major causes of spoilage but can be a problem for some foods. Fusarium sp. cause plant diseases and produce several important mycotoxins but are not important spoilage organisms. However, their mycotoxins may be present in harvested grains and pose a health risk. Bacteria Spore-forming bacteria are usually associated with spoilage of heat-treated foods because their spores can survive high processing temperatures. These Gram-positive bacteria may be strict anaerobes or facultative (capable of growth with or without oxygen). Some spore-formers are thermophilic, preferring growth at high temperatures (as high as 55ºC). Some anaerobic thermophiles produce hydrogen sulphide (Desulfotomaculum) and others produce hydrogen and carbon dioxide (*Thermoanaero bacterium*) during growth on canned/ hermetically sealed foods kept at high temperatures, for example, soups sold in vending machines. Other thermophiles (*Bacillus* and *Geobacillus* sp.) causes flat sour spoilage of high or low pH canned foods with little or no gas production, and one species cause ropiness in bread held at high ambient temperatures. Mesophilic anaerobic bacteria, growing at ambient temperatures, cause several types of spoilage of vegetables (Bacillus sp.); putrefaction of canned products, early blowing of cheeses, and butyric acid production in canned vegetables and fruits (*Clostridium* sp.); and "medicinal" flavors in canned low-acid foods (*Alicyclobacillus)* [11]. Psychrotolerant spore formers produce sickly and gas odors in chilled meats and brine-cured hams (*Clostridium* sp.) while others produce off-odors and gas in vacuum-packed, chilled foods and milk (*Bacillus* sp.). Lactic acid bacteria (LAB) are a group of Gram-positive bacteria, including species of *Lactobacillus, Pediococcus, Leuconostoc,* and *Oenococcus,* some of which are useful in producing fermented foods such as yogurt and pickles. However, under low oxygen, low temperature, and acidic conditions, these bacteria become the predominant spoilage organisms in a variety of foods. Undesirable changes caused by LAB include greening of meat and gas formation in cheeses (blowing), pickles (bloater damage), and canned or packaged meat and vegetables. Off-flavors described as mousy, cheesy, malty, acidic, buttery or liver-like may be detected in wine, meats, milk, or juices spoiled by these bacteria. LAB may also produce large amounts of an exo-polysaccharide that causes slime on meats and ropy spoilage in some beverages.

Spoilage of dairy products

Milk is an excellent medium for the growth of a variety of bacteria. Spoilage bacteria may originate on the farm from the environment or milking equipment or in processing plants from equipment, employees, or the air. LABS are usually the predominant microbes in raw milk and proliferate if milk isn't cooled adequately. When populations number reach about 10^6 cfu/ml, off-flavors develop in milk due to production of lactic acid and other compounds. Refrigeration suppresses growth of LAB media and within 1 day psychrophilic bacteria (*Enterobacter, Alcaligenes, Pseudomonas,* and some spore-formers) grow and can eventually produce rancid odors through the action of lipases and bitter peptides from protease action. Pasteurization kills the psychrophiles and mesophilic bacteria (LAB), but heat-tolerant species (*Alcaligenes, Microbacterium*, and the *Sporeformers, Bacillus* and *Clostridium* sp.) survive and may later cause spoilage in milk or other dairy products [12]. Immediately following pasteurization, bacterial counts are usually pH of 5.0–6.5 and a moisture content of 50–80% may be spoiled by *Pseudomonas*, *Alcaligenes*, and *Flavobacterium. C. sporogenes* has been found in spoiled processed cheese, where it produces gas holes and off-flavors. Yeasts and molds are the main spoilage organisms found in cultured milks (yogurt, sour cream and buttermilk) because the high acidity in these products inhibits many bacteria. Pseudomonas, yeasts and molds can spoil butter and "light" butters. Since the light butters have higher moisture content than butter, they can support more microbial growth. The cream may become rancid, when populations of *Pseudomonas* and *Enterobacter* proliferate [15,16].

Prevention from food spoilage microorganism

Many food products are perishable by nature and require protection from spoilage during their preparation, storage and distribution to give them desired shelf-life. Because food products are now often sold in areas of the world far distant from their production sites, the need for extended safe shelf-life for these products has also expanded. The development of food preservation processes has been driven by the need to extend the shelf-life of foods. Food preservation is a continuous fight against microorganisms spoiling the food or making it unsafe. Several food preservation systems such as heating, refrigeration and addition of antimicrobial compounds can be used to reduce the risk of outbreaks of food poisoning; however, these techniques frequently have associated adverse changes in organoleptic characteristics and loss of nutrients [13]. Within the disposable arsenal of preservation techniques, the food industry investigates more and more the replacement of traditional food preservation techniques by new preservation techniques due to the increased consumer

