

Periodic graphics

A collaboration between C&EN and
Andy Brunning, author of the popular
graphics blog **Compound Interest**

More
online

To see more of
Brunning's work, go to
compoundchem.com.
To see all of C&EN's
Periodic Graphics,
visit <http://cenm.ag/periodicgraphics>.

THE CHEMISTRY OF CANNING

To preserve fruits and vegetables, you must first sterilize them and then seal them in airtight containers. In this graphic, we take a look at some of the key parts of the process.

ACIDITY

Two types of foods are destined for canning. High-acid foods have a high enough acidity to block the growth of bacteria. Low-acid foods need to have acid added (often from lemon juice or vinegar), or they must be sterilized at a higher temperature (see right).

HIGH-ACID FOODS pH < 4.6

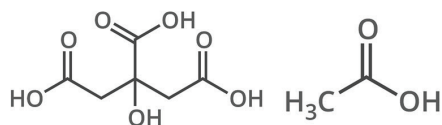


Fruits and foods with added acid (e.g., pickles)

LOW-ACID FOODS pH > 4.6



Red meat, poultry, seafood, and fresh vegetables
(tomatoes can have pH > 4.6 in some cases)



CITRIC ACID & ACETIC ACID

Both can be used to lower the pH of low-acid foods to ensure it is below pH 4.6

THE IMPORTANCE OF TEMPERATURE

WATER FREEZES

0°C

5-20°C

DANGER ZONE

rapid microorganism growth

5-60°C

PRESSURE CANNING

for low-acid foods*

100°C

116-121°C

IDEAL STORAGE TEMPERATURE
for canned foods

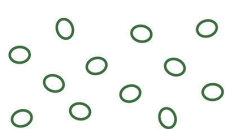
WATER BATH CANNING
for high-acid foods

* Pressure cooker at 10 psi (116°C) and 15 psi (121°C) needed to reach these temperatures

Heating foods to the correct temperature is important because it kills microbes that might otherwise grow under some storage conditions. In the case of low-acid foods, you must use a pressure cooker to reach the required temperature. The temperature at which jars are stored can also affect the quality of canned produce.

BOTULINUM SPORES AND CANNING

Botulinum spores reside on most fresh foods. Though they're usually harmless, under the right conditions, they can germinate into bacteria that make deadly botulinum toxin. Acidity and temperature are key to preventing toxin production in canned goods.



C. BOTULINUM SPORES

<2% OXYGEN
HIGH MOISTURE
pH > 4.6
5-60°C



C. BOTULINUM BACTERIA



© C&EN 2016 Created by Andy Brunning for Chemical & Engineering News