

METTLER TOLEDO APPLICATION NOTE

pH Measurement In Jam, Jelly, Marmalade And Fruit Sauce

BACKGROUND

As jam, jelly, marmalade and fruit sauce require high and consistent quality, it is important to control the pH value during the process. The quality criteria greatly influence the flavor, color and consistency. The pH value affects gelling behavior, flavor and shelf life of the product. Generally, edible acids (e.g., citric acid) are added to lower the pH. The gel formation by pectins takes place at a certain pH range depending on soluble solids content (see Fig. 1). Therefore, the feed of edible acids is controlled by on-line pH measurement during the production of jam, jelly, marmalade and fruit sauce. This procedure offers high safety as well as the possibility for automation of the process.

THE PROCESS

First, the basic materials (e.g., fruit and sugar) are blended and pasteurized at 105 °C (220 °F). The process usually contains 60 to 65% sugar and sometimes fruit pieces. After cooling down, the mass is transferred to the cooking-batch where additives such as pectins, flavors and edible acids are fed to the pre-mix in a closed vessel at 80 to 100 °C (176 - 212 °F) and 1.2 to 1.3 bar (18 - 19 psi) static pressure under agitation. Temperature and pressure depend on the size of the vessel, place of installation, and product.

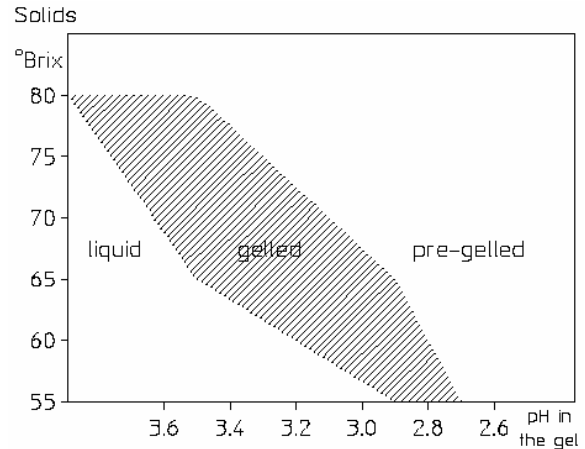
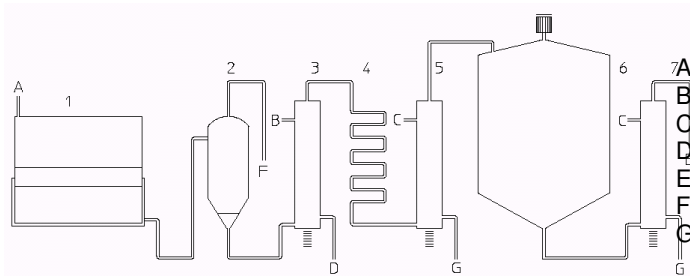


Fig 1: Relationship of pH value, gel behavior and sugar content

Edible acids are added until the pH reaches the recommended value, normally 2.8 to 3.2 depending upon the product. During the cooking process, the pH value is continuously controlled so that it can be adjusted by the addition of more edible acids. If the pH value is too low (e.g., apple pectins 2.8), the gel becomes hard and brittle and begins to form too early. If a certain pH limit is exceeded, gelation is no longer possible.



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|---|----------------|---|-------------------------|
| A | Product inlet | 1 | Horizontal food blender |
| B | Steam | 2 | Vacuum de-aeration unit |
| C | Cooling | 3 | Scraped surface heater |
| D | Condensate | 4 | Holding tube |
| E | Product outlet | 5 | Surface heat exchange |
| F | De-aeration | 6 | Buffer storage area |
| G | Cooling outlet | 7 | Surface heat exchange |

INSTRUMENTATION

We recommend either of the following systems for pH measurement in jams, jellies, marmalades and fruit sauces.

The first system is side entry installation of a Model HA405-DPA-SC electrode and the InTrac[®] 777 - SL housing. The housing is equipped with a flushing chamber and the complete unit is available for either manual or pneumatic retraction. This enables the pH

electrode to be retracted for cleaning in the flushing chamber; the sensor can be serviced or replaced without interruption of the process.

The second system is side entry installation of an HA405-DPA-SC electrode and the InFit[®] 761-25CIP stationary housing.

The Model 2100 pH analyzer is recommended for either pH electrode system.

PRODUCTS

Model 2100 pH Analyzer

- Detachable front panel and plug-in terminals for ease of installation
- All functions accessible through the keypad for increased ease of use
- Continuous sensor and transmitter diagnostics to monitor performance
- FM certification for Class I, Div 1 & 2 Environments and CSA General Purpose Approval
- 3 year warranty

Model HA405-DPA-SC pH Electrode

- Gel electrolyte eliminates fill requirements to reduce maintenance
- Internal over-pressure ensures gradual electrolyte outflow, efficiently cleaning the diaphragm and preventing influx of process medium into the reference electrolyte
- HA membrane to minimize sodium error
- Silver ion barrier prevents diaphragm contamination for accurate results and longer life

InTrac[®] 777-SL Retractable Housing

- Rugged 316L SS or PVDF construction for maximum chemical resistance
- Flushing chamber for automatic cleaning and calibration reduces overall system downtime
- Patented immersion tube design isolates the sensor on retraction and guarantees complete separation of the process from the outside environment.
- Safety interlocks prevent sensor removal from housing while in measuring position\
- Manual or pneumatic operation

InFit[®] 761-25CIP Housing

- Steam-sterilizable & autoclavable for hygienic and CIP/SIP applications
- Meets 3-A guidelines and EHEDG Certification to ensure maximum cleanability
- Exclusive o-ring positioning guarantees perfect sealing, permitting full CIP procedures to be performed without any compromise of sterility
- Specially designed smooth surfaces of the housing and o-rings prevent the adherence of microorganisms
- Recommended for use with Mettler-Toledo safety weld-in sockets to provide the highest level of protection for personnel, equipment and the environment