# Department of Food Science

*Food Safety*

FSE 99-21

## Formulating Dressings, Sauces, and Marinades

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Dressings, sauces, marinades and similar food products depend on their acidity to prevent spoilage. They may consist of naturally occurring acid foods such as fruit juices or tomatoes, or they may be formulated by combining acid foods with other foods to achieve the desired acidity. Some foods, such as vinegar and certain pickled vegetables, may have developed acidity from microbial fermentation.

Since foods without adequate acidity may allow the growth of those micro- organisms which cause foodborne illness, **government regulations** address the manufacture of these products. Title 21 of the **Code of Federal Regulations**, Part 114 (21CFR114) regulates acidified foods.

### CATEGORIES OF FOODS PRESERVED BY ACIDS

Naturally acid foods and fermented foods along with jams, jellies, preserves and certain dressings and sauces are **exempted** from the provisions of 21CFR114. Generally, if a food is formulated from predominantly acid foods it meets the exemptions. If, however the food contains a mixture of acid and low acid foods, it falls under the provisions of the regulation.

### ACIDITY AND pH

Food scientists measure the acidity of a food based on its **pH value**. The pH scale ranges from 0 to 14 with ph 7 being neutral. Any pH below pH 7 falls in the acidic range while those above pH 7 are considered to be in the basic range. The lower the pH reading, the more acid the food.

In order to preserve foods with acidity, the regulation requires the pH to be **4.6 or below**. At these levels, toxins formed by the deadly organism causing botulism are inhibited.

We refer to foods which have readings greater than pH 4.6 as **low-acid foods**. Remember, low-acid foods have high pH readings. Table 1 lists the pH of some representative foods.

**Table 1. Some pH Values of Common Foods**

| | |
|---|---|
| **Vinegar** | **2.5** |
| **Lemon Juice** | **2.6** |
| **Jelly** | **3.1** |
| **Ketchup** | **3.6** |
| **Mayonnaise** | **3.7** |
| **Canned Peaches** | **3.9** |
| **Canned Tomatoes** | **4.0** |
| **Canned Green Beans** | **5.0** |
| **Canned Hominy** | **6.8** |

### FORMULATION OF ACIDIFIED FOODS

Acid foods depend on one or more food acids such as citric, malic, or acetic acid to achieve stability. Most acidified foods including dressings and sauces use vinegar (acetic acid) to produce the desired acidity. Vinegar is a familiar and effective source of food acid.

When low-acid foods are used in formulations, it is important that they are properly acidified before they have a chance to spoil. They must reach **equilibrium pH** within an adequate time. The rate of up-take of acid by low acid foods can be influenced by factors such as piece size or the presence of a waxy peel. These factors can often be overcome simply by reducing the piece size of the low acid food. When oil is used in the formulation, the low acid components should reach an equilibrium pH below 4.6 prior to addition of the oil.

Most foods possess a chemical property called **buffering capacity**, which allows them to resist changes in pH. Greater amounts of acids must be added to the foods at certain pH levels to continue to achieve reductions in pH. Buffering can also be a

useful property to prevent changes of pH with minor variations in added acid.

**DETERMINATION OF pH**

The pH of a food is usually determined using a **pH meter**. Electrodes from the meter are inserted into solution to measure the pH electronically. A variety of pH meters are available from scientific equipment suppliers. Prices range from less than $100 to over $1,000 depending on the type and the features of the meter.

Estimation of pH can also be obtained **colorimetrically** using pH test papers. These papers, available from scientific supply houses, can be purchased for a few dollars. Regulations allow colorimetric monitoring for foods with pH levels below 4.0 In order to have a built-in safety factor, acid and acidified foods are normally formulated to pH well below 4.6. Most acidified foods have a pH below 4.0.

**MEASURING THE pH OF A FOOD**

In order to measure the pH of an acid food, the food should be liquid or prepared as a puree in a blender. Distilled water may be added in order to thoroughly mix the components. Be sure to test a sample representative of the whole. Any oil layer may need to be removed by decanting in order to get a measurement of the non-oil phase. In order to measure the equilibrium pH of a low acid food, separate the low acid food portion from the acidifying portion and prepare and measure the two samples individually.

