

METTLER-TOLEDO APPLICATION NOTE

pH Measurement In Raw Meat Processing

BACKGROUND

The pH value is very important in the processing of raw meat such as sausages, ham, and dry meat. The initial pH value of the raw meat must be within a certain range (see Fig. 1) to reach optimal ripening. Variations in pH value of the raw meat affect the color, consistency, flavor, the ripening process, and the shelf life of the end product. Generally, bacteria cultures are used for the processing of raw meat, initiating micro-biological reactions which lower the pH value and increase shelf life.

The preservation of raw meat is an old tradition based on experience and locally established methods. Today consistent quality is very important in order to optimize costs and keep up with the competition. This can be realized through standardization and rationalization of the meat processing operations. Therefore incoming control of the raw meat through pH measurement and the continuous measurement of the pH value during ripening are significant factors. In addition, when pH measurement during the ripening of raw sausages is used to control the temperature in the curing chamber, energy can be saved.

THE PROCESS

The pH value in different muscles is not uniform. Therefore it is recommended that the pH measurement is always carried out in the same muscle and at the same place in the muscle.

- a) Meat for dry sausages
- b) Meat unsuitable for dry sausages
- c) Meat unsuitable for raw hams
- d) Meat spoiled after storage

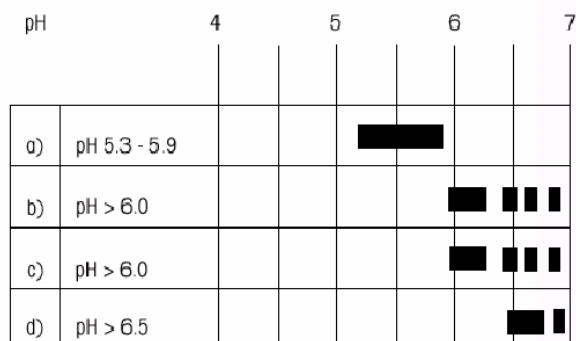


Fig. 1: pH values in meat as criteria for raw material selection.

Control of the ripening process

Generally, lactic acid bacteria are used in the ripening of raw sausages. The lactic acid bacteria break down the sugar content into acids, causing the pH value of the sausage to drop. If the temperature and the sugar content are too high, the pH value will drop too quickly. In this case the sausage will have a sour taste and less delicate flavor, and will be too moist due to water formation in the meat protein.

The pH measurement during the ripening of raw meat has particular importance since it influences color, flavor, and microbial stability (shelf life), and also determines whether the end product will be firm enough to cut. Change in pH value during the ripening of raw meat depends on the temperature of the curing chamber, on the content and type of sugar, on the bacteria culture, and on the fat concentration.

The pH value can be continuously measured during ripening to control the temperature in the curing chamber.

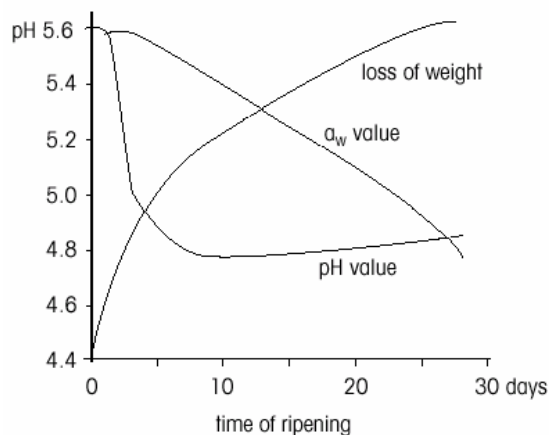


Fig. 2: Continuous pH measurement in salami, 60 mm diameter.

Firmness

The firmness of raw sausages is strongly influenced by the pH value. Between pH 4.9 - 5.9, the proteins reach the gel-point, so this range accounts for the biggest increase in firmness.

Fat content

The pH value decreases less with increasing fat content in raw sausages. Thereby the firmness of the end product will be reduced.

Sugar content

The higher the sugar content, the quicker the pH value decreases and the faster the sausage ripens. If the sugar content is too high, the result is sausages with a sour taste and a less delicate flavor.

