Preservation of Food, from Bacterial Action.

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Outline,

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Preservation of Food.
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Man labors primarily to secure food, some of which may be destroyed by bacteria. Other men seek to discover preventives of bacterial decomposition, so that it may be possible to preserve foods indefinitely. Hermetically sealing is the only positive means of preventing the growth of bacteria in foods. Bacteria are so abundant in water and air that it is impossible to keep them out of any exposed mass of food. Foods as well as animals have a natural resistance to bacterial action. For instance the skin of fruit prevents the attack of bacteria for a while.

Of all methods employed for preserving fruit, for any length of time, none has so great a future before it as dessication. Because the process does not require technical skill, it excels in cheapness, for neither vessels sugar, nor other, nor other auxiliaries - are required; the product possesses excellent keeping qualities, retains its natural flavor, and being healthier and more agreeable than fruit preserved by any other method, is especially suitable as food for the people.

The process of evaporating fruit is a recent one. It is less than fifteen years since Alden received his patent. Like all inventions some years were required before the merits were thoroly understood, though at the Paris exposition of 1878 the first prize was unanimously awarded to the fruit dried by dessication. It was first introduced into California and from there spread thruout the whole country.

The advent of steam evaporators and scientific methods has wrought a great change in the business. Dessication of fruit is an extensive business giving employment to thousands of people. The new process now in use produces fruit that retains much of its original color, and is almost as palatable as though fresh. At first only kernel and stone fruits were dessicated, but now the list has enlarged and comprises the following articles, cherries, pears, peaches, apricots, plums, nectarines, figs, black berries, grapes, corn, peas, potatoes, sweet potatoes, onions, tomatoes, pumpkins, rhubarb, asparagus, hops, tobacco, meat, oysters, fish, grasses, and eggs. One of the great advantages of dried fruit is that even after years, it retains its natural form and freshness, when placed a few hours in fresh water and then boiled with an abundant addition of water. The object to be obtained in dessication of fruit is not only to make it keep, but also to retain its properties for what it is valued. This can only be reached by with drawing the content of water, and at the same time converting a portion of the starch into sugar in as short a time as possible without boiling the fruit. The latter would injure the taste of the fruit, and slow drying gives a flavor, as in decayed fruit. The quicker the watery portions are removed from thoroughly ripe fruit, the richer and more durable its taste will be, and the more completely the oxygen of the air is excluded during the process, the more perfectly will it retain its color. In the drying apparatus the high temperature is not sufficient, it is the current of air that dries the fruit rather than the high temperature, both of course must work in conjunction. The rapidity of the process prevents the action of bacteria and causes the color and aroma of the fresh fruit to be retained. The advantage of this is that considerable quantities of starch is converted into sugar.

Dessication is the most easily applied means of preventing growth of bacteria. It prevents the growth of bacteria, in as much that after the amount of water gets below thirty per cent most bacteria stop growth and all growth stops when the water content is below twenty-five per cent. Evaporated fruit of today is entirely different from the dried fruit of a dozen years ago. Who does not remember the shrivelled, dark-colored, wedge shaped pieces of apples and peaches that were sold out of barrels? They possessed the tenacity of sole leather and were uninviting as to looks and smell. Before they could be used in the home made pies they required to be boiled and stewed for hours at a time. The preparation of dried fruits in those days were primitive. Farmers wives and daughters pared and quartered apples, strung them on a string and hung them out to dry. These were called "snitz".

All cereals when ripe are dry enough that bacterial action cannot proceed.

It is almost impossible to dry meat, owing to the fact that before the meat looses its moisture decay will set in. In hot climates the method is used with the addition of salting, and produces a food known as, pemmican, charqui, and tassajo. The meat preserved this way keeps for an indefinite length of time, but looses considerable of its natural flavor. Experiments are being tried of artificial heat on this line and results give a better flavor than by the sun. In the form where smoking of meat is carried on it is accompanied by drying. In this process the subsequent bacterial action is prevented, partly by the drying it receives and partly by the germicidal action of the smoke. Certain woods are used such as oak, beech, and hickory, and this gives rise to various volatile products, such as phenol and creasote, which act as a germicide. The bacteria on the surface are destroyed by the smoke and the product from the wood prevents the growth of other bacteria.

