



Food Safety

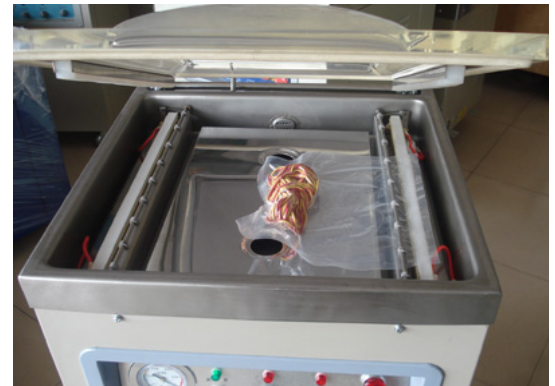
Reduced Oxygen Packaging- including Vacuum packaging

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Many food processors are interested in using vacuum packaging and other types of Reduced Oxygen Packaging (ROP). However, it is also important to know the food safety concerns and regulations associated with this packaging option.

Benefits of ROP

- Removal of oxygen prevents growth of aerobic spoilage organisms responsible for off-odors and texture changes.
- Reduces oxidation of foods, retards rancidity and color deterioration.
- Increases quality and shelf-life of refrigerated foods, which increases marketing appeal.



Types of Reduced Oxygen Packaging include:

- a) *Vacuum packaging*: air is removed from a package of food and the package is hermetically sealed, so that a vacuum remains inside the package, such as sous vide.
- b) *Modified atmosphere packaging*: the atmosphere of the package is modified so that its composition is different from outside air (21% oxygen), but the atmosphere may change over time due to permeability of the packaging material or respiration of the food. Note that this method is generally considered safer than vacuum packaging as it generally maintains enough oxygen to control the growth of *Clostridium botulinum*.
- c) *Controlled atmosphere packaging*: the atmosphere of a food package is modified so that while the package is sealed, its composition is different from air, and continuous control of that atmosphere is maintained, such as by using oxygen scavengers or a combination of total replacement of oxygen, non-respiring food, and impermeable packaging material.

What are the food safety concerns with vacuum packaging?

A dangerous bacterium called *Clostridium botulinum*, which is not detectable by sight or smell, can grow in the absence of oxygen such as in vacuum packaged or canned foods. It can form heat-tolerant spores which can produce a deadly toxin of which only a few nanograms can cause paralysis and death. Some types can grow slowly even under refrigerator temperatures, although it grows better at room temperature. Because it is present everywhere, any food can be contaminated with it.

Further, the extended shelf life possible with vacuum packaged products allows pathogens present to grow slowly over a longer periods of time, even at refrigeration temperatures. This can be particularly problematic because it is difficult to ensure that foods will always stay below safe refrigeration temperatures ($\leq 41^{\circ}\text{F}$) in transit, in stores, and in consumer homes. Because spoilage bacteria cannot grow under the anaerobic conditions, the product may appear to be safe (no

off odors or appearance), even when it may not be safe any longer. *C. bot* also grows better when it does not need to compete with spoilage organism growth.

List of acceptable barriers to ensure ROP product safety:

In all ROP foods, at least two (2) barriers must be in place to control *C. bot* growth and toxin formation. These barriers include the following:

- Refrigeration carefully maintained at $\leq 41^{\circ}\text{F}$ with clearly labeled “use by” date (of less than 14 days after production). The product must also be labeled with: “Important- must be kept refrigerated at $\leq 41^{\circ}\text{F}$.”
- pH below 4.6 (example foods: most fruit products¹)
- Water activity² below 0.91 (example foods: fermented sausage, dry cheese)
- Use of oxygen permeable film
- Presence of high levels of non-pathogenic competing microorganisms (i.e. raw meat, fermented cheeses containing live cultures)
- Freezing. Note that frozen foods must be clearly labeled with the statement: “Important- Keep Frozen Until Use”
- Inspected, properly cured meat or poultry product³

**Note that other than fish that is frozen before, during and after packaging, fish may NOT be packaged using ROP by restaurants, caterers, delis in retail stores, and other operations under the Vermont Department of Health Food Service regulations⁴.

In addition to utilizing at least two of these barriers, operations must ensure that employees are properly trained on ROP.

VT Department of Health Requirements for safe vacuum packaging for Food Service Operations⁵:

In addition to utilizing at least two (2) of the barriers listed above, all ROP foods that are produced under the Food Service regulations⁴ of the Vermont Department of Health (restaurants, caterers, delis in retail stores, etc.), a HACCP plan must be in place which specifies the following:

- Identification of the food to be packaged
- Specifies the method for maintaining the food at 41°F or below
- Describes how the packages will be prominently labeled with instructions to:
 - o Maintain food at 41°F or below
 - o Discard the food within 14 calendar days if not already consumed.
- That the shelf life will be limited to no more than 14 calendar days from packaging to consumption.
- Includes operational procedures that a) prohibit bare hand contact with the food, b) specify methods of separation of raw foods and ready-to-eat foods, and c) cleaning and sanitizing procedures for food contact surfaces.
- Procedures to restrict access to ROP equipment to responsible trained personnel.
- Describes the training program to ensure that the person responsible for ROP understands all the necessary safety precautions.

¹ List of pH of many foods: www.foodscience.caes.uga.edu/extension/documents/fdaapproximatephoffoodslacp-phs.pdf

² More information on water activity: www.apps.fst.vt.edu/extension/valueadded/wateractivity.html. More information on some labs that will test water activity (and product pH): www.uvm.edu/extension/food/pdfs/vt_lab_testing_options_nov%202012.pdf

³ The product must contain salt (brine concentration > 3.5%) AND nitrates or nitrites (120 ppm of sodium nitrite). The cured product must be produced following these regulations: 9 CFR 318.7 and 9 CFR 381.147

⁴ Regulations available from: www.healthvermont.gov/regs/03food_estab.pdf

⁵ Note that these regulations are for the vacuum packaging itself. Regulations for any other production and processing activities are separate and are available in: www.uvm.edu/extension/food/pdfs/foodprocessingregs_nov2012.pdf

Vacuum packaging in food processing facilities

Activities in food processing facilities licensed by the Vermont Department of Health must follow Good Manufacturing Practices⁶ for safe processing and address potential risks to food safety accordingly. Seafood processors must follow the FDA Seafood HACCP regulations:

www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/Seafood/ucm120134.htm

Vacuum packaging of meat and cheese in food processing facilities

The Vermont Agency of Agriculture regulates the processing/production of meats and cheeses in Vermont. If meat processors are vacuum packaging their product, they must include vacuum packaging as one of the steps of that product's HACCP plan and address the potential risks accordingly. Cheese processors must also consider the hazards of vacuum packaging when developing and implementing their food safety measures. However, no specific regulations apply specifically to vacuum packaging of meat or cheese by meat or cheese processors.

Other useful resources:

- FDA Food Code 2009, Annex 6:
www.fda.gov/Food/GuidanceRegulation/RetailFoodProtection/FoodCode/ucm188201.htm
- VT Dept of Health Food Service Regulations, including Reduced Oxygen Packaging requirements:
www.healthvermont.gov/regs/03food_estab.pdf (especially p 12, 26-27)
- Cornell Small Scale Food Entrepreneurship Guide: <http://necfe.foodscience.cornell.edu/publications/initial-guide.php>

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⁶ More information on GMPs available in: http://www.uvm.edu/extension/food/pdfs/GMP%20fact%20sheet_Aug%202012_final.pdf