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Selecting a pH Meter

Food Processing for Entrepreneurs Series

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This publication provides information about selection of equipment to measure the acidity (pH) of foods. Entrepreneurs who wish to market foods with a significant amount of non-acid food ingredient must acidify that food to a pH of 4.6 or lower, and maintain records of the finished pH of each batch of acidified low-acid food manufactured. A pH meter is necessary to measure the pH of the food.

Many of the food products brought to the University of Nebraska–Lincoln Food Processing Center are *acidified, low-acid foods.* These foods must meet the legal and safety requirements for acidified foods. The processor is required to confirm that each batch of the food is equalized at a safe pH before the food is packaged or shipped. The pH is the determining factor in whether or not *Clostridium botulinum* will grow and produce toxin in foods that do not receive a full retort process (pressure cooking).

Accurate pH testing is necessary to produce safe, high quality foods. Even if the food is a naturally acid food (pH below 4.6) it is often desirable to monitor and adjust the pH, because the flavor profile is largely defined by the sugar-to-acid ratio in the food product. Adjusting the sugar-to-acid ratio enables the food manufacturer to meet quality specifications in each batch.

There are easily understood explanations of acidity and pH measurement in books, pamphlets and on the World Wide Web. The pH meter manufacturer often includes a detailed manual describing pH measurement. Under current regulations, if a product pH is less than 4.0, it may be checked with simple pH papers (often called litmus strips). Litmus strips are inexpensive, but litmus strips have disadvantages. If the viscosity is high or if the product has significant color, the strip may be difficult to read. Accuracy with litmus strips is comparatively poor, and it may be possible to have a product with a pH above 4.0 due to a formula deviation not detectable with strips. A wise manufacturer would invest in a pH meter to insure product uniformity even if dealing only with acid foods. Remember the pH is critical in defining the flavor profile of your product!

Often people ask the same questions concerning pH meters.

1. Where can one purchase a pH meter?

Scientific supply companies are usually the best place to purchase a pH meter. Several companies supply inexpensive pH meters. Some possible sources of meters include:

Fisher Scientific, Inc
www.fishersci.com
Telephone: 800-766-7000
FAX: 800-926-1166

Omega Engineering, Inc.
www.Omega.com
Telephone: 888-826-6342

VWR Inc.
www.VWR.com
Telephone: 800-932-5000
Fax: 630-879-6718

Cole Parmer, Inc.
www.Coleparmer.com
Telephone: 800-323-4340
Fax: 847-247-2929

2. How much does a pH meter cost?

A pH meter can be purchased for under $80 to over $1,000. The least expensive usually would not be the best bargain as a quality assurance tool for foods. A temperature-compensating pH meter is best because the pH varies slightly with the temperature of the food being measured. It is also desirable to have a meter that will withstand moderately high temperatures (160°F or higher). Some vendors have meters with these features for approximately $175. With proper care and maintenance, most of these meters will withstand daily use for long periods of time.

3. What should I look for in a pH meter?

Accuracy should be the first consideration. The very best – and very expensive meters have an accuracy of ±0.002 pH

units. These instruments are meant for research. This degree of accuracy is not needed in the food industry.

Food processors will find a unit with an accuracy of ±0.01 to ±0.02 pH units to be adequate. If you are making flavored vinegars that have a very low pH, where it is highly unlikely the product will have a pH as high as the 4.0 range, a less expensive model with accuracy range of ±0.2 pH units will be adequate. That means the instrument could be reading 0.2 units above or below (±) the actual pH of the product. If the normal product pH is 3.2, and a batch happens to deviate to 3.4, a meter reading of 3.6 or 0.2 units above the actual pH is not going to matter too much in terms of safety, but may impact factors such as jelly-set strength and jelly-set temperature.

If you are manufacturing a product with a pH of 4.0 (the scheduled process says you must stay at 4.2 or below) and the product deviates to 4.1 but your inexpensive pH meter gives you an actual reading of 4.3, you then would add more acid to the product and change the flavor (and your profit margin). A more accurate meter would detect whether or not the product is within the specified range and the safety of the product. If your pH meter reads 0.2 units lower than the actual pH and your product deviates to above 4.4, you could have a finished pH above 4.6. A high pH could place a dangerous product on the market and you would not know it until someone became ill.

Here are some other features to consider:

Calibration. All pH meters can be calibrated (checked against a known standard) to assure accuracy. Most meters can be calibrated to at least two standards at the same time.

Calibration Standards or Buffers: You should order at least two calibration standards (pH 7 and pH 4). The pH4 is necessary because your meter should be calibrated to a standard that is no more than 3.0 pH units from that of your product. Sometimes buffers are sold in sets of pH 4, pH 7 and pH 10. The pH10 buffer is generally not needed in the food industry.

Electrodes: The electrode is the part of the instrument that is immersed in the product. Your product will determine which electrode you need. The electrode needed will depend upon the temperature at which you must measure pH, and upon whether or not your product contains oil. Oil can easily clog an electrode and cause erroneous readings. Very oily products (such as salad dressings) that are emulsified, to keep the oil from separating, require the use of a special electrode such as a "sure-flo" electrode. These electrodes are more expensive, but will last longer with better results than the standard electrodes, when used under adverse conditions.

For products with small amounts of oil, or products that can be tested before the oil is added (or if the oil can be separated out) the standard electrodes supplied with most meters work fine. When pricing meters, find out if the model you are considering comes with the electrode or if you will have to buy it separately.

Temperature: pH readings are affected by temperature. Purchase a meter that has automatic temperature compensation, which gives you an accurate pH reading of your product at the test temperature. *A sample should always be withdrawn from a well-mixed batch before measuring the pH. Withdrawing a sample eliminates the possibility of breaking the electrode in the batch of food you were about to package.* If you choose a non-temperature-compensated pH meter, you can either cool the sample to room temperature before taking a reading, or use a temperature compensation chart to determine the correct pH of your sample. It is best to choose a temperature-compensating meter with a temperature range that includes the fill temperature of your cooked product.

Shop carefully! Talk to sales representatives and ask questions about features and capabilities of the meters they sell. You want and need an accurate, easy-to-use instrument, but there is no need to pay several hundred dollars to buy a meter that is better than needed. Some pH meters can be connected with computers to automatically record pH and temperature readings, but these features usually cost $75 to $100 more than units without this feature.

The Food Processing Center does not endorse any particular company or instrument.

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