Take Advantage of Nature's Bounty: Consider Vacuum Seal

Schools that have access to local, fresh produce and who wish to take advantage of low prices during abundant supply and peak nutrition may want to consider vacuum sealing in-house processed and frozen fruits and vegetables. Vacuum sealing provides optimal preservation of these foods and allows their use in future child nutrition program meals.

Processing fruits and vegetables through freezing in the school allows for control of salt, sugar, and fat, and the opportunity to customize spices being used to season the foods. The quality of the product is in your control. However, as with any food preparation, safe practices should be followed. This fact sheet identifies what school nutrition operators should consider when using a vacuum seal packaging system to ensure safe and quality products. Alternate packaging systems can be used, but product characteristics, quality, and other issues should be considered when making the decision.

An alternative option is to outsource processing. Some produce companies offer the custom service of cleaning, shelling, chopping, and freezing produce for districts, per your specifications. It would be worthwhile to compare the costs of processing your own produce versus having a produce company do it for you. For more information, see *Food Safety Practices to Expect from Your Fresh-Cut Produce Processor*, available at: www.fns.usda.gov/ofs/produce-safety-fact-sheets.

GETTING STARTED

It is wise to discuss in-house processing with your local health inspector as part of the decision making process. While the inspector's primary role is to ensure compliance with all local and state ordinances, he/she is also an excellent source of good information on safe handling practices. Because different versions of the Food Code may guide regulatory authorities, it is best to discuss food safety requirements directly with the health inspector for your district.

Determining which items to process and the form of the final product may influence your decisions on sourcing, or methods used to process in-house. When considering vacuum sealing, it is important to recognize that hazards must be controlled, even if the characteristics of the food do not present conditions for bacterial growth. Vacuum sealing reduces the oxygen levels in the package.

Reduced Oxygen Packaging (ROP) is defined by the Food and Drug Administration (FDA) as the reduction of the amount of oxygen in a package by 1) removing oxygen, 2) displacing oxygen and replacing it with another gas or combination of gasses, or 3) controlling oxygen content to a level below that normally found in the surrounding atmosphere (which is about 21%).

Vacuum packaging removes air from the package of food and then is hermetically sealed so it falls within this definition. Food safety concerns of ROP include *Clostridium botulinum*, which are spore forming bacteria (heat resistant), can grow under anaerobic (without oxygen) conditions, and produce toxins (also heat resistant), as well as the bacteria *Listeria monocytogenes* which can survive for months in a cool, moist environment. These bacterial cells, are heat resistant, and also grow slowly under refrigerated conditions.

With the exception of leafy greens, sliced melons, sliced tomatoes, and sprouts, the FDA does not categorize raw fruits and vegetables as Time and Temperature Controlled for Safety (TCS) foods. However, the process of cooking changes the water activity and pH of the produce, rendering the fruit or vegetable a TCS food. Blanching may or may not alter the fruit or vegetable as in cooking; therefore the determination of whether the item should be blanched will be on a case by case basis. Again, before implementing a ROP system – including

vacuum packaging – look to your health inspector to guide you through this process, which may require a variance, and possibly submission of a specialized HACCP plan to control for *Clostridium botulinum* and *Listeria monocytogenes*.

Follow your district's protocols for processing fruits and vegetables, and recognize that these may vary by food item depending on product characteristics. Most vegetables should be blanched prior to freezing to ensure quality. Some fruits are blanched to loosen the skin for removal. Blanching is a process of placing the food item into boiling water or steam for a short period of time (typically between one and five minutes) followed by submersion in an ice water bath. The process slows or stops the action of enzymes which cause loss of flavor, color and texture, and also brightens the color. Some items that are processed may involve the addition some type of acid, such as lemon juice, to prevent browning. Because additional ingredients may affect the pH and/or water activity level of the product, processing methods may need to be reviewed by a Process Authority.

For more information, refer to the FDA 2013 Food Code, available at: http://www.fda.gov/downloads/Food/GuidanceRegulation/RetailFoodProtection/FoodCode/UCM374510.pdf or the FDA Guidance regarding ROP foods at http://www.fda.gov/Food/GuidanceRegulation/RetailFoodProtection/FoodCode/ucm188201.htm or the currently applicable food code for your state.

