

## OAC 3717-1 Reduced Oxygen Packaging



### (76) Reduced Oxygen Packaging:

- (a) Means the reduction of the amount of oxygen in a package by removing oxygen; displacing oxygen and replacing it with another gas or combination of gases; or otherwise controlling the oxygen content to a level below that normally found in the surrounding atmosphere, which is 21% oxygen, and
- (b) Is a process specified in paragraph (B)(76)(a) of this rule that involves a food for which *Clostridium botulinum* is identified as a microbiological hazard in the final packaged form.
- (c) Includes:
  - (i) **Vacuum packaging**, in which air is removed from a package of food and the package is hermetically sealed so that a vacuum remains inside the package, such as a sous vide;
  - (ii) **Modified atmosphere packaging**, in which the atmosphere of a package of food is modified so that its composition is different from air but the atmosphere may change over time due to the permeability of the packaging material or the respiration of the food. Modified atmosphere packaging includes: reduction in the proportion of oxygen, total replacement of oxygen, or an increase in the proportion of other gases such as carbon dioxide or nitrogen; and

- (iii) **Controlled atmosphere packaging**, in which the atmosphere of a package of food is modified so that until the package is opened, its composition is different from air, and continuous control of that atmosphere is maintained, such as by using oxygen, nonrespiring food, and impermeable packaging material.

### **Types of ROP**

Most ROP foods can be produced by one of the following procedures.

**Vacuum Packaging:** reducing the amount of air from a package by pulling a vacuum and hermetically sealing it. Also includes vacuum skin packaging. Normally done by VP machines. Examples: vacuum packaged dry foods.

**Controlled Atmosphere Packaging:** active system that continuously maintains the desired low oxygen atmosphere within the package. In this case, agents that bind oxygen or compounds that emit a gas are incorporated in the package. Example: controlled atmosphere (CA) storage of apples.

**Modified Atmosphere Packaging:** gas (with little or no oxygen) flushing and sealing or reduction of oxygen through respiration of produce or through microbial action. Represents a one-time modification of the gaseous composition inside the package. Example: refrigerated fresh cut produce in bags.

**Sous Vide:** vacuum packaging of raw or partially cooked foods, followed by pasteurization (low temperature cooking) to reduce the microbial load and rapid refrigeration/freezing. Reheating to a safe temperature before consumption is required. Not very common in the USA.

**Cook-chill:** process that uses a plastic bag filled with hot cooked food from which air has been expelled and which is closed with a plastic or metal crimp (similar to hot-filled). Example: refrigerated bagged soups for the food service industry.

### **Safety Concerns**

The extended shelf-life offers the opportunity for pathogens to grow slowly. Refrigeration is often used with ROP as a way to control microbial growth but the required temperatures (below 41°F) are difficult to maintain during distribution, at retail stores and homes. Pathogens such as *Listeria monocytogenes*, *Bacillus cereus*, *Salmonella* spp., *Staphylococcus aureus*, *Vibrio parahaemolyticus*, *Campylobacter* spp, and *Brucella* spp., can survive for long periods of time and even grow slowly if the food product is under marginal refrigeration or mild temperature abuse. Indeed, the anaerobic conditions under ROP favor the growth of *Clostridium botulinum* and if spoilage organisms are not growing to indicate the end of the shelf-life, the food could appear acceptable even though pathogens are present. Pasteurization of ROP foods will not destroy spores of *C. botulinum* and may actually select for it. Examples of foods that cannot be ROP because of their high inherent risk of *C. botulinum* include raw mushrooms, **raw fish\* and seafood products.**

### **Safety Guidelines for ROP**

Use ROP for foods that do not support the growth of *C. botulinum*, that is:

- Foods with a water activity below 0.91 – like dried spices and dried nuts.
- Foods with a pH of 4.6 or less – like pickles, sauerkraut, most fruit products.
- USDA inspected and cured meat which has salt (brine concentration of 3.5% or more), and nitrates and nitrites (120 ppm of sodium nitrite) – such as ham and bacon.
- Frozen foods with the labeling statement “Important-Keep Frozen Until Use”.
- Control Atmosphere Packaging that maintains enough oxygen to control the growth of *C. botulinum*.

In addition, the following precautions should be implemented:

- Refrigerated ROP should have a maximum of 14 days shelf-life clearly marked in the label.
- Refrigeration temperatures of 41°F or below should be kept and indicated in the label - “Important: Must be kept refrigerated at 41°F (5°C) or below.”

Sources: University of Vermont and Cornell University Northeast Center for Food Entrepreneurship newsletter *Venture* Volume 3, No. 3, Fall 2001

\*For more information about vacuum packaging fish and requirements fisheries please see:

<http://vm.cfsan.fda.gov/~dms/qa2haccp.html>

P: Food/Education/Fact Sheets