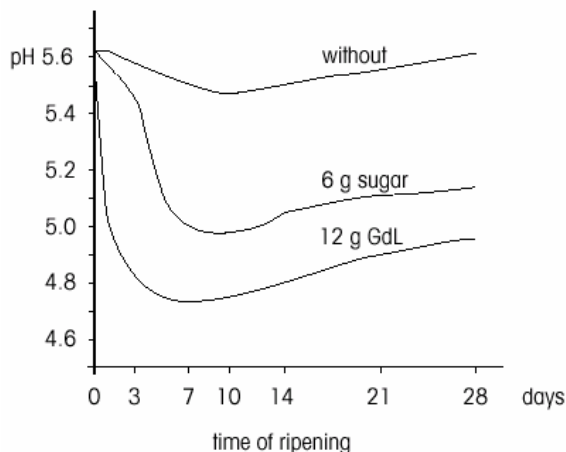


Fig. 3: Influence of different amounts of sugar and GdL (Glucono-delta-Lactone) on the pH development during the ripening of raw sausages.

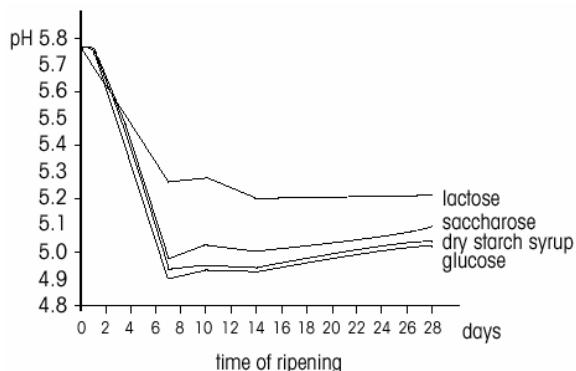


Fig. 4: Influence of different kinds of sugar on the pH development during the ripening of raw sausages.

Temperature

At a higher temperature in the curing chamber, the pH value of raw sausages decreases quicker during ripening, resulting in less firm sausages.

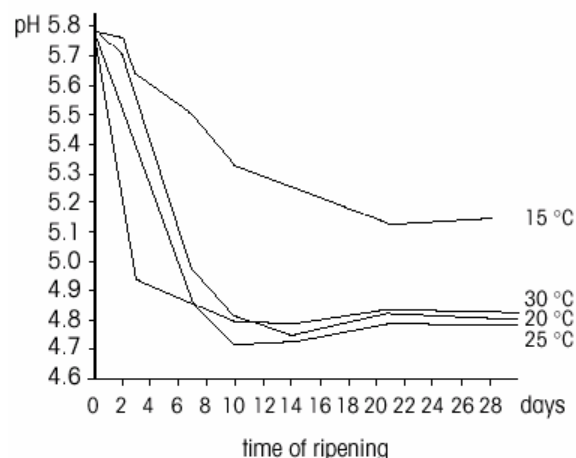


Fig. 5: pH development in raw sausages at different temperatures during ripening.

INSTRUMENTATION

The combination Xerolyt® puncture pH electrode (LoT406-M6-DXK-S7/25) provides quick, reproducible, and accurate values. The needle-shaped tip of the electrode has been specially designed for puncture measurement in sausages, meat and many other solid foods. With its polymer Xerolyt reference electrolyte, refilling of the electrolyte is not necessary. Instead of the conventional ceramic diaphragm junction, an open aperture junction enables direct contact between the medium and the reference electrolyte, minimizing diaphragm clogging by proteins and fats and decreasing the response time. (Diaphragm clogging delays the response time, resulting in sluggish value readings). A plastic shaft of FDA positive-listed PBT protects the electrode from mechanical stress.

An additional knife style attachment is available for use in firmer applications to protect the needle tip from accidental breakage.

Mettler Toledo Process recommends the use of the portable pH 1120/1140 Portable Meter. The meter features a waterproof enclosure suitable for measurement in environments with high humidity.

PRODUCTS

1120 or 1140 Portable pH Meter

- Rugged, portable design allows use in a variety of applications and environments
- Sensor & transmitter diagnostics for process safety
- Logbook for adherence to QM documentation and procedure requirements
- FM certification for Class I, Div. 1 Environments

LoT406-M6-DXK-S7/25 Puncture pH Electrode

- Specially designed for pH measurement in meat, sausage and cheese
- Rugged, needle-shaped membrane may be used to penetrate foods for quick, accurate measurement
- Patented Xerolyt[®] solid polymer reference system maintains a stable potential for accurate and repeatable pH measurement and low maintenance
- Open junction eliminates reference clogging by proteins and fats, extending sensor life
- Optional knife mount for easy puncture and penetration of food surface