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Food Preservation

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NAME: _____

Biology 401: Applied Plant Science



HISTORY OF FOOD CANNING



Emperor Napoleon Bonaparte stated that “an army marches on its stomach.” In 1795 Napoleon needed a way to feed his army as it marched across Europe. He offered a 12,000 franc cash prize to whoever could develop a reliable method for preserving food. At that time the methods for preserving food included salting (for meats) and drying (for meats and vegetables). Nicholas Appert conceived the idea of preserving food in modified wine bottles. It took Appert 15 years to perfect his food preservation technique. Appert experimented with various packaging methods, and found that food would not spoil if it was sealed in an airtight container and boiled in water for several hours. He was unaware at the time that he was destroying the bacteria and yeast that could spoil the food. When Appert perfected his food preservation procedure he sent 18 bottles of partridges, vegetables, and gravy to Napoleon’s army. Appert reportedly said “every one of which had retained its freshness, and not a single substance had undergone the least change at Sea.” (From M. Appert, Nicolas Appert. 1812. *The Art of Preserving All Kinds of Animal and Vegetable Substances for Several Years*. D. Longworth Publisher). After receiving the award money, Appert built a bottling factory for preserving food that subsequently burned down in 1814 during the Napoleonic Wars. In 1811, Appert published a book entitled “*L’Art De Conserver, pendant plusieurs années, Toutes les Substances Animales et Vegetales*” (The Art of Preserving All Kinds of Animal and Vegetable Substances For Several years) in which he revealed his preservation methods. Even though his book sold well and his invention was successful, he never could explain why it worked.

The Englishman Peter Durand continued the process by using tin containers for sealing the food. The process of tinning was perfected by Bryan Dorkin and John Hall in 1813 who started the first commercial canning factory in England. In the United States, Thomas Kensett established the first canning facility in New York in 1812 for oysters, meats, fruits and vegetables. It was not until 1848 when Louis Pasteur described the reason for microbial growth spoiling food that effectiveness of canning was understood.

Contemporary Canning

The principle behind canning has not changed dramatically over time. Heat is used to destroy microbes in foods that are packed into airtight containers. Canned foods are heated between 240-250 °F under pressure to kill the microorganisms. The duration of the heat and pressure treatment varies depending on the acidity, osmotic content, and density of the food. For example, high acid foods like tomatoes require far less time for processing than low acid foods like green beans. High osmotic content foods like jams and jellies also require less time for processing.



Emperor Napoleon in His Study at the Tuileries, by Jacques-Louis David, 1812 [File:Jacques-Louis David - The Emperor Napoleon in His Study at the Tuileries - Google Art Project.jpg]



http://i238.photobucket.com/albums/ff144/vento/use/06b_bouteille.jpg



Appert and canning equipment, designed and engraved by Henry Cheffer (1880-1957), and issued by France on March 5, 1955, Scott No. 759, Y&T No. 1014.

The minimum processing conditions are chosen to ensure that foods are sterile yet retain flavor and nutrition. Most processed foods are monitored using a system called Hazard Analysis and Critical Control Point, or HACCP. The HACCP system identifies areas of potential contamination within the food processing and institutes check points to ensure that safety standards are maintained at all times. All processes are approved by the U.S. Food and Drug Administration. After canning food can maintain high eating quality for more than two years and is safe to eat as long as the container is not damaged. No preservatives are added or necessary especially in the home canning process. Many canning facilities are located within a few miles of the point of harvest for convenience and to ensure that foods are packed at their peak of freshness. Since canned food is packed at the peak of harvest, nutrient levels are usually high as well.

Canning Jars

Until 1858 canning jars were glass with flat tin lids that were sealed with wax. In 1858 John L. Mason, an inventor and tin smith from New York City, created the Mason jar. Mason invented a machine that cut threads into lids, which made it practical to manufacture a jar with a reusable, screw-on lid. The sealing mechanism involved a glass container with a thread molded into its top and a zinc lid with a rubber ring that created the seal. The affordability and ease of use of Mason jars helped home canning spread across the nation, not only among farmers, homesteaders and settlers, but also urban families, who began family traditions of canning sauces, pickles, relishes, fruit and tomatoes. Unfortunately, Mason sold his rights to the jar to several different people and died a relatively poor man around 1900.

