Food Preservation

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Reasons that Microbes Survive in Preserved Food

Preservation techniques should prevent food spoilage at all levels. However, this is not often the case. Indeed, preserved foods also spoil after some time. The surprising thing though is that the spoilage is not due to problems with the preservation techniques. Studies have pointed out that spoilage in preserved foods could be due to resistant microbes. In addition, researchers have noted that chemical processes continue to take place in preserved foods which can be blamed for the spoilage. Since this topic has not been conclusively researched on, there is need to ascertain why food spoilage continues to take place yet the preservation mechanisms are correctly done and what should be done to curb the causes. Thus, this paper will first highlight some food preservation techniques, and how each of the technique allow microorganism to grow in the preserved food. Finally, the paper will give details of ways to curb the identified problem.

One of the food preservation techniques is heat processing. It is a form of food preservation where food is put in a container and then heated until vacuum is achieved and all the microorganisms in the food substance killed. This technique has been widely employed for preserving fruits and vegetables. It can be done at the domestic scale where fruits and vegetables are put in glass jars with lids and the jars and their contents heated in boiling water. This is also known as the hot bath method. In food industries, this method is widely used to prevent food spoilage through numerous techniques such as canning and pasteurization. Pasteurization is the preservation technique where liquid food is heated to specific temperature for a given time period. The food is then cooled immediately after being removed from the heat. There are two forms of pasteurization, thermization which uses low temperature to kill bacteria and ultra heat treatment. The former method does not intend to kill microorganisms but to reduce the number of food poisoning bacteria. This method holds on the promise that reducing the number of pathogens in food will prevent these microorganisms from causing disease. Since in pasteurization not all microorganisms are killed, it is likely that the pathogens that remained in pasteurized food will multiply and cause food spoilage. However, ultra heat treatment kills 99.9999% of the number of viable microorganism in milk (Nicholas and Grahame, 2003, p. 45). Nevertheless, it does not destroy the spore forming bacteria such *Clostridium perfringens*. Besides, heat treatment through pasteurization does not destroy toxins produced by the bacteria.

Chill storage and freezing preserve food from the time it's frozen until the time it is eaten. Low temperature preservation method is effective technique because it deactivates microorganisms. Thus, the microorganisms do not grow rapidly and some are killed. When compared with the thermal methods such as pasteurization, this technique is less effective since microorganisms are able to grow in low temperatures. The problem with this technique is the fact that once the food thaws the deactivated bacteria will once again become active. All the same, foods can be preserved for several months using this method. For long term storage methods, the temperature should be -18º C (Da-Wen, 2006, p. 77). Studies have established that when the food is thawed, the microorganisms become active and their activity rates improves so fast that they only need a shorter time to cause spoilage than when the food is not frozen.

Fermentation is another effective food preservation technique. This method converts carbohydrates to carbon dioxide and alcohols or organic acids. This conversion is facilitated by bacteria and yeast under anaerobic condition. Bacteria and yeast can also be used together to ferment foods. In addition to food preservation, fermentation serves the following purposes; elimination of the antinutrients factors in food and decreases the cooking time. It also contributes

to biological enrichment of food with vitamins, essential amino acids and protein. It also contributes diversity of aromas, flavors and textures to food substrates. Fermented foods pose a great risk to botulinism, food poisoning caused by bacteria *Clostrodium botulinum* (McGovern et al., 2004, p. 17596). The bacteria thrives better in an anaerobic conditions which are created by the air tight containers used enclose fermented foods. Besides, fermentation of food is not enough to destroy the toxins produced by the bacteria.

Food preservation using chemicals was one of the earliest methods of food preservation. Salt was one of the chemicals used by the earliest man. Today, acids and salts are used extensively to preserve onions, cabbage, cucumbers and other vegetable products. Salt has a selective inhibitory action on some microorganisms and it also lowers the water activity thereby controlling the growth of pathogens in food. Acids on the other hand preserve foods through its two anti-microbial effects. Acids affect the PH of foods thereby making the conditions unsuitable for acid loving bacteria (Grahame, 2000, p. 139). In addition, it hinders microbial growth through its undisassociated specific toxicity. Sugars on the other hand reduce water activity and make the water to be unavailable for microorganisms. The problem with sugars is the fact that they permit the growth of other food organisms and suppress the growth of other microorganisms which would make food spoilage evident. It has also been established that moulds and yeast can spoil low pH foods.

