



Liquid Measurements in Wool Processing

BACKGROUND

Production of wool fabric from sheep involves multiple steps of chemical treatment and rinsing. Over 50% of raw (grease) wool consists of impurities such as suint, dirt, and dust that are removed by scouring in various stages that may involve detergents or organic solvents. Some byproducts such as lanolin are removed during the scouring process.

THE PROCESS

Wool carbonizing is used to remove additional vegetable matter. The process begins by immersing the wool in a solution of sulfuric acid (H_2SO_4) that reacts with the cellulose impurities in the wool. The wool is then dried and baked in an oven near $100^{\circ}C$ to carbonize (burn) the impurities.

The Burr crushing process crushes and agitates the wool so that all traces of the vegetable matter can be vacuumed away. The wool is then washed in a solution of soda ash and soap to soften the wool and neutralize any residual acid from the carbonizing process.

The concentration of the sulfuric acid solution used on the wool must be carefully controlled. Depending on the wool characteristics, a 4-7% solution may be used. If the concentration is too high, the wool fibers will be weakened and produce inferior product. A low concentration will not convert the cellulose and will require additional processing of the final wool product.

The wool product should be neutralized to 5-6 pH before dyers and mechanical steps such as carding and spinning to produce a durable product with a long shelflife.

INSTRUMENTATION

Electrical conductivity is an economical and convenient method for controlling the sulfuric acid bath concentration. Toroidal conductivity sensors are recommended to resist the coating effects of the oils and grease carried by the wool. The versatile Model 228-02 sensor can be inserted through a $1\frac{1}{2}$ " ball valve or lowered into the bath from above. The large-bore Model 226 sensor is excellent for high-solids conductivity measurement and is usually lowered into the bath from above. The flow-through Model 242 offers over 250 combinations to accommodate a wide variety of size, mounting configuration and material requirements. Analyzers such as the easy to use Model 54eC and multi-parameter Model 1055 are ideal for this application because they show readings directly in percent sulfuric acid. All sensors should be mounted in a location where there is some agitation to provide representative samples and avoid measuring in "dead spaces".

Due to the high levels of solids in wool, pH is best measured using the TUpH™ sensor Model 396P with the wide area reference that resists the effects of coating and plugging. The TUpH design is also available as a ball valve insertable sensor in the model 396R. The Model 54epH includes comprehensive sensor diagnostics that indicate potential problems with the pH measurement.

INSTRUMENTATION

Model 1055 Analyzer

- Broad selection of measurement choices includes pH/ORP, Resistivity/Conductivity, % Concentration, Total and Free Chlorine, Dissolved Oxygen, Dissolved Ozone, Flow, and Temperature.
- Single or dual measurement with dual 4-20 mA outputs.
- Full complement of measurement combinations can be commissioned in the field.
- Three fully programmable alarms.
- Clear, easy-to-read, two-line, back-lit display easily customized to read in English, French, German, Italian, Spanish, or Portuguese.
- Choice of enclosures for pipe, surface, and panel mounting—meet NEMA 4X/CSA 4 (IP 65) requirements.



Model 54e pH/ORP Microprocessor Analyzer

- Comprehensive pH glass and reference diagnostics to warn user of the need for calibration, maintenance, or sensor replacement.
- Heavy NEMA 4X (IP65), enclosure of epoxy-painted aluminum.
- Fully descriptive diagnostic messages and easy-to-use interface to spell out each operation in English, French, German, Italian or Spanish.
- Optional PID current outputs and TPC alarm relays.



Model 242 Flow-Through Toroidal Conductivity Sensor

- Suitable for high solids applications
- Sizes 1 inch thru 4 inch
- Rebuildable
- Wetted materials:
 - PEEK or Teflon
 - 316 SST or Carpenter20 or HastelloyC
 - EPDM or Viton or Chemraz



Model 226 Toroidal Conductivity Sensor

- Suitable for high-solids applications.
- Available in PEEK (polyetheretherketone).