**CONTROLLING SPOILAGE**

Properly acidifying to pH 4.6 or below will inhibit the growth and formation of toxins from the bacteria which cause botulism. Acidification cannot take the place of proper sanitation and care in manufacturing. The manufacturer must, therefore adhere to the highest standards of cleanliness and protection of product. These standards are covered under another regulation: 21CFR110, often referred to as Good Manufacturing Practices.

When manufactured under proper conditions of acidification and sanitation, a food product may still be spoiled by yeasts and molds. In order to prevent this, acid and acidified foods are usually heated to 180°F and packaged hot to kill yeast and mold spores on the products and in the container and cap. Cool the product prior to placing in cardboard cases in order to avoid "stack burn".

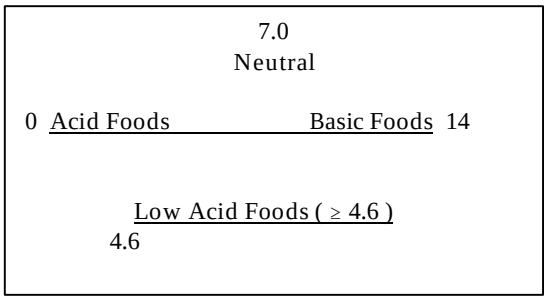
When measuring the pH of a prepared sample, be sure to follow the instructions of the pH meter manufacturer carefully. In any case follow these guidelines:

- Calibrate the pH meter using 2 buffers, usually pH 4 and pH 7.
- Make sure the temperature compensation is properly set.
- Rinse the electrodes with distilled water between readings. Pat dry with tissue.

**CAUTION: DO NOT RUB THE ELECTRODES WITH THE TISSUE AS THIS WILL PRODUCE A STATIC CHARGE AND RESULT IN IMPROPER READINGS.**

- Stir samples while measuring. Record pH only after readings stabilize.
- Products which have a high oil content may clog the electrodes. Clean in alcohol or as recommended by the manufacturer.
- Store the electrodes with tips submerged in distilled water or buffer as directed by the manufacturer.

**Figure 1. The pH Scale**




Some products should not be heated. In these cases, increase the levels of acid or use chemical preservatives. Sodium benzoate and potassium sorbate are often used for this purpose. They are usually used together to take advantage of their combined effects.

**OTHER REQUIREMENTS**

The potential for improper formulation in the manufacturing of acidified foods has been determined to be a public health hazard. To reduce the likelihood of foodborne illness, the acidified foods regulation requires that a **scheduled process** for each product be filed with the FDA. The information filed must come from a recognized **process authority** who is qualified

by training and experience. In addition, persons supervising the manufacturing of acidified foods must attend an **approved school** and must earn a **certification** as a supervisor for acidified foods. The regulation also addresses other important aspects of manufacturing such as monitoring and record keeping.

**LABELING THE FOOD**

Regulations dealing with the food label are extensive and complicated. Many are in a state of change. Before purchasing any labels, it would be wise to consult with regulatory authorities.

**WHERE TO GET HELP**

**The North Carolina Cooperative Extension Service Office In Your County**

- Training and Certification
- Technical Assistance

**The North Carolina Department of Agriculture, Food and Drug Protection Division**

- Copies of Regulations
- Filing of Processes

**North Carolina Small Business Technology Development Centers**

- Business Start-up Advice
- Building a Business Plan

**READING**


- **Acidified and Fermented Foods,** Ralph Costilow. Pickle Packers International, Inc., St. Charles, IL 60174
- **Canned Foods,** FPI. Food Processors Institute, 1401 New York Ave. N.W.,Suite 400, Washington D.C. 20005
- **A Complete Course In Canning,** A. Lopez. The Canning Trade, Inc., Baltimore, MD 21218-4576


**Guide to Formulating Acidified Foods**

Produce the foods using Good Manufacturing Practices

Carefully formulate to assure that sufficient acid is added to reach the desired pH below 4.6.

Eliminate mold and yeast spoilage with "hot filling" or by using chemical preservatives.

Properly file the scheduled process with FDA under the guidance of a recognized process authority

Monitor the pH and formulation carefully. Keep good records on each lot produced.