The Key to Successful Automation and Improvement of Separation Processes

Simple liquid measurements can improve separator efficiency and protect against metal corrosion while minimizing product loss

‘It’s best to look for a pH sensor with a microporous junction and a high surface area.’ By Dave Joseph

FACTS TO REMEMBER

Many chemical plants rely on processes that contain two different phases of chemicals that do not mix, such as organics and water, solids and water or gas and liquid. Typically, these components are mixed and react, and then the products are separated by settling in a pond or a vessel called a separator. Separators are used in a variety of industries including the following: &#149 Chemical processing &#151 separation of aqueous and non-aqueous solutions &#149 Alkylation processes &#151 polymer surge drum &#149 Secondary oil production &#151 water recovery &#149 Environmental &#151 recovery of contaminated water

In a typical API separator, wastewater is first collected in a pretreatment section that allows sludge removal. A diffusion barrier slowly lets the wastewater flow down the separator toward the outlet while lighter oil fractions can be skimmed off. Conveyors may be used to remove heavier solids and help separate the lighter oils. Baffle plates are used to prevent oil from escaping into the outlet section. Following this primary step, further treatment processes are used to completely remove entrained oil in all forms, including emulsified oil, and to condition the water to meet the specifications for release into a stream or body of water. Downstream treatment can include chemical flocculation to remove emulsified oil and special processes for the removal of phenols and sulfides. Factors such as oil globule size, specific gravity, temperature and viscosity are involved in separator design and affect downstream water characteristics. Generally, pH is controlled within a chemical plant to minimize corrosion due to acid, meet environmental discharge regulations and optimize chemical reactions that can depend on the concentration of hydrogen ion. Because it can be difficult to measure in streams with high concentrations of oil, it can be hard to control acid levels in these streams. When pH is measured at the discharge from the separator, upstream

control allows protection of metal surfaces and enhances the efficiency of secondary waste treatment processes such as flocculation. However, because some emulsified oil may still be present at this stage, the pH sensor can still become coated, resulting in slow response and eventual failure. Obtaining the benefits of an accurate pH measurement may require regular attention by removing and cleaning the sensor or by automating a cleaning regimen using a cleaning nozzle or retraction device. The characteristics of the oily waste itself will determine how often the sensor needs cleaning. It’s best to look for a pH sensor with a microporous junction and a high surface area to prevent the formation of a continuous coating on the sensor, thereby preserving the pH signal. A sensor designed specifically for the rugged environment found in refineries and chemical plants will resist damage due to solids and other coating agents. Some sensors also simultaneously measure both glass and reference impedance as diagnostics &#151 a technology that can be used to alert the user to pH glass breakage or the buildup of a coating and help predict maintenance schedules. Dave Joseph is the industry manager for the chemical and pulp and paper industries for the Liquid Division of Emerson Process Management, Rosemount Analytical, 2400 Barranca Pkwy., Irvine, CA 92606. He has a bachelor’s degree in chemical engineering from the California Institute of Technology and a master’s degree in chemical engineering from UCLA. He has more than 17 years of industrial process and control experience and is a member of AIChE. Questions about this article can be addressed to him at 949-757-8531 or dave.joseph@emersonprocess.com.pipvus the control system or operator to take corrective measures before the pump bearings are overheated and fail. Among the many types of point flow/level switches available are those that offer dual alarm capability. One alarm detects low flow between 0.01 and 3 feet (0.003 and 0.9 meters) per second and can be regarded as a pre-warning signal for the control system or operator, who then can decide to keep the pump running or shut it down. The second alarm occurs when the feed line to the pump is running dry. It is an emergency signal to shut down the pump immediately. In this case, the bearings have gas instead of liquid as a heat transfer medium, causing the temperature of the bearings to rise very quickly. The flow switch prevents permanent damage to the pump\rquote s bearings, but an overhaul of the pump is required to prevent more damage. The flow switch is a dual-function instrument that indicates both flow and temperature or level and temperature sensing in a single device. Available in either insertion or in-line styles for pipe or tube installation, a single switch measures and monitors flow or level and temperature simultaneously.