METTLER TOLEDO APPLICATION NOTE

Chemical Concentration Control

BACKGROUND

Numerous industrial applications require solutions of a specific chemical strength. Such specific concentrations are achieved by mixing a full strength solution with water in the desired proportions. Flow-paced control is used as a crude control in this operation, and a conductivity signal is used as a trim control.

THE PROCESS

The full-strength solution and water are mixed in two stages illustrated in Figure 1:

1. A flow ratio controller on a mixing tank is set for a given flow rate of the full strength solution and a proportional flow rate of the water. The flow-ratio controller is set to produce a concentration slightly weaker than that which is desired.

2. A control valve receiving input from a conductivity analyzer functions as a “trim control”. It adds a small amount of full strength solution to the mixing tank to produce the exact concentration desired.

For example, in making a 35% caustic solution from a large bulk caustic supply at 50%, the flow ratio controller is adjusted to make a 30% solution and the conductivity signal is used to add additional caustic to make the 35% solution.

Conductivity is an economical and widely used index of concentration for most acid, base, and salt solutions. It is important to determine the range of possible concentrations at a given location in order to interpret conductivity measurements. A good conductivity application will have a significant change in reading over the possible concentration range and only one concentration value for any given conductivity reading. Conductivity tends to increase with concentration for dilute solutions; however concentrated solutions can have very different properties. Caustic (NaOH) is an example in which conductivity actually drops with increased concentration over 15% (see Figure 2).

Conductivity graphs normally apply to pure mixtures of water and the indicated chemical. Although the conductivity of a mixture is usually close to the sum of the conductivity of its components, the presence of significant amounts of certain substances (iron, copper, and some sugars, for example) can actually lower the measured conductivity. Conductivity data is temperature dependent and is frequently stated at a reference temperature of 25 ^{o}C (77°F). Temperature correction is specific to the application and can be very important when extreme and/or variable temperature is likely.

INSTRUMENTATION

METTLER TOLEDO InPro® 7200 series of toroidal sensors are especially suitable for monitoring chemical concentration.

The compatible toroidal analyzer is the Model CondI 7100 Analyzer. This analyzer provides conductivity and temperature curves for NaCl, HCl, NaOH, H_2SO_4, and HNO_3.

PRODUCTS

Model CondI 7100 Toroidal Conductivity Analyzer

- Measures conductivity, resistivity and % concentration
- 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
- 3 year warranty

InPro® 7200 Toroidal Conductivity Sensors

- Recommended for high accuracy measurement in high conductivity processes
- Choice of materials of construction for increased chemical compatibility
- High temperature range option suitable for CIP and Boiler Blowdown applications
- FM approved for electrical safety

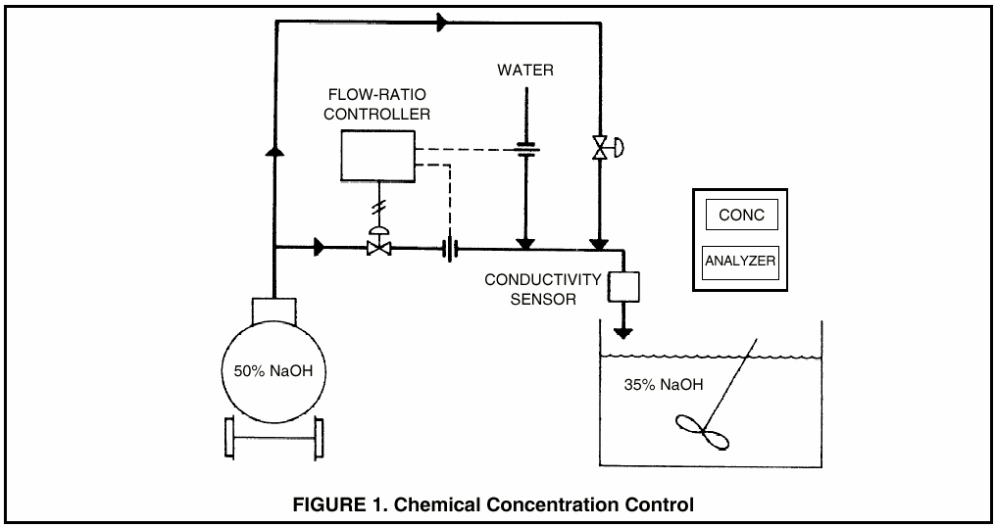

FIGURE 1. Chemical Concentration Control

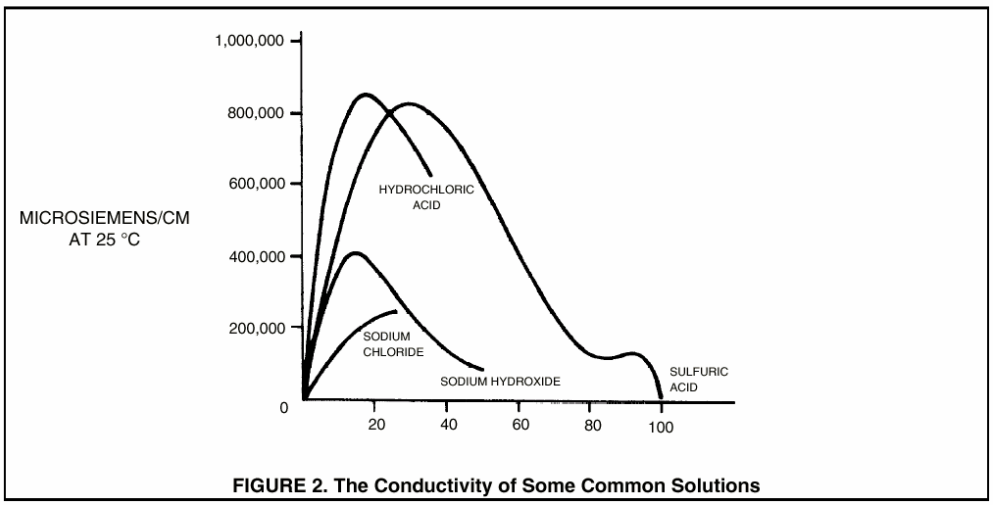

FIGURE 2. The Conductivity of Some Common Solutions

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