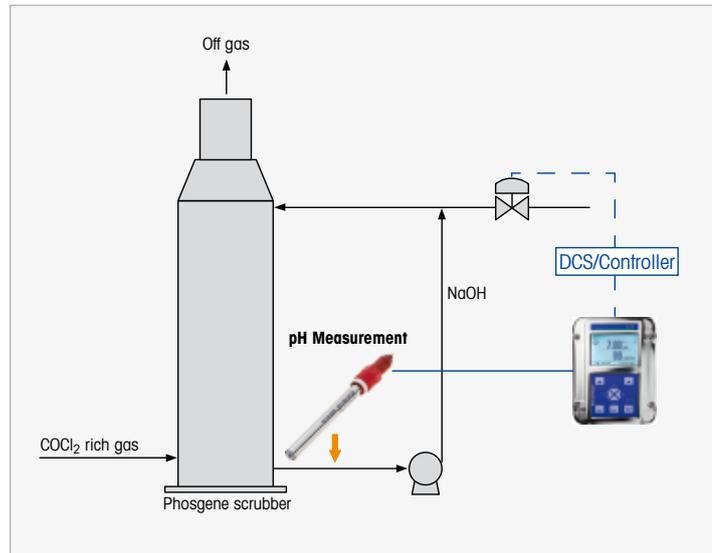


pH Control in Phosgene Removal in TDI Production



Background

Toluene diisocyanate (TDI – $\text{CH}_3\text{C}_6\text{H}_3[\text{NCO}]_2$) is an intermediate petrochemical obtained from toluene feedstock. It is used for the production of polyurethane foams (bedding, car seats, etc.), polycarbonate, adhesives, coatings and elastomers.

Process

TDI is produced through three main reactions: nitration, hydrogenation and phosgenation. The effluent from the third reactor is refined via distillation but not before remaining phosgene and hydrogen chloride are removed in a scrubber. As the reaction of phosgene with water is very slow, typically a caustic soda solution is chosen as a scrubbing agent as the reaction is instantaneous and complete:



When using continuous scrubbers for phosgene removal, the pH control setpoint is usually pH 10. Maintaining this value is very important as too high a pH will reduce the solubility of sodium carbonate and sodium chloride which may cause scaling and clogging of downstream units. Too low a pH reduces phosgene absorption which is very dangerous due to the extreme toxicity of phosgene.

Challenges

Keeping pH measurements reliable requires frequent maintenance work. If the measurements drift or sensors are not calibrated properly, safety may be compromised or substantial amounts of chemicals could be wasted. As is the case with most processes where toxic substances are involved, major precautions need to be taken to avoid personnel being exposed to toxicant release. Replacing or calibrating a pH sensor in phosgene service may therefore be quite an operation involving the use of breathing apparatus and chemical protection clothing, often not to the liking of maintenance technicians.

METTLER TOLEDO Solution

The EasyClean™ 400 automated cleaning and calibration unit offers the highest degree of safety in pH measurement and maintenance. Using the InTrac® 777 retractable housing with its patented Tri-Lock™ triple safety system, EasyClean 400 automatically retracts the pH sensor from the process and runs a full cleaning and sensor calibration routine. This helps ensure maximum measurement performance and extends sensor life. Human intervention is only required when sensor replacements is due. Thanks to the InTrac housing's multiple O-ring sealings, complete process isolation is secured and leaking of hazardous process media is avoided.

The InPro 4800i pH/ORP sensor is the ideal probe for this application. Its double reference chamber and large PTFE diaphragm provide an excellent barrier against hydrocarbon fouling, securing accurate measurement under tough process conditions. The sensor features ISM®, METTLER TOLEDO's analyzer platform that uses digital technology for 100% signal integrity

and continuous performance diagnostics. These features maximize measurement reliability and reduce maintenance to a minimum.

InPro 4800i pH sensor

- Combined pH/ORP/temperature measurement
- High temperature and pressure rating
- Dirt-repelling PTFE annular junction
- Predictive diagnostics

EasyClean 400 cleaning and calibration system

- Completely unattended sensor maintenance
- High flexibility thanks to free choice of individually programmable intervals or weekly programs
- EasyClean 400X ensures safe application in explosion hazardous areas

InTrac 777 retractable housing

- For sensor removal without process interruption
- Advanced Tri-Lock safety system prevents release of process medium
- Intrinsically safe for operation in Ex-classified zones

► www.mt.com/InPro4800

► www.mt.com/EC400

► www.mt.com/InTrac777

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