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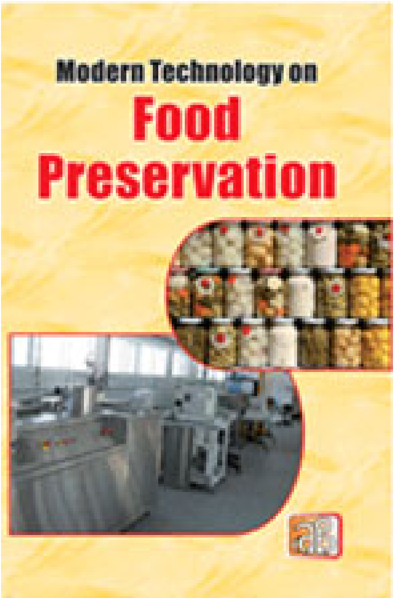
Modern Technology on Food Preservation (2nd Edition)



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Food Preservation has become an integral part of the food processing industry. There are various methods of food preservation; drying, canning, freezing, food processing etc. Food processing is one the method of food preservation which is the set of methods and techniques used to transform raw ingredients into food or to transform food into other forms for consumption by humans or animals either in the home or by the food processing industry. Canning is one of the various methods of food preservation in which the food is processed and then sealed in an airtight container. This process prevents microorganisms from entering and proliferating inside. Dehydration is the process of removing water or moisture from a food product. Food dehydration is safe because water is removed from the food. Freezing is also one of the most commonly used processes commercially and domestically for preserving a very wide range of food including prepared food stuffs which would not have required freezing in their unprepared state. Benefits of food processing include toxin removal, preservation, easing marketing and distribution tasks, and increasing food consistency. In addition, it increases seasonal availability of many foods, enables transportation of delicate perishable foods across long distances and makes many kinds of foods safe to eat by deactivating spoilage and pathogenic micro organisms. Nanotechnology exhibits great potential for the food industry. New methods for processing nanostructures are being developed having novel properties that were not previously possible. As such, due to the recent up gradation of preservation techniques, the preservation industry is also growing almost at the same rate as the food industry which is about 10 to 12% per year.

The purpose of this book is to present the elements of the technology of food preservation. It deals with the products prepared from various fruits and vegetables commercially. Relevant information on enzymes, colours, additives, flavours, adulteration, etc., has been given. This book also contains photographs of equipments and machineries used in food preservation.

This book will be very useful for new entrepreneurs, food technologists, industrialists, libraries etc.

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Development of a Frozen Food Industry

Freezing temperatures, once feared by mankind, have been turned to his great advantage by his inquiry into the phenomena. While ice-salt systems were used to freeze foods in the mid 1800's, and patents for freezing fish, for example, were granted in 1861 to Enoch Piper in Maine, and even earlier to H. Benjamin in England in 1842 the invention of mechanical refrigeration in the late 1800's provided the base for subsequent commercial exploitation of the process. Frozen foods have become important items of commerce (90 per cent of Iceland's export trade is frozen fish) and important in food preparation for dinner tables (Figs. 4.1 8s 4.2).

Clarence Birdseye fathered this revolution as a technologist by developing quick freezing processes and equipment, and successfully promoting consumer units of frozen foods. He overcame tremendous obstacles. In the 1920's there "were few mechanical refrigerators in homes in the United States.

In the 1930's, as facilities for food freezing and retail distribution developed across the United States, frozen foods began to find their place in commerce. Yet, it was not until 1940 that they became important competitors of other consumer-type preserved foods. While Clarence Birdseye was a prime mover industrially, the frozen food industry had support in the scientific aspects of the development by men such as Dr. Donald K. Tressler, at Cornell, and Dr. C.R. Fellers at the then Massachusetts State College.

