

[54] **ALTERED BRINING PROPERTIES OF PRODUCE BY A METHOD OF PRE-BRINING EXPOSURE OF THE FRESH PRODUCE TO OXYGEN OR CARBON DIOXIDE**

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[58] Field of Search **426/281, 49, 270, 321, 426/615, 486, 312; 99/535**

[56] **References Cited**

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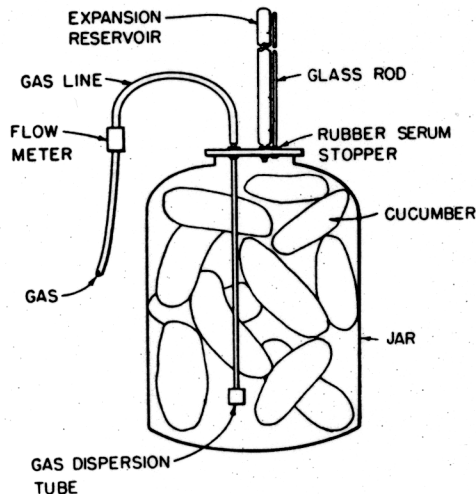
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[57] **ABSTRACT**

Fresh whole produce is placed in a container and continuously purged for about 30 to 120 minutes with oxygen or carbon dioxide gas. The container is then filled with a brine solution and the produce allowed to stand for a period of about 2-24 hours, thus resulting in superior pickled produce.

5 Claims, 4 Drawing Figures



Jar-reservoir assembly used to expose cucumbers to gases prior to brining and to subsequently brine the cucumbers.

ALTERED BRINING PROPERTIES OF PRODUCE BY A METHOD OF PRE-BRINING EXPOSURE OF THE FRESH PRODUCE TO OXYGEN OR CARBON DIOXIDE

BACKGROUND OF THE INVENTION

(1) Field of the Invention

This invention relates to a unique process for the preservation of fresh produce.

(2) Description of the Prior Art

Pickling cucumbers, peppers, and certain other produce have been stored and safely preserved in sodium chloride solutions for many years. The brined produce may or may not undergo microbial fermentation depending upon the concentration of sodium chloride (salt) and the addition of other preservatives. Furthermore, if the produce is allowed to ferment, the fermentation may occur as a consequence of growth by the natural microorganisms that are present in the produce-brine mass or by addition of selected microorganisms. The general procedure for the preservation of fruits and vegetables by brining is accounted for in the reports of Vaughn et al., 1954, Pederson, 1969, and Etchells et al., 1975. Procedures have been described for the pure culture fermentation of cucumbers (U.S. Pat. No. 3,403,032) and olives (U.S. Pat. No. 3,480,448). More recently, a procedure was described for the controlled fermentation of commercially brined pickling cucumbers, which included the use of starter cultures of lactic acid bacteria, and the removal of carbon dioxide from the fermenting brine by purging of the brine with nitrogen gas so as to prevent gaseous spoilage of the cucumbers (Etchells et al., 1973; U.S. Pat. No. 3,932,674). Air purging has also been shown to be effective in removal of carbon dioxide (Fleming et al., 1975; Costilow et al., 1977). In all of the aforementioned procedures, however, the vegetables remain visually uncured in the internal flesh, and are highly buoyant in the brine solution for several weeks or longer. Uncured appearance and buoyancy are attributed to the presence of undissolved gases which remain within the flesh until sufficient time passes for the gases to diffuse from the tissue and be replaced with liquid from the flesh or from the surrounding brine.

One problem associated with the above procedures is that the brines must be purged (if the product is fermented) with a lowly soluble gas such as nitrogen or air to remove the carbon dioxide from the brine so as to prevent bloater damage (hollowness inside the vegetable). The purging rate must be sufficient to control the dissolved carbon dioxide below the critical concentration for bloater formation. A second problem is the slow development of a cured appearance in the flesh which is one cause for delay in removal of vegetables from the brine solution so that they may be further processed. If the vegetables are removed before the acquisition of the desired appearance, the cucumbers may require mild heating to drive gasses from the tissue and thereby gain the desired cured appearance. A third problem associated with the above procedures is the great buoyancy that the cucumbers retain for extended periods of time while in the brine. This increased buoyancy causes the cucumbers to be physically damaged, especially those near the top of the cucumber-brine mass. Heading timbers of sufficient strength are required to keep the vegetables submerged in the brine. The depth at which vegetables may be brined without severe physical damage is

limited by the buoyancy of the vegetables during brine storage.

Vacuum impregnation has been used for many years in the firming and processing of apple slices. The procedure involves placing freshly prepared apple slices under a vacuum of 14-29 inches of mercury, followed by addition of steam or an aqueous solution containing various chemicals to be impregnated into the tissue (Hoover and Miller, 1975). The vacuum created within the intercellular spaces of the tissues causes the solution to be drawn into the flesh. The procedure presents difficulties when whole fruits, such as cucumbers, are evacuated in this manner. It is difficult to achieve a proper vacuum without causing physical disruption of the internal structures, particularly the carpel sutures, of whole pickling cucumbers. Also, infusion of liquid into the tissue by vacuum is diminished with whole fruit or thick slices, making it desirable to slice the fruit before the vacuum treatment.

SUMMARY OF THE INVENTION

In the present invention, pickling cucumbers, peppers, and certain other produce are exposed to pure oxygen or carbon dioxide in a container for sufficient time for the added oxygen or carbon dioxide to displace undissolved gases within the flesh of the produce. Then, without allowing the produce to be exposed to air, an aqueous solution is added to the container until the produce is entirely submerged in the solution. The produce is held in the solution until the desired physical changes occur or it is removed for further processing.

The main object of the invention is to provide a method for attaining a greater resistance to carbon dioxide during brine storage if the produce is fermented, a rapid visual cure, and a rapid increase in the density of the produce.

Produce treated by pre-brining exposure to oxygen or carbon dioxide can be used more quickly when visual cure is a prerequisite for removal from brine storage, and the produce may be stored with less physical damage because they are less buoyant and are more resistant to bloater damage by carbon dioxide.

DESCRIPTION OF THE DRAWINGS

FIG. 1 represents a jar-reservoir assembly used to expose cucumbers to gases prior to brining and to subsequently brine the cucumbers.

FIG. 2 represents a graph of internal gas composition of fresh cucumbers exposed to O₂ in 1-gallon jars.

FIG. 3 represents graphs of brine uptake by O₂ exchanged and untreated cucumbers of four sizes. The O₂ exchanged cucumbers had been exposed to O₂ at 50 ml./min./gal. cucumbers for 1 hour before brining.

FIG. 4 represents a graph of the effect of O₂ exchange in cucumbers upon density of the brined cucumbers. Densities (d) were determined after the cucumbers had been in brine for 24 hours at 25° C.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Cucumbers, peppers, and certain other fruits and vegetables are placed in a suitably sized, non-porous container. The container is capped in some manner to allow containment of introduced oxygen or carbon dioxide gas and a minimum possibility for re-entrance of air. Oxygen or carbon dioxide is introduced into the container until the internal gases of the produce have