Drying food is a technique that removes water from the food. This inhibits the growth of food poisoning bacteria. Drying is often used for preserving grains. This is done through removing moisture by heated air or aeration process of moving air through the grain. The main methods that are used in drying include the in storage drying, batch drying and continuous flow drying. Drying method eliminates aerobic microorganisms. However, facultative and anaerobic microorganisms will still thrive in dried food products (Nicholas and Grahame, 2003, p. 46). Besides, it does not destroy the spore forming bacteria. Also microorganisms which can survive in low water activity such as the

Precaution to Minimize the Risk

Heat processing is the most effective preservation method. However, pasteurization is not completely effective since its main intention is not to kill bacteria but to reduce the number of the pathogens that can cause disease. Since ultra heat treatment, one of the many pasteurization techniques, can destroy 99.999% microorganisms (Nicholas and Grahame, 2003, p. 45), it should be recommended. But it will not be suitable for all liquids preserved through pasteurization because it destroys nutrients and results to low quality food. In this case, the most suitable method will be thermization. Foods pasteurized through low temperatures should be handled with care during storage and must be stored at the recommended temperatures. In most occasions, pasteurized foods are stored at refrigerated temperatures which are lower than 4^{o} C. This temperature is enough to reduce activities of most food destroying bacteria such as Bacillus and Staphylococcus in food, especially milk.

The beauty with low temperatures preservation methods, especially freezing, is its ability to deactivate microorganisms provided that the food is stored at temperatures below -18^{o}C (Da-Wen, 2006, p. 77). However, once the food is thawed, the microorganisms regenerate and reproduce at an accelerated rate. This means that proper handling of the frozen foods will be sufficient to ensure that the food is not spoiled until it's consumed. Handling will be critical

immediately the foods are out of the freezers. The time it takes for the food to be thawed and during food preparation (Grahame, 2000, p. 139). In addition, proper handling of the food must be ensured to prevent cross contamination which would further fasten food spoilage.

Fermentation will prevent spoilage of food particularly from the acid thriving microorganisms. However, those bacteria with wide pH range such as Clostridium botulinum will still thrive in fermented foods. This problem can be avoided by storing the preserved foods in aerobic conditions since the microorganism thrive better in anaerobic conditions. Further, storing the fermented foods in the traditionally accepted containers which are not air tight will better reduce incidence of food spoilage due to Clostridium (McGovern, 2004, p. 17594). Thus, food handlers should not rush to choose air tight plastic containers which provide conditions favorable for bacterial growth.

Food preservation using chemicals will be effective when spore forming bacteria is not allowed in the food substrate prior to preservation. Thus, foods preserved through chemicals should first be subjected to heat treatment. In addition, a combination of chemicals should be used in the preservation (Nicholas and Grahame, 2003, p. 46). For instance, salts which have specific inhibitory for certain microorganisms should be used along with acids. On the other hand, there are a number of acids which are used to preserve foods. These acids should also be used in combination. This means that acetic and citric acids should be better used together than using each individually. Foods preserved in brine will need additional care and special storage since moulds and yeasts will still spoil foods subjected to very low pH. They need special monitoring and handling during storage and preparation.

Drying food removes moisture from food. This is sufficient to control a number of microorganisms that causes food poisoning (Grahame, 2000, p. 140). However, for spore forming bacteria it is not. Therefore, it is most appropriate to use other preservatives along with drying. For instance, meat can be first smoked and then dried. Grains on the other hand can be first preserved through chemical preservatives such as brine before subjected to drying. Besides, proper handling of the dried foods is essential to keep moisture away. Thus, the packaging of the dried foods should ensure air tight conditions. Hence, the packaging material should not allow the entry of moisture into the preserved food.

References

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