Model 228 Toroidal Conductivity Sensor

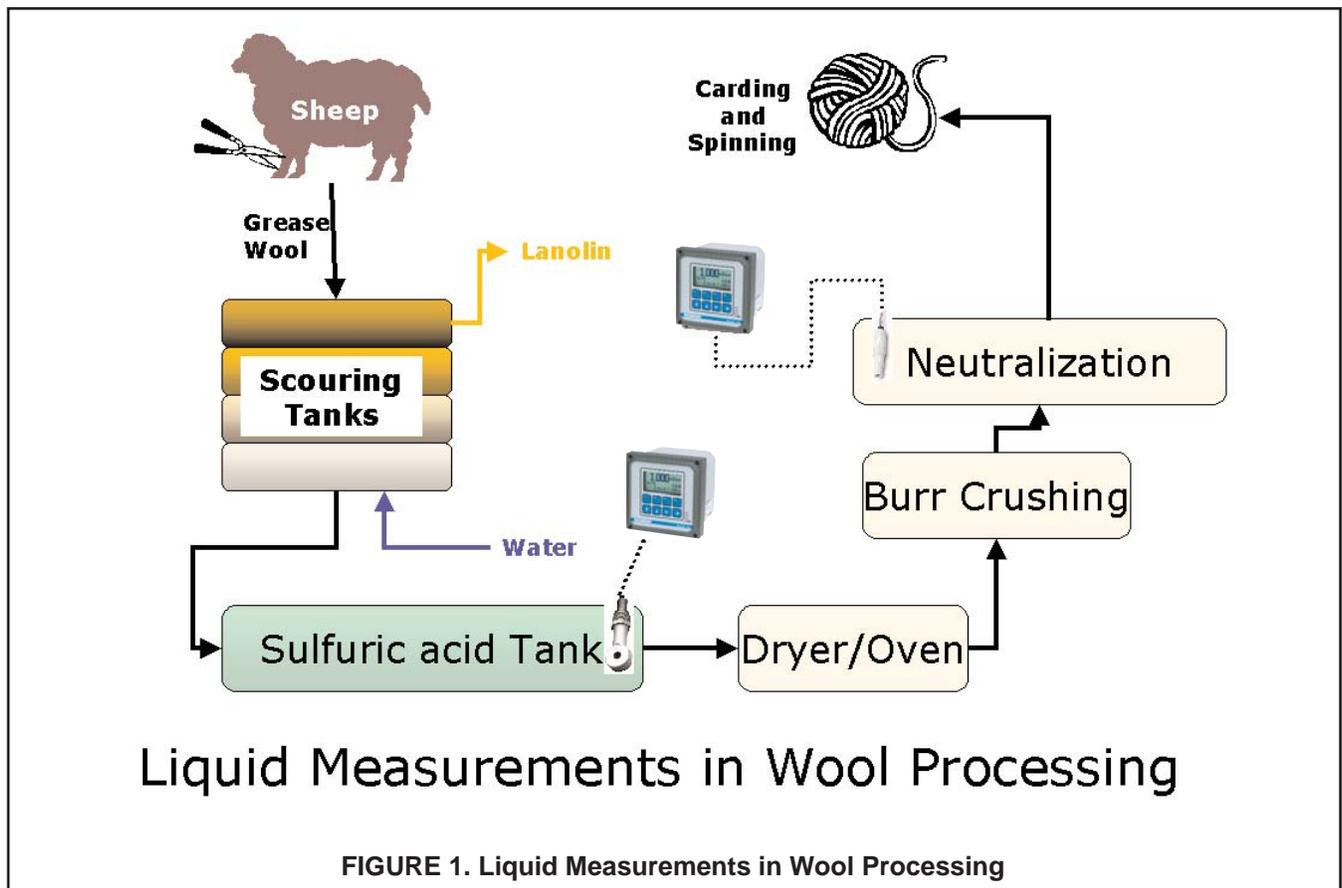
- Suitable for high-temperature, high-pressure service.
- Reduced cleaning requirements due to inductive technique.



Model 54e C Conductivity Analyzer

- Measures Conductivity, Resistivity, or Percent (%) Concentration.
- Uses either contacting or inductive sensors to meet most application requirements.
- Percent concentration curves for 0-12% NaOH, 0-15% HCl, and 0-25% or 96-100% H₂SO₄.
- Temperature correction algorithms for high purity water, cation conductivity, and linear temperature coefficient. Temperature correction can also be turned off.
- Optional TPC and PID control capability.
- Fully Descriptive Diagnostic Messages and easy-to-use interface spells out each operation in English, French, German, Italian, or Spanish.
- Two Independent Outputs for conductivity and temperature.
- Three alarms with Programmable Logic, plus one dedicated fault alarm.





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