Clamped Glass-Lid Jars (Lightning Jars): In 1882, Henry William Putnam of Bennington, Vermont, invented a fruit jar with a glass lid secured by a metal clamp. These "Lightning jars" became popular because metal which could rust, breaking the seal or contaminating the food did not contact the food. The metal clamps made the lids easier to seal and remove (hence the name "Lightning"). These type jars were produced for home canning into the 1960s.

Atlas Jars: The Atlas E-Z Seal was a form of Lightning jar that had a raised lip to help keep the jar from cracking. Cracking was a common problem with shoulder seal jars. This "Strong Shoulder" jar was similar in strength to the Mason jar. The Hazel-Atlas Glass Company was in business from the late 1800s until 1964.

Ball Jars: William Charles Ball and his brothers (Lucius, Lorenzo, Frank C., Edmund Burke, and George Alexander) of Buffalo, NY, manufactured wood-jacketed tin cans for storage of oil, lard and paints. In 1883, the Ball's changed from tin to glass containers and in 1886, to glass fruit jars. After a fire at their Buffalo factory they moved operations to Muncie, Indiana was chosen because the city was offered free natural gas and land to rebuild the factory. The Balls quickly became the leaders in the industry as they acquired smaller companies and mass produced and distributed jars across the country.

Kerr Jars: Alexander H. Kerr founded the Hermetic Fruit Jar Company in 1903. Among their first commercial products were the Economy and Self Sealing jars. Economy jars were among the first wide-mouth jars that were easy to fill. These jars incorporated aspects from two 1903 patents held by another inventor, Julius Landsberger. The metal lid and permanently attached gasket made the lids easy to use and inexpensive. In 1915, Mr. Kerr invented a smaller, flat metal disk with a permanent composition gasket. The lid sealed on the top of a mason jar; a threaded metal ring held the lid down during the hot water processing. This allowed re-use of old canning jars together with inexpensive and easy to use disposable lids. This two-part lid system transformed home canning safety and is still in use today.

History of Preserving Foods

- 1795 - Napoleon offers 12,000 francs to anyone who can devise a way to preserve food for his army and navy.
- 1809 - Nicolas Appert of France devises a way to preserving food in bottles. Wins prize preserving food by sterilization.
- 1810 - Peter Durand of England gets a patent using pottery, glass and tinned iron to use in canning.
- 1812 - A small plant started by in New York cans oysters, meats, fruits and vegetables in hermetically sealed containers.
- 1818 - Peter Durand introduces his tinned can in America.
- 1819 - Thomas Kensett and Ezra begin to sell products in canned tinplate cans.
- 1825 - Thomas Kensett obtains an American patent for tinned cans.
- 1830 - Huntly and Palmer sell biscuits and cakes in decorated cans.
- 1849 - Henry Evans given a patent making cans by machine. Production increases from 5-6 cans per hour to 50-60 per hour.
- 1856 - Henry Bessemer discovers method of making steel from cast iron.
- 1856 - Gail Borden granted a patent on caned condensed milk.
- 1858 - Ezra Warner granted a patent on first can opener.
- 1858 - American John Mason invents a practical glass jar for home canning.
- 1866 - J Osterhoudt patents the tin can with a key opener.
- 1870 - William Lyman patents an opener with a rotating wheel that cuts the top rim of the can.
- 1875 - Libby develops a tapered can for canning corned beef.
- 1880-1890 - Automatic can making machines begins.
- 1892 - Tobacco cans first seen.
- 1909 - Tuna canning starts in California.
- 1921 - Canned citrus juice begins in Florida.
- 1926 - Canned ham, SPAM begins.
- 1931 - Electric can opener introduced.
- 1933 - Motor oil canned.
- 1940 - Carbonated soft drink canning.
- 1957 - First all aluminum beer can.
- 1962 - Beverage can pull-tab appears.
- 1973 - Six-paks introduced

Apple Butter Recipe

Apple butter is a great way to preserve the fruits of an apple harvest. There is no "butter" in apple butter as the name might imply. The name comes from its smooth buttery texture. Apple butter takes time to make, the sauce is slow cooked for at least an hour to reduce water content of the fruit. However, preparation of the apples for cooking is easy. The apples are washed, cored, peeled, and chopped. After the initial cooking period the apple pulp is blended and then cook for about another hour.