CHECKLIST OF PLANNING CONSIDERATIONS FOR VACUUM SEALING

- ☑ **What products are to be preserved and what type of preservation method will be utilized?** Remember, the preserved fruits and vegetables can only be used in the child nutrition program, if the items are used in another venue, such as a catered event, a food processing license is needed.
- ☑ Discuss with the local health inspector proposed preservation techniques and products.
- ☑ **Is adequate product cleaning and preparation space available?** Produce must be cleaned thoroughly before processing with excess moisture completely drained.
- ☑ **Is adequate processing and freezer space available?** For Individual Quick Freezing (IQF) of fruit and vegetable pieces, an adequate number of sheet trays and carts will be needed.
- ☑ **Is adequate storage space available?** Vacuum packed bags should be stored flat in freezer or refrigerator. Vacuum sealed fruits and vegetables should not be stored at room temperature as they are not shelf stable.
- ☑ **Are safe storage temperatures in place and monitored?** Safe frozen temperatures are defined by USDA as zero to minus 10° F. Shelf life for frozen product is unspecified by the FDA Food Code; it states that the product must remain frozen. The TCS ROP refrigerated product storage requirements were updated in the 2013 FDA Food Code.

  All TCS hot foods to be vacuum packed must be cooled to 41° F within two hours or less. For holding, the product may be cooled to 34° F within 48 hours of initial cooling and stored at that temperature for 30 days after the date of packaging or held at 41° F for no more than 7 days.
- ☑ **Are there HACCP and traceability protocols for processing and transporting frozen or chilled product to local schools, where applicable**?
- ☑ Check power needs of machine and pneumatic requirements. Some building utilities may not support required power and air for a commercial unit.

☑ **Is there a sufficient budget?**
A commercial grade, new vacuum sealer could cost up to $7500. Include purchase of bags and additional labor in your budget. (For example, a quart size bag may cost 25 cents.) If the packaging will occur infrequently, consider purchasing a used or reconditioned sealer to lower investment costs.

- Processing labor costs should be calculated and included in the budget. See *Guide to Preserving Locally Harvested Produce for School Meals* at www.fns.usda.gov/ofs/produce-safety-fact-sheets. Because processing fruits and vegetables occurs during harvest time, often in the summer, additional staff may be needed. The cost of additional labor will need to be considered when figuring the total cost of in-house preservation of fruits and vegetables.
- The food cost per serving of the raw, agricultural product should be calculated. Consider comparing the combined food and labor per serving cost of in-house processing to the equivalent item from your vendor(s).

☑ **What size and type of bags are needed?**
An 8" x 12" bag will hold about 1 quart of product; a 12" x 12-14" bag about 1 gallon; and a 14" x 16-20" bag about 1 ½ gallons. There should be some head room, meaning empty bag space above the product to allow for a complete seal. Make sure the machine you purchase will accommodate the bag size you want to use. Typically, packaging materials are available from the local distributor of the packaging equipment. Be sure the bag material is appropriate for the intended use; this will ensure quality of product during storage. Avoid using vacuum seal units with unapproved bags, such as zip lock style.

☑ **Is the bag safe for cooking?**
For frozen or refrigerated product, bags that can be heated in boiling water, microwave, or steamers increase convenience of use. Note that although chamber vacuum sealers are sometimes used to seal traditionally canned foods in mason jars, home-canned foods are not allowable in the school meals program.

☑ **Has label information been determined?**
Identify the use by date (for quality and safety) and include date product was packed on the label of each product along with product name. Consider a simple lot coding system whereby the processing date is recorded on the bag, and the location/farm where the produce was obtained is stored in a file for traceability and recall.

ADVANTAGES OF VACUUM SEALING

- Produce that is vacuum sealed is much less likely to become freezer burned, which is damage caused by dehydration and oxidation when air reaches the food, as the amount of oxygen present is reduced. Therefore, shelf life of processed foods is increased and quality improved.
- This technique allows for a quality product throughout the school year.
- Produce may be preserved with vacuum sealing and then refrigerated or frozen in amounts that work best for your school system with considerations of staff availability and space for processing and storing.
- Bags of cooked product may be reheated in hot water or steam while remaining in the vacuum bag, if specialized bags are used.
- Bags of fruits can be thawed in the refrigerator.

EQUIPMENT

There are two types of vacuum sealers: External and Chamber. Both types are available for home use or foodservice use; but because equipment used in foodservice establishments must meet certain standards, it is advised the local health inspector review specifications for any intended equipment purchase before it is bought.