demand for natural, tasty, nutritious, and easy-to-handle food products. Improvements in the cold distribution chain have made international trade of perishable foods possible, but refrigeration alone cannot assure the quality and safety of all perishable foods. The most common classical preservative agents are the weak organic acids, for example acetic, lactic, benzoic and sorbic acid. These molecules inhibit the outgrowth of both fungal and bacterial cells and sorbic acid is also reported to inhibit the outgrowth and germination of bacterial spores. In the production of food, it's crucial that proper measures are taken to ensure the safety and stability of the product during its whole shelf-life. In particular, modern consumer trends and food legislation have made the successful attainment of this objective much more of a challenge to the food industry. Firstly, consumers require higher quality, preservative-free, safe but mildly processed foods with extended shelf-life. For example, this may mean that foods have to be preserved at higher pH values and have to be treated at mild-pasteurization rather than sterilization temperatures. As acidity and sterilization treatments are two crucial factors in the control of outgrowth of pathogenic spore-forming bacteria, such as *C. botulinum*, addressing this consumer need calls for innovative approaches to ensure the maintenance of products. Secondly, legislation has restricted the use and permitted levels of some currently accepted preservatives in different foods. This has created problems for the industry because the susceptibility of some microorganisms to most currently used preservatives is falling. An increasing the numbers of consumers prefer minimally processed foods, prepared without chemical preservatives. Many of these ready-to-eat and novel food types represent new food systems with respect to health risks and spoilage association. Against this background, and relying on improved understanding and knowledge of the complexity of microbial interactions, recent approaches are increasingly directed towards possibilities offered by biological preservation. The high salt concentration in the serum-in-lipid emulsion of butter limits the growth of contaminating bacteria in the small number of nutrients trapped within the droplets that contain the microbes. However, psychrotrophic bacteria can grow and produce lipases in refrigerated salted butter if the moisture and salt are not evenly distributed. When used in the bulk form, concentrated (condensed) milk must be kept refrigerated until used. It can be preserved by the addition of about 44% sucrose and/or glucose to lower the water activity below that at which viable spores will germinate (aw 0.95). Lactose, which constitutes about 53% of the non fat milk solids, contributes to the lowered water activity. When canned as evaporated milk or sweetened condensed milk, these products are commercially sterilized in the cans, and spoilage seldom occurs. Microbial growth and enzyme activity are prevented by freezing. Therefore, microbial degradation of frozen desserts occurs only in the ingredients used or in the mixes prior to freezing. Chemical preservatives are substances, which are added to food just to retard inhibit or arrest the activity of microorganisms such as fermentation, putrefaction and decomposition of the food [14,15]. Commonly used preservatives include common salt, sugar, dextrose, spices, vinegar, ascorbic acid, benzoic acid and it's salt, SO_2 and the salts of sulphuric acid, nitrates, sorbic acid and its salts, propionic acid and its salts, lactic acid and its salts.

Features of Potassium metabisulphate

It releases the SO_2 and it is unstable and it's used for the fruit, which has non-water solvent pigment, it is used in naturally coloured juices such as jamun, phalsa because they have the anthocynin pigment. Hydrogen sulphide has an unpleasant smell and also forms a black compound with the base plate of containers. The requirement of 350 ppm KMS is mostly used in fruit juice products.

Features of Sodium benzoate

A mixture of benzoic acid that's added in water, which delays the fermentation in the juices; commonly it is used in the anthocynin pigment. Total 750 ppm sodium benzoate is mostly used in fruit juices, squashes and cordials.

CONCLUSIONS

The microorganisms like fungi and bacteria, which spoil food by growing in it and producing substances that change the colour, texture and odour of the food. Eventually, the food will not be beneficial for human consumption. When food is kept with a furry growth and becomes pulpy to produce bad smells, which cause the spoilage by the growth of moulds and yeasts. Spoilage caused by moulds and yeasts such as souring taste of milk, growth of mould on bread and rotting of fruit and vegetables. These organisms are rarely harmful to humans, but bacterial contamination is often more severe because the food does not always look bad, even if it is severely infected. When microorganisms get present in food, they use the nutrients, which have present in it and their numbers rapidly increased. They change the food's smell and prepare new compounds that can be harmful to humans. Food spoilage directly affects the colour, taste, odour and consistency or texture of food, and it may become dangerous to eat. The bad odour or smell coming from food is an indication that it may be unsafe. The chief factor for food security is reduction in food spoilage. Through, spoilage the food become deteriorates and it is not edible to humans or its quality of edibility becomes reduced.

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