



Caustic Control in Textile Mercerization

BACKGROUND

Mercerization is a process in which textiles (typically cotton) are treated with a caustic (NaOH) solution to improve properties such as fiber strength, shrinkage resistance, luster, and dye affinity. The caustic actually rearranges the cellulose molecules in the fiber to produce these changes. Higher-end fabrics may be double or triple mercerized for added benefits.

Effective Mercerization requires attention to variables such as caustic strength, dwell time (feed rate), temperature, and neutralization. The feed rate of the fabric may also be limited by its strength and weight and is usually run at 80 to 120 yards (73 to 110 m) per minute.

THE PROCESS

The fabric is first immersed in a caustic solution of about 23% strength and a relatively cool temperature of 60-90°F (16-32°C). It is then fed around a series of rollers (timing cans) which keep it flat and smooth while controlling the time of caustic exposure. The fabric is then sprayed with rinse water and then washed with a neutralizing chemical before final drying.

The process will cause the fabric to shrink somewhat, so the fabric must be stretched before removing the caustic solution. Optimum dwell time of 45 seconds to 5 minutes (depending on the fabric) allows the yarn to swell and the fibers to untwist while tension is applied.

Control of the caustic concentration in the bath is important for the uniform and consistent quality of the mercerized textile. Proper caustic control ensures the fabric will have an even and predetermined caustic exposure, based on weight and feed rate. It also helps in controlling the neutralization steps by avoiding overexposure to caustic that can prolong the washing and neutralization part of the process.

INSTRUMENTATION

Electrical conductivity is an economical and convenient method for controlling the caustic bath concentration. Toroidal conductivity sensors are recommended to resist chemical attack by the strong caustic and fouling by accumulated solids. The versatile Model 228-02 sensor can be inserted through a 1½" ball valve or lowered into the bath from above. The large-bore Model 226 sensor is the ultimate in high-solids conductivity measurement and is usually lowered into the bath from above. The Flow-Through Model 242 sensor is also available for locations that cannot be easily accessed from above. Analyzers such as the easy to use Model 54eC and multi-parameter Model 1055 are ideal for this application because they can show readings directly in percent NaOH (caustic).

The relationship between caustic concentration, temperature, and conductivity is somewhat complicated. However, over the range of 20-28% caustic, the conductivity decreases in a relatively linear manner. This allows simple programming of an accurate percent concentration curve using "Conductance Data for Commonly Used Chemicals," available at www.EmersonProcess.com. Note that conductivity is a non-specific measurement and that a buildup of salts in the process may produce some background conductivity that may interfere with the concentration measurement.

INSTRUMENTATION

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.
- User-defined concentration curve included.
- 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.



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.
- User-defined concentration curve included.
- 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 228 Toroidal Conductivity Sensor

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



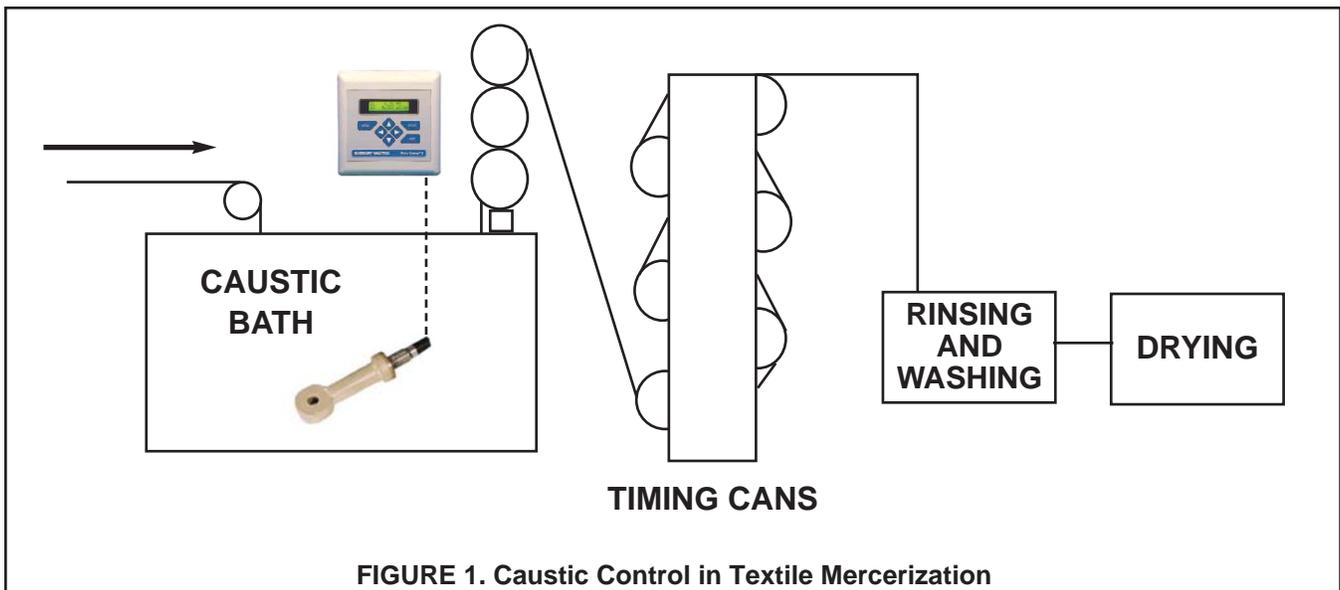
Model 226 Toroidal Conductivity Sensor

- Suitable for high solids applications.
- Available in PEEK (polyetheretherketone).
- Automatic temperature compensation with integral RTD.



Model 242 Flow-Through Toroidal Conductivity Sensor

- Now available in 4" pipe size.
- Toroidal measurement principle greatly reduces sensor fouling.
- Automatic temperature compensation with integral RTD.
- Externally-mounted toroids are protected from harsh processes.
- Modular design allows liner replacement without sensor replacement.



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