In all comparative dry countries hay is preserved by drying. The grass is cut and the moisture it contains is dried out by the sun and air, thus preventing the growth of bacteria. In the more moist climates two artificial processes are used.

Burned Hay - In this process the hay is cut and piled in stacks ten to thirteen feet high, then packed tightly. These heaps produce the heat of spontaneous combustion, in about twelve hours. The heat is allowed to rise till it reaches one-hundred and fifty-eight degrees, Fahrenheit, which occurs most time in from forty-eight to sixty hours, then the heaps are spread out and allowed to dry. The heat in the hay soon dries it and after one turning it is stored away. The nature of this fermentation is still unknown. It has been attributed to bacteria that live in a high temperature, but this is opposed by others, for the thermophilous bacteria are not able to produce sufficient heat to destroy themselves. Chemists attribute it to chemical fermentation, either to respiratory changes, or to enzyme-like bodies. If these masses of hay are allowed to continue heating after they reach one hundred and fifty-eight degrees Fahrenheit, spontaneous combustion will result. This is the cause of so many barns catching a fire.

Brown Hay - This is employed in very moist countries where the above method cannot be used. In its preparation the grass is piled up thirteen to sixteen feet high and sixteen to twenty-four feet in diameter. It is packed down but not so much as in the Burnt method, and the whole pile is thatched so as to shed water. This mass becomes heated by fermentation, the temperature rising as high as one hundred and sixty degrees Farenheit, but it does not rise much higher, and there is no danger of spontaneous combustion. The pile is not opened, but the hay remains in the mass ready for use. A great change is caused in this grass by the fermentation which takes place. The mass is dry, pale brown color, and is very firm. Its odor reminds one of freshly baked bread. Lactic acid as high as seven per cent, and butyric acid over two per cent is also developed, which comes from the carbohydrates. It is thought that the acid is caused by bacterial action and the fermentation to enzyme-like bodies, but the facts are unknown. The whole subject of curing hay needs further study before we can understand its real nature or the importance of these fermentation processes. Both cotton and hops undergo a similar fermentation during the curing.

Refrigeration.

Refrigeration is the oldest method of preventing bacterial action. Bacterial action ceases at freezing and some species grow more slowly as the temperature is lowered, and even a moderate degree of cold will greatly check bacterial action.

In large cold storage houses the food is practically frozen, because it is cooled at a temperature below freezing. A fact to be remembered is that these low temperatures do not kill the bacteria but only delay their action, and as soon as such food products are warmed, the bacteria begin their action immediately. In an ice-chest ordinary bacteria do not grow and food will not undergo decomposition, although there are some species that will grow at these temperatures and destroy the food substance.

Preservation by the Use of Chemicals.

By this is meant that some harmless material is added to a substance, that has the power of checking bacterial growth. By this "harmless material" is meant preservatives. These materials should be harmless and without a disagreeable odor. For this reason many of our best antiseptics can not be used. A common substance that we use for this most is common salt. It is not a disinfectant, but in solution will prevent the growth of bacteria and prevent common putrifaction.

Among the common things that we find it used for as a preservative is butter, where it also used as a product to produce flavor. Salt is also used in the preserving of salt-corned beef, salt pork, pickles, fish, and especially dried mackerel.

Sugar is another common preservative. We find it used in large amounts to prevent fermentation changes in condensed milk. In preservation of foods by dessication, it is the sugar, with the drying that perverts bacterial action. Pure sugar, or if kept in a strong solution, or in crystals will not ferment, but will in a weak water solution.

Acetic acid prevents the growth of bacteria in vinegar. Salicylic acid, borax, boracic acid, and formalin are often used.

Hermetic Sealing.

This was invented by Appert, about the time the scientists were experimenting over the problem of spontaneous generation. It was at first thought that the sealing was to keep out the air, but now it has been demonstrated that it was the bacteria they kept out because pure air does not effect the substance. This was at the time the scientists were disagreeing, fruit was being canned - an evidence against spontaneous generation - and shipped to all parts of the United States.

