Batch Neutralization

Industry: **Chemical**
Product: **pH/ORP Meters**

Introduction

Environmental regulations require pretreatment of waste water prior to discharge into municipal sewage systems. This is because raw industrial waste streams, especially those with low pH values, can damage sewage system piping and destroy the micro-organisms used in the sewage treatment plant itself.

Many variables contribute to the level of corrosion that can take place within a water supply system. The material of construction of the system itself, or components used in the system, are key factors. Chemically inert materials, such as gold, silver, platinum, or noble metals, greatly reduce the rate of corrosion. Base metals, such as magnesium, aluminum, and zinc have a high corrosion rate; while steel, lead, and copper fall somewhere in the middle. In addition, the amount of exposed area to the water increases the corrosion rate as well. Controlling the level of dissolved oxygen in the water is one tool for controlling the corrosion rate in the system. Another, is to control the Oxidation Reduction Potential (ORP) of the water supply.

Additional factors influencing corrosion include the quality and velocity of the water flowing through the system. Salt content increases the electrochemical conductivity of the water, which in turn, increases corrosion. Adding calcium carbonate will cause a film to form on the metal surfaces slowing the corrosion effect of dissolved oxygen in the system. Excessive flow velocities produce an effect known as Flow Accelerated Corrosion (FAC), a result of the relative motion of the process wearing on the metal surface. It is characterized by a directional erosion pattern on the metal surface. FAC or Erosion corrosion is most prevalent in soft alloys (i.e. copper, aluminum and lead alloys).

Application

Industrial plants use a batch neutralization system to treat their chemical waste products. Acid-base reactions are among the most common used in water conditioning systems. Commercially available acids and bases can be used, but often the chemicals wastes from the plant are used for neutralization.

Treating acidic water is relatively easy because the allowable effluent pH range is fairly broad, usually 5 to 9 pH. FIGURE 1.0 shows a typical batch neutralization system for spent acid. In this scheme, a level controller opens the inlet valve to the reaction tank admitting the acid waste, and then closes the valve when the tank is full.

A pH loop is installed in the reaction tank to measure the waste water as it is mixed, and to control the addition of the alkaline reagent whenever the pH drops below the designated set point. The level controller and the pH analyzer are interlocked to assure the discharge valve does not open until the tank is full and the proper pH value has been reached.

A second pH loop is typically installed in the discharge line as a final check that the correct pH value of the water is being discharged back to the environment.

Problems/Solutions

An inherent problem for all batch neutralization applications is “overshoot” of the chemical feed. This is when more chemical is added to neutralize the waste water than is necessary to achieve the desired pH set point. The result is the need for additional chemicals, of an opposite pH value, to bring the pH back in line.

The source of the problem is allowing insufficient retention time for the neutralizing chemical to mix adequately before accepting the pH measurement. The size of the tank, poor mixing, and location of the pH sensor with regard to the point where the chemical addition all contribute to this problem.

A simple solution is to provide a timer that allows the chemical feed for a set period of time (i.e. 30 seconds, one minute, etc),; then shut it off for a period of time to allow adequate mixing; and then release control back to the pH Analyzer. Depending on whether the set point has been reached determines whether more chemical will be added. Such a system optimizes mixing and chemical reaction times so that the pH measurement is a true representative of the batch value.

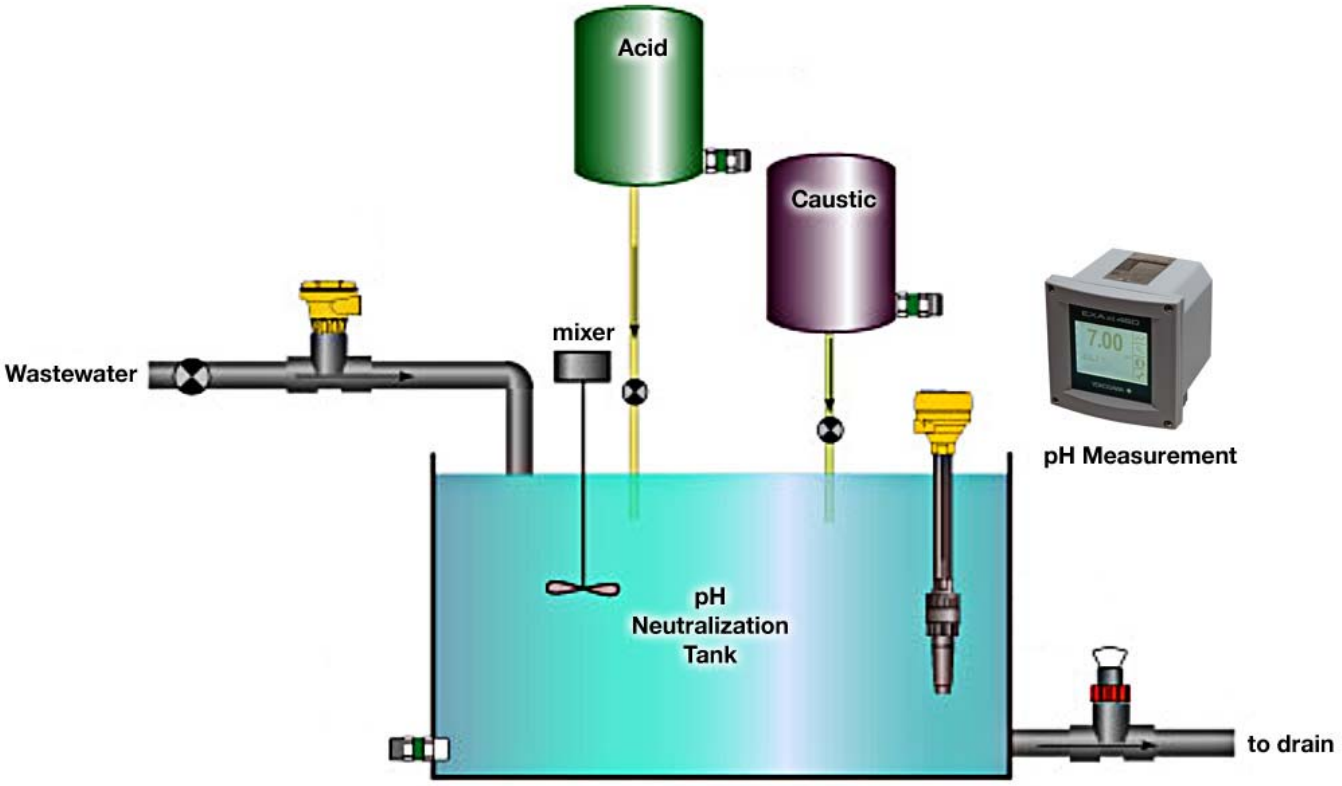

FIGURE 1.0

Summary

For control of batch neutralization, a pH measurement coupled with a timer-controlled chemical feed scheme provides very satisfactory results.

This system can be adapted for either acid waste or alkaline waste neutralization.

Opportunities

Any facility that discharges effluent to municipal sewer systems must comply with these pH requirements.

Product recommendations

Transmitter:

PH202 two-wire pH transmitter (intrinsic safety)
PH450 four-wire pH transmitter (general purpose)

Sensors:

FU20 Four-in-one pH sensor
FF20 Flow-thru pH fitting
FS20 Insertion pH fitting
FD20 Immersion pH fitting
PH87/97 Retractable pH fitting

*Note For additional information on this application contact the Yokogawa Analytical Product Marketing Department