During the heating process, pectin from the middle lamella region of the apple cells will be released when the pulp is acidified with the lemon juice. Pectin is a structural heteropolysaccharide found in the primary cell walls of terrestrial plants where it helps hold the cells together. It was first isolated and described in 1825 by Henri Braconnot. It is produced commercially as a white to light brown powder, mainly extracted from citrus fruits, and is used in food as a gelling agent, particularly in jams and jellies. It is also used in fillings, medicines, sweets, as a stabilizer in fruit juices and milk drinks, and as a source of dietary fiber.

This recipe makes about 40 ounces of apple butter, which will fill 5 small 8-ounce jars, or a couple large sized jars.

Ingredients

- 4 lbs of good cooking apples (Granny Smith or Gravenstein)
- ½ gallon of apple cider
- Sugar (about 4 cups, see cooking instructions)
- Salt
- 2 teaspoons cinnamon
- 1/2 teaspoon ground cloves
- 1/2 teaspoon allspice
- Juice of 1 lemon

Equipment Needed

- 1 wide 8-quart pan (Stainless steel or copper with stainless steel lining)
- Blender
- A large (8 cup) measuring cup pourer
- 6-8 8-ounce canning jars

Method

Make the Apple Butter:

1. Peel and core about 4 pounds of apples. Cut the apples into small sized chunks and place into a big heavy pot.
2. Begin cooking the apples over medium/med-high heat and add enough apple cider to just cover the apples. Bring to a simmer. A bit of foam will form; you want to skim the foam off a couple of times (don't obsess). Cook the apples until they are tender throughout, roughly 20-30 minutes. Take the apples off the heat, let them cool for a couple minutes, and then puree in a blender, in small batches (do not fill the blender over half full with the hot liquid or you will burn yourself and make a mess). The puree should be the consistency of a thin applesauce.
3. Put the puree back in the big pot over medium heat. Bring puree to a simmer. You need it to hit 220°F (104 °C) on a candy thermometer. Then, while stirring, slowly sprinkle in the sugar, cinnamon, cloves, and lemon juice. Continue to simmer over medium/med-low heat. It takes quite a while from this point until the apple butter reduces and really thickens up, anywhere from 1 to 2 hours (try to keep it around 220 °F). Make sure you stir regularly; you do not want it to burn or cook to the bottom of the pot. You are looking for the apple butter to thicken up and darken. Towards the end it gets a bit messy, the simmer becoming more lava-like - it also sounds different, lots of plop and slop noises and lots of spattering coming from the pot. Remove from heat.

Canning

4. While waiting for the apple butter to evaporate and come to the correct consistency you can prepare your canning jars. There are several ways to sterilize your jars for canning. You can run them through a short cycle on your dishwasher. You can place them in a large pot (12 quart) of water on top of a steaming rack (so they don't touch the bottom of the pan), and bring the water to a boil for 20 minutes. Or you can rinse out the jars, dry them, and place them, without lids, in a 200°F oven for 20 minutes.
5. We will boil the jars for 20 minutes in a water bath on the stove. Before applying the lids and canning rings, sterilize the both by placing them in a sauce pan and boil in water for at least 20 minutes.

Fill the Jars

6. Using tongs carefully remove one sterilized jar from the hot water bath. Ladle the hot apple puree into the hot jar to within 1/4 inch of the top. Wipe off the jar rim with a clean dry paper towel before applying the lid. Place a sterilized lid on each jar, then add the canning ring, and close tightly. Using tongs load all jars into the boiling water bath. Process the jars Apple Butter in a hot water bath for 10 minutes to ensure a good seal.
7. Remove the jars from the hot water bath after 10 minutes and place them on a cutting board to cool. Check the canning rings to make sure they are still tight – but do not over tighten as it will bend the lid disallowing a good seal.

Makes a little more than five 8 oz. jars.

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Questions:

1. Why do people “can” foods?
2. How did food canning begin and why?
3. How did the ability to preserve food through canning change society?
4. What properties can be used to aid in food preservation?
5. What is Pectin, and why did it aid us in making Apple Butter?