The objective point in this process is that the material is first put into a vessel, then heated to sterilize, after which it is hermetically sealed to prevent the access of bacteria. But properly sealed, sometimes, is not possible, for the substance or container, may not be sterilized. If such a defect happens the material ferments and the pressure of the gases accumulate within, causing the vessel to swell or break, and the contents are ruined. Many spores resist the boiling temperature hence they may be sealed up with the supposed sterile substance. Many foods are more easily canned than others. Tomatoes have been most satisfactory canned of any other article. Corn is the most difficult to can, due to the fact that while it is growing in the field it is infested with a bacteria, which produces resisting spores, and the destruction of these spores by heat is difficult. Thirty years have led to great changes in the canning industry, the most important of which, the reduction in cost, is due to the application of machinery in the preparation of raw materials and in the manufacture of tin cans. It seems almost incredible that articles which cost from two dollars, ($2.00) to three dollars and twenty-five cents ($3.25) per dozen in 1869 now sell from thirty-five cents, (.35) to seventy cents (.70) per dozen.

Bacteria in Eggs.

For ages past people have been trying to prevent the action of bacteria in eggs. It has been proven that bacteria are in freshly layed eggs, they having entered the oviduct and contaminated the mass of the egg even before its shell is deposited. Bacteria will also enter the shells of eggs after they are layed. There are numerous methods of keeping eggs, which are of commercial importance. The large surplus of eggs which if thrown upon the market during the season of greatest production, would reduce prices as low as to entail loss to both producer and handler, are now well taken care of by cold storage. This process is certainly effectual in keeping eggs for months in dormant condition. However eggs must be fresh and good when placed in storage, for they are certainly not improved by the process. In studying the subject, the question naturally arises, what are the causes of deterioration? The answer is simple enough. Ferments or germs cause chemical changes in the contents of the egg, resulting in the formation of liquid or gaseous compounds and finally in the offensive or "rotten egg."

Fresh infertile eggs, even after several days of incubation, are found to have changed but slightly, and may be used for culinary purposes. But a fertile egg, which has been incubated even for a few hours, so that the chick embryo has started to grow and has then by any means died, soon decomposes under ordinary conditions. Among numerous methods of preserving eggs, the following have been considered worthy of experimental tests.

Water Glass. (Silicate of Soda). Method: The water glass is obtained of druggists, and costs from forty to twenty cents per gallon. On May eighteenth eighteen hundred and ninety-nine, twenty eggs of Lehorn fowls, laid during the five days from twelveth to the sixteenth were washed and placed in a stone jar. The ten per cent solution of water glass was poured over the eggs until covered.

The covered jar was placed on the floor of a cellar closet and left untouched until end of test, April fourth, nineteen hundred. Result: Good one hundred per cent, bad no per cent. The Water glass was found to have formed a white gelatinous percipitate; which adhered more or less closely to the eggs. The shells of the eggs were very clean, owing to the alkaline nature of the solution; the air cells were not enlarged. The taste of the eggs was slightly flat, or at least was not perfectly fresh.

Dry Table Salt. Method: Salt to a depth of two inches was placed in a stone jar, and on May eighteenth, eighteen hundred and ninety-nine, twenty eggs were placed in the jar, small ends down, not touching each other, and closely packed in the salt. The jar remained untouched in the cellar closet to the end of test. Result: Good, no per cent, bad, one hundred per cent. On the following April these eggs were examined and their contents had somewhat shrunken, the air cells being greatly enlarged. For preserving eggs for a few months, however, this method may be recommended. It is simple, cheap, and for short periods reasonably effective.

Lime Water and Salt Brine. Method: One pound of quick lime and one half pound of table salt were thoroughly mixed with four quarts of boiling water.

After slaking and settling, the clear solution was drawn off for use in the test. The eggs were washed and laid in the jar, and the solution poured over them until all the eggs were fully surrounded and covered by the liquid. Result: Good one hundred per cent, bad no per cent. Salt brine, salicylic acid, sulphur, wood ashes, and vaseline were also tried and of the different methods tested in this series of experiments the old way of using slaked lime and salt brine proved to be very effectual, and has

also the advantage of being inexpensive.
For a period of a few weeks only, an effective method of preservation is smearing the eggs with vaseline. In the place of vaseline almost any clear, greasy substance may be used. For a period of a few months only, packing in dry table salt is worthy of recommendation. Of all the substances experimented with, the Water Glass solution proved most worthy of commendation. The fourth series of experiments showed that the Water Glass solution could be reduced to three per cent, and still retain its preserving quality.