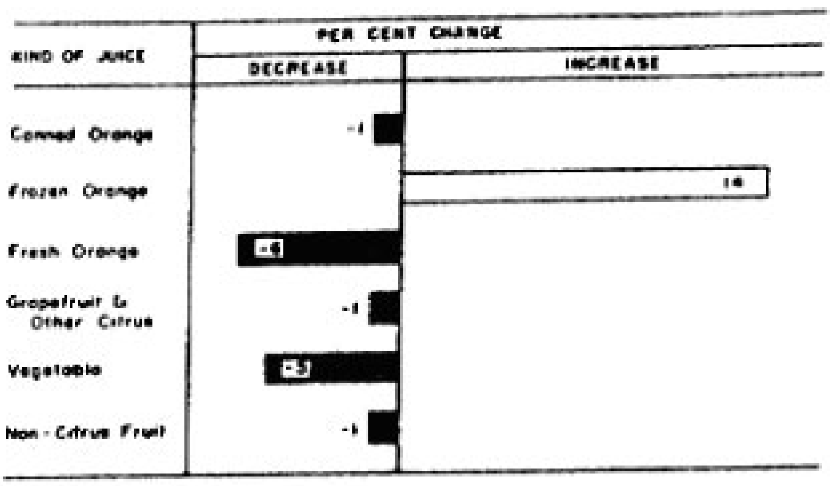

Fig. 4.1: TREND IN THE CHANGING PATTERN OF SERVING JUICES IN THE UNITED STATES

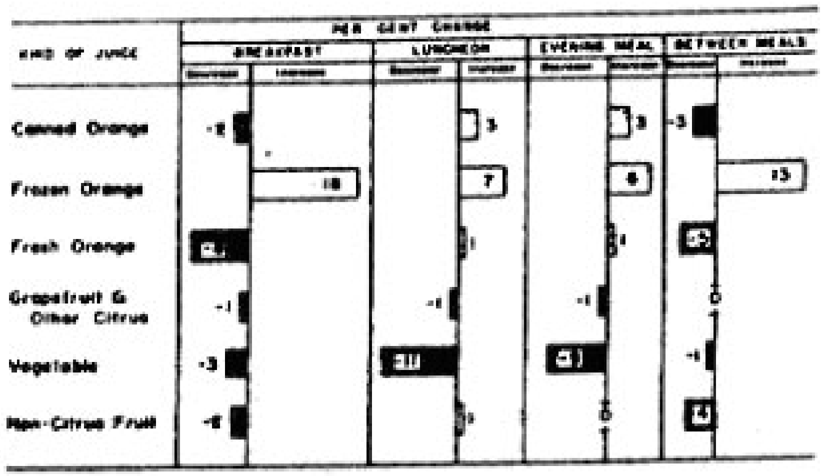

Fig. 4.2: TRENDS IN THE CHANGING PATTERN OF CONSUMING JUICES IN THE UNITED STATES

The present day finds competition between all methods of food preservation, and the competition is being resolved by consumers (Fig. 4.2). Those foods best preserved by freezing are largely frozen. Those foods highly acceptable as canned products continue as highly successful consumer goods. The economic struggle for survival between fresh commodities, canned foods, and frozen foods in a free market evidences itself in better foods at lower prices for consumers.

The Freezing Point of Foods

Living cells contain much water, often two-thirds or mgre of their weight. In this medium there are organic and inorganic substances, including salts and sugars and acids in aqueous solutions, and more complex organic molecules such as proteins which are colloidal suspension. To some extent gases are also dissolved in the watery solution.

The physical, chemical, and biological changes occurring during the freezing and subsequent thawing of foods are complex and not completely understood. Nevertheless it is useful to study the nature of these changes which have been recognized in order to design a successful freezing process for a food.

The freezing point of a liquid is that temperature at which the liquid is in equilibrium with the solid. A solution with a vapour pressure lower than that of a pure solvent will not be in equilibrium with the solid solvent is at normal freezing point. The system must be cooled to that temperature at which the solution and the solid solvent have the same vapour pressure. The freezing point of a solution is lower than that of a pure solvent. The freezing point of food is lower than that of pure water.

When a liquid evaporates the escaping molecules exert a pressure known as the vapour pressure. The total pressure of a system will be equal to the sum of the partial pressures of the system. The addition of a non-volatile solute (sugar) to water lowers the vapour pressure of the water solution of sugar, and the freezing point of the water solution will be lower than that of pure water (Table 4.1).

Because of the high content of water in most foods, most of them freeze solidly at temperatures between 32Â° and 25Â°F (Fig. 4.3). The temperature of the food undergoing freezing remains relatively constant until the food is mostly frozen, after which time the temperature approaches that of the freezing medium.

Quick freezing has been defined, by those who adhere to rapid crystallization theory, as that process where the temperature of the food passes through the zone of maximum ice crystal formation (32Â° to 25Â°F.) in 30 minutes or less. The basic principle of all rapid freezing methods is the speedy removal of heat from food. These methods include freezing in cold air blasts, by direct immersion of the food in a cooling medium, by contact with refrigerated* plates irf a freezing chamber, and by freezing with liquid air, nitrogen, or carbon dioxide. Freezing in still air is the poorest method of all. By circulating cold air, the freezing rate is greatly accelerated, as will be explained.

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