External

The storage bag is held outside of the vacuum sealer during air removal. The external design is less expensive and more portable. With this type of sealer, product is placed in a specially made bag, and then sealed. One advantage is that longer products, such as long slices of squash could be sealed. Product of this size will not fit into a chamber type unit. Disadvantages of the external design is the liquid from the bag may leak into the machine. The external machine will need an occasional break during processing in order to cool down, which will affect processing productivity.

Chamber

These types of vacuum sealers cost more and weigh more (around 80 to 100 pounds) so are not as portable (unless purchased on casters). For the chamber sealer, size of the unit matters. With some machines, you can seal one bag in 30 seconds. For larger machines, you can place 2-4 bags in the machine at once, speeding up your efforts greatly. They generally seal better, last longer, and the bags used for preserving product cost less than those for the external sealer. The bags are also available in a variety of sizes (i.e. quart and gallon). Their strong vacuum pump enables sealing of several bags at the same time. Therefore, these types are recommended for institutional food production.

GENERAL GUIDANCE - USE OF A VACUUM SEALER

- Train your employees on safe food handling and correct use of the vacuum sealer machine. Refer to manufacturer's directions to develop steps your operation that can be posted by the work area.
- Carefully inspect foods to be processed. Discard any parts that are bruised, over-ripe, or diseased. Culled produce may be composted.
- Wash all fruits and vegetables thoroughly and allow for draining (Only dry fruits and vegetables should be vacuum packed to reduce formation of additional ice crystals in the bag, which can cause the product to be mushy).
- Trim, peel, and cut into desired size pieces for your intended use or for the recipe.
- Verify that the vacuum packaging equipment is clean and sanitary before using.
- Prepare items for vacuum sealing. Optimum quality of preservation may require cooking or blanching of the item, but for some fruits and vegetables these steps are not necessary. USDA Extension resources are available to guide further development of the processing steps. See *Guide to Preserving Locally Harvested Produce for School Meals* at www.fns.usda.gov/ofs/produce-safety-fact-sheets.
  - If you are preserving items that do not need to be pre-cooked or blanched, such as strawberries or blueberries, wash, drain well, and freeze on sheet pans covered in parchment or wax paper before sealing into bags. Alternatively, for non-IQF product, drain, dry and chill to 41°F before sealing. Note that the vacuum seal process tends to heat the food itself.
  - Vegetables, such as broccoli and cauliflower, should be blanched first. Check with your extension agent for a list of recommended procedures for various vegetables including blanching period(s) of time. After blanching, cold water cooling, and draining, place vegetable pieces in a single layer on sheet trays to freeze before vacuum sealing. Alternatively, blast chillers may be used to cool blanched food.

- If you are fully cooking a product before processing, cook at least to the recommended minimum, safe internal temperature. Chill rapidly to 70° F, within two hours, using an ice bath, blast chiller/freezer, or cooling bat, if a cook-chill system is not used in your operation. Attempts to vacuum seal at temperatures higher than 70° F will likely be unsuccessful due to the inability of the chamber to operate and seal properly because of steam and bubbles escaping from the hot product.
- The fully cooked, packaged product should be chilled to 41° F within a total of six hours.
- Place prepared food into bags. Make sure enough head room is left at the top of the bag to effectively seal the product without overflow. Keep the top edge of the bag completely clean so that it seals properly. One tip is to fold the top of the bag back when putting the food in. Many food service suppliers sell racks or stands to hold the bags while they are being filled. This tool may make it easier to fill the bags.

