

Measurement of pH in the Biochemistry and Food Industries

The pH of food can be measured with the use of color indicators or electrochemically. In acid-base titration, indicators are used which change color at around pH 9.0. The pH values of foodstuffs which are not too highly colored can be readily determined by the use of pH indicator papers. These are now available in wide and narrow ranges of pH, enabling values to be measured within 0.5 or less units of pH.

Electrochemical measurements using pH meters are now simple and accurate. Micro-electronic components have made possible small portable high quality instruments with digital displays, some with built-in electrodes. These meters measure the potential difference between a glass electrode and a standard calomel electrode or silver/silver chloride electrode and are calibrated by the use of prepared or purchased buffer solutions of accurately known pH. There are also available other types of electrodes designed for special purposes, such as probe electrodes for the examination of carcass meat. Very accurate pH measurement, through seldom required in food analysis, is very susceptible to the temperature of the test solution. Temperature compensation devices are incorporated in pH meters to correct for known temperature deviations.

Some of the pH values of a number of biological materials are given below:

| Material | pH value |
|-----------------------------------|-----------|
| Blood, normal limits | 7.3 - 7.5 |
| Blood, extreme limits | 7.0 - 7.8 |
| Enzymes, activity range of | |
| Amylopsin, optimum | 7.0 |
| Erepsin, optimum | 7.8 |
| Invertase, optimum | 5.5 |
| Lipase, optimum | 7.0 - 8.0 |
| Maltase, optimum | 6.1 - 6.8 |
| Pepsin, optimum | 1.5 - 2.4 |
| Trypsin, optimum | 8.0 - 9.0 |
| Fruit Juices | |
| Apple | 3.8 |
| Banana | 4.6 |
| Grapefruit | 3.0 - 3.3 |
| Orange | 3.1 - 4.1 |
| Tomato | 4.2 |
| Gastric juice (adult) | 0.9 - 1.6 |
| Milk (cows) | 6.2 - 7.3 |
| Plants (extracted juice) | |
| Alfalfa tops | 5.9 |
| Carrot | 5.2 |
| Cucumber | 5.2 |
| Peas, field | 6.8 |
| Potato | 6.1 |
| Rhubarb, stalks | 3.4 |
| String beans | 5.2 |
| Sweat | 4.5 - 7.1 |
| Saliva | 6.2 - 7.6 |
| Urine (human) | 4.2 - 8.0 |
| Tears | 7.2 |

Table A - pH Values of Representative Biological Materials, *Elements of Food Biochemistry*, William H. Peterson, Ph.D., John T. Skinner,

Recommendations

Eutech's [pHScan 1/2/3](#) and [pHScan BNC/3BNC](#) series is the ideal tool for quick testing the pH value. For discerning technologists and researchers, best to use a pH hand-held meter i.e. [pH5/6/10/100](#) or bench meter i.e. [pH510/1000/2500](#) for better accuracy and useful features. Note some models require separate specialized electrodes for different applications.

| Electrode Type | Application |
|----------------|---|
| EC-FG73504-01B | General purpose application for aqueous pH measurement. Glass body 110mm (L) x 12mm (dia.) |
| EC-FG73905-01B | For tris buffers, clinical and biological media containing proteins, creams, fats and cosmetics. Also suitable for measurement in fruit juices, beer, milk and yogurt. Glass body 110mm (L) x 12mm (dia.) |
| EC-FG63511-01B | Sharp tip pH electrode for solid or semi-solid sample such as cheese, meats, fruits, bread or other similar samples |
| EC-FE13901-01B | Ideal for test tube measurements of fruit juices, beer, milk and yogurt. Epoxy body 155mm (L) x 9 mm (dia.) |