Food Science and Technology Notes

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Loss of quality during storage of canned food is a continuing problem. The following article on quality deterioration should be of interest to you. J. David Baldock, Extension Specialist, Food Technology.

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QUALITY DETERIORATION IN CANNED FOODS

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Canning may be defined as food preservation by heat sterilization[a] of foods packed in hermetically sealed containers. Canners strive to maintain the characteristics of the fresh foods in their canned products. It is obvious that one of the major factors influencing quality is the quality of the fresh product from which it was prepared.

Loss of quality in canned foods may take place in a number of different ways. The causes may be bacteriological or chemical. Bacteriological processes usually produce a rapid and pronounced deterioration of the canned food. This is usually called "spoilage". The chemical type of deterioration is characterized by very slow changes which usually take months or years to become apparent. Notwithstanding the slow rate of change, chemical deterioration also contributes in an important way to loss of quality. Because of advances made in food technology in the last 40 years, the food industry in this country has virtually eliminated the problems of bacteriological spoilage and safety of commercially canned foods. For this reason, food scientists working with canned foods have been in a position for the last 20 years to dedicate a larger proportion of their time to the improvement of canned food quality.

Today, the most important causes of quality deterioration in canned foods are the very slow chemical changes that take place during storage. A resulting effect is a loss of quality below the level of freshly processed canned items.

[a]Heat sterilization produces canned food in which all microorganisms that might cause food spoilage have been destroyed, and enzymes have been inactivated. Food then will not spoil if handled normally. This is normal condition of sterility in commercially canned foods.

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What causes these chemical reactions? To understand this better, we must remember that canned foods, as well as all foods, are a mixture of chemicals produced and put together through processes in nature. These chemicals are the proteins, carbohydrates, fats, fiber, minerals, vitamins, pigments, and flavoring substances which, with water, make up foods. Some of these canned food components are continuously reacting in the container with other food substances, with oxygen gas present in the foods, with air trapped in the container, or with the can when this is the container used. Some of these reactions may take place at a faster rate when storage temperatures or other factors inside the container are not normal. Again, it should be emphasized that the chemical reactions are among the most important causes of quality deterioration in canned foods. They are responsible for changes in nutritive value, flavor, color, and texture of the product. No harmful substances are formed, however. These different types of chemical deteriorations in canned foods are important factors since they have a definite bearing upon consumer acceptance.

Warm or hot storage temperatures, above 70°F, accelerate the chemical reactions responsible for deterioration of color, flavor, texture, and nutritive value of canned foods. Therefore, cool storage temperatures are recommended since quality loss is proportional to the storage temperature.

In canned fruits, particularly, air trapped within the container can cause surface darkening and sometimes off-flavors and small losses of vitamin C. Contact of the raw materials with utensils or equipment and dissolution of minute quantities of iron and copper in the food may result in a grayish or black discoloration. When hard water is used in canning, it may give some vegetables a tougher texture and also cause a sediment in the container. Sediments also may be produced when over-mature vegetables are canned.

The iodine in iodized salt may cause a black or purplish discoloration in foods containing starch such as canned corn, gravies, or puddings. Iodized salt is generally recommended as table salt, but for the reasons mentioned, it should be used in canning only when the quality of the food will not be adversely affected by the iodine.

Off-flavors from the development of rancidity in fats or oils may contribute to the deterioration of quality in certain canned seafood, meat poultry, and vegetable products.

Great advances have been made in the manufacture of containers for canned foods. It has not been possible, however, to develop a can that will not react chemically, at least slightly, with certain foods. The most common of these reactions is internal can corrosion. This is a process in which minute amounts of tin and iron dissolve from the can surface into the food. The main disadvantage of can corrosion is that the container or the food, or both, may become discolored, resulting in loss of product quality. In extreme cases of corrosion, the can may bulge because of pressure generated in the can by hydrogen gas, which is usually formed under these circumstances. Food technologists can differentiate between cans bulging by hydrogen pressure, and those which do so because of microbiological spoilage. Since consumers cannot make the differentiation, they are advised to discard, without opening, all swelled cans, although contents from cans bulged by hydrogen pressure are edible. Internal can corrosion is more common in fruit products than in vegetable, meat, or fishery products. Corrosion is not a problem with glass containers.

Can corrosion may also produce bleaching of the food color. This effect is sometimes considered advantageous, such as in the case of canned applesauce. Here, the slight amounts of tin that dissolve keep the product light in color, whereas the same product packed in glass containers tends tc darken in color, which is usually considered a loss of quality. In other instances, bleaching of the food is decidedly objectionable, such as in the case of canned cherries.

When canned foods are packed in glass containers, light-instigated reactions may cause color changes in the product, as well as small vitamin losses.

Another type of deterioration of canned food quality takes place when foods with high content of the sulphur-bearing amino acids, cystine and cysteine, are canned using internally uncoated cans, or cans coated with enamels other than a C-enamel[b]. Foods in this category are prone to give off hydrogen sulphide during heat processing in the can. The hydrogen sulphide combines with iron that has dissolved from the tinplate, forming black ferrous sulphide. Thus, black discoloration or black specks are found on the internal surface of the can, or in the product itself. Canned seafoods, meats, poultry, asparagus, corn, and peas are most susceptible to the formation of this harmless but unsightly substance.

Darkening of canned foods may also be caused by certain chemical reactions known as non-enzymatic browning. These reactions promoted by heat take place between sugars and their derivatives, and amino acids that are in the food. Browning reactions in canned fruits and vegetables are usually undesirable. Color and flavor changes take place when non-enzymatic browning occurs. On the other hand, desirable flavor and color develop in certain products like canned meat products.

Consumers of canned foods complain occasionally of yellow crystals in asparagus, green beans, and onions. They also show dissatisfaction with grape products showing white transparent crystals. Likewise, crystals resembling particles of glass in canned crab meat are objected to by consumers. These crystals are completely harmless, nevertheless, canners strive to prevent their formation. The reason for the occasional presence of these crystals in canned foods is that certain natural components of the food become too concentrated in a particular spot and then precipitate out of solution as crystals.

All of the above mentioned causes of food deterioration can produce loss of quality in canned foods. However, progress made in scientific understanding of quality deterioration and its causes in canned foods have made possible a way to control them through application of modern commercial canning methods. Today, commercial canning procedures are designed to minimize occurrence of chemical deterioration and consequent loss of quality and nutritive value. This is an important reason why we have available in this country safe, high quality, nutritious commercially canned foods.

[b]C-enamel contains zinc oxide which reacts with hydrogen sulphide preventing formation of the objectionable ferrous sulphide.