- Place the filled bag(s) into the chamber with edges of bags hanging over the upper edge in order to obtain a good seal. The open end of the bags should go over the sealing bar. Make sure no other part of the bag is hanging out of the chamber. If part of the bag is hanging out, the vacuum process will not work and the bag could possibly burst or leak.
- Be sure no part of the food item is on the inside of the bag where the seal will be formed. If food is present in this area, clean this portion of the bag to remove. If food is present, it may result in a poor seal which will result in a lower quality product or leakage of the food.
- Follow the guidelines from your particular machine for processing. There are often tables included with the machine which recommend length of time for sealing depending on size of bag and type of food. The two main parameters are strength of the vacuum (usually measured in mm of Hg mercury) and heat of the sealing bar. The greater the vacuum (higher mm of Hg), the less oxygen remains in the package. But higher vacuums also mean longer processing times. The heat of the sealing bar will vary, and must be determined by trial and error for each product. Too little heat will result in a weak seal that may give way under the stress of placing the bags in the freezer. Too much heat will cut the plastic bag completely, which may result in an incomplete or leaking seal.
- Air and excess moisture is removed from the bag via the vacuum process. The amount of pressure reduced (in millibars) determines how much the bag will tighten around the food.
- To complete the process, the bag must be heat sealed, or air will rush back into the bag once the vacuum process is complete. The amount of sealing time is usually just a few seconds but will depend on thickness of the bags. Follow vacuum sealer manufacturer recommendations.
- Label the bags with the name of the food, the date processed, and the use by date for quality and safety. Your health inspector may also require the label to include storage instructions (keep frozen) and specify storage period(s) of 7 days (if refrigerated at 41° F) or 30 days (if refrigerated at 34° F). This information, combined with purchasing and production records should allow for trace back to the farm should there be the need.
- If preserved product is distributed to other units within the nutrition program, consider a simple method of traceability. For example, label with name of product, date processed and the name of the farm/supplier. Record the ship date and receiving school on internal invoice or other document.
- Refrigerate or freeze the sealed bags on sheet pans or shelving away from anything that could puncture the bags.
- Follow the manufacturer's suggestions for cleaning the vacuum port (for external machines) and the chamber (for chamber machines) when you have completed processing for the food item, or for the day.

SAMPLE RECIPES

Corn on the Cob

Husk the corn, remove silk, trim ends, and rinse under running water. Blanch in boiling water or steamer: small ears (6 inches or less) - 8 minutes; medium ears (6 to 8 inches) - 10 minutes; large ears (greater than 8 inches) - 12 minutes. Blanching times may vary. Shock by submersion in ice cold water. Drain well and freeze immediately on sheet pans for IQF. Once corn is frozen, place into vacuum seal bags that can be reheated. Vacuum seal according to manufacturer's recommendations. Label properly for quality and safety. When ready to use, place bag in boiling water or steamer to reheat to safe serving temperature – at least 135˚F.

Marinara Sauce (50 ½ cup servings)

20 each	Carrots, large, chopped (about 5 pounds)
13 each	Onions, large, chopped (about 7 pounds)
¾ cup	Garlic, cloves, minced (may use ¼ cup granulated garlic)
24 ounces	Olive oil blend
120 each	Tomatoes, medium, peeled and medium diced (about 40 pounds)*
1 ½ cup	Basil, fresh, chopped (may use ¾ c dried basil flakes)
1 cup	Oregano, fresh, chopped (may use ½ c dried oregano flakes)
1 ½ Tbsp	Salt
1 ½ tsp	Pepper

*To remove the skin, drop tomatoes into boiling water for 1 ½ to 2 minutes. Remove and peel away skins.

Directions

1. In a braising/tilting skillet, or large kettle, sauté the carrots, onions, and garlic in olive oil blend until tender. Add tomatoes and seasoning; bring to a boil. Reduce heat and simmer uncovered for 2 hours or until thickened. Stir often.
2. Cool rapidly to room temperature using an ice bath, blast chiller, or cooling bat. Current FDA Food Code requires foods are cooled to 70º F within two hours, and cooled to 41º F within a total of six hours.
3. Once product reaches 70º F, carefully pour into vacuum sealer bags. Leave plenty of space at the top of the bag.
4. Set vacuum according to machine directions and then seal according to manufacturer's recommendations.
5. Label for quality and safety, and place in refrigerator or blast chiller to lower product temperature to 41º F within 4 hours. Once 41º F is reached, place product in freezer for storing.
6. To serve, thaw overnight in refrigerator. To reheat, place desired number of bags in boiling water, microwave, or steamer. Heat bags to 165˚F or above.

Nutrients Per Serving					
Calories	193	Saturated Fat	1.93 g	Iron	1.07 mg
Protein	3.49 g	Cholesterol	0 mg	Calcium	55 mg
Carbohydrate	18.75 g	Vitamin A	7368 IU	Sodium	230 mg
Total Fat	13.42 g	Vitamin C	46 mg	Dietary Fiber	5 g

*Nutrients are based upon 1 Portion Size (1/2 cup) of marinara sauce