

# Cost-effective Amine Sweetening with In-line pH Analysis

**Amine sweetening is a common unit process in ammonia production for the removal of sour gases. However, it can be a costly procedure that is often inefficient. Real-time, in-line pH analysis ensures sweetening is effective and money is not being wasted.**

## **Controlling amine sweetening**

The removal of carbon dioxide or hydrogen sulfide from syngas by amine sweetening, relies on maintaining the quality of the amine solution fed to the absorber and proper adjustment of the steam feed to the amine stripper. Insufficient steam at the stripper results in incomplete amine regeneration, while excessive steam represents a costly waste of energy. Feeding the absorber with an amine solution that is not sufficiently lean means gas absorbance will not be optimal, and adding fresh amine when it is not required is simply throwing money away.

Typical methods employed for monitoring acid gas load in amine units are laboratory analysis of samples or in-line CO<sub>2</sub>/H<sub>2</sub>S monitoring. Both techniques are not without their problems. Lab analysis is time consuming and does not pro-



vide real-time data. The amine sweetening process is a continuous operation and the acid gas load of the feedstock can fluctuate dramatically. Therefore, basing process control on grab sample analysis can be ineffective. Although in-line CO<sub>2</sub> analyzers do provide real-time data, they are expensive to purchase, install and maintain, and do not measure H<sub>2</sub>S content which may be present. But there is a third alternative: one that is not only cost effective, it is also highly efficient – in-line pH analysis.

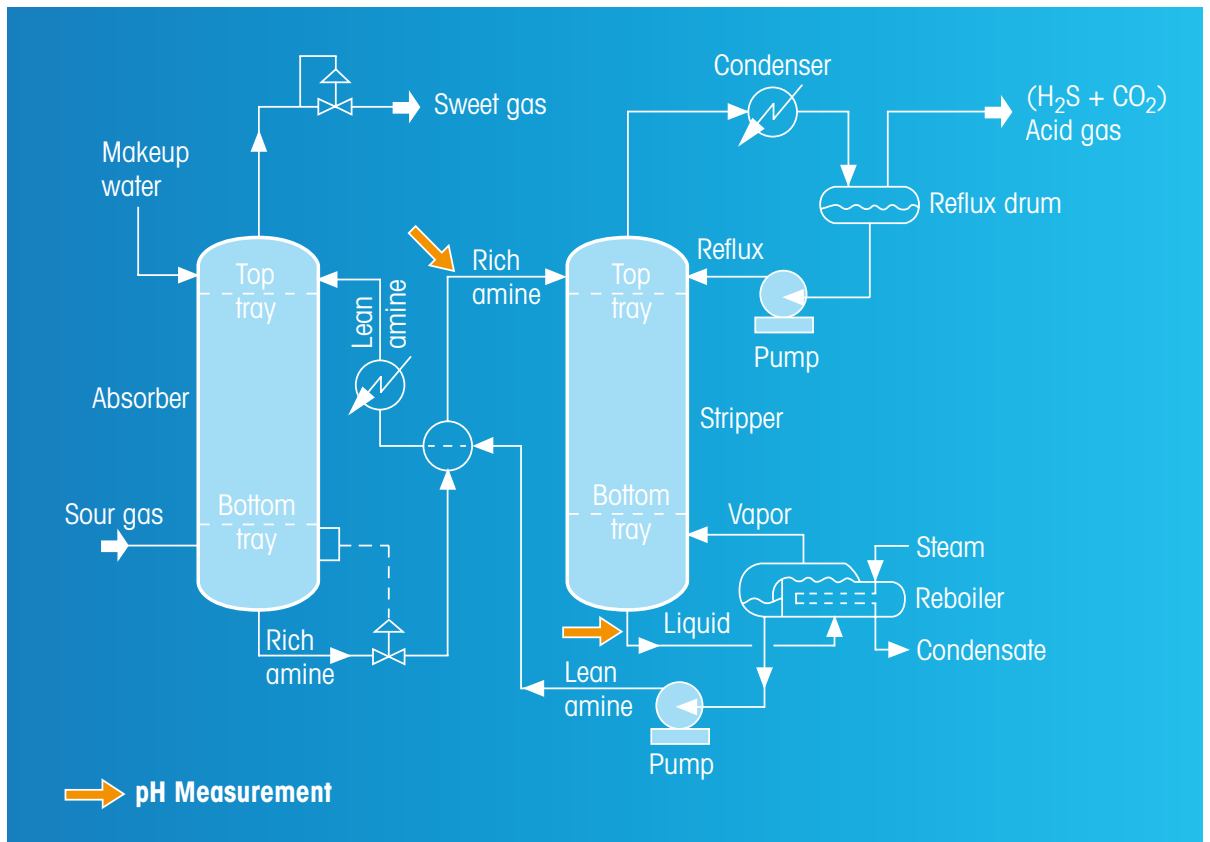
**Value of pH monitoring**

Simply by monitoring the pH upstream and downstream of the amine stripper, the acid gas load of the amine solution can be easily measured. When the acid gas load is known, the steam feed to the stripper can be adjusted to the point where it efficiently removes the acid gases from the amine solution. Degeneration of the amine solution is also easily detected, so fresh make-up amine can be added in order to guarantee sufficient absorption.



Transmitter M700

Before making adjustments to the process, the exact relationship between the pH value of the amine solution and the acid gas loading must be ascertained. The easiest way of doing this is empirically. First, the actual acid gas content of the rich and lean solutions needs to be measured in the laboratory by analyzing grab samples. Then, by comparing the acid gas concen-



Schematic of amine sweetening process.

trations found in the laboratory with the process pH values and temperatures at the time of taking the samples, the correlation between pH and acid gas loading can be determined.

The use of a METTLER TOLEDO M700 transmitter can be of great help here. With its internal flash memory card, the M700 can log both pH and temperature values for an extended period. This makes it easy to look up the process values at the time the samples were taken. And only one M700 is required for both the upstream and downstream pH electrodes.

Now, based on the upstream, real-time pH level, adjustments to the steam feed can be made to ensure the optimum amount of steam is continually being fed to the stripper. A decrease in the pH level downstream of the stripper indicates that stripping is not sufficient or that amine in the solution is spent and that fresh amine must be added.

### Rugged electrodes

For the pH measurement itself, the InPro 4260i electrode is ideal as it is designed for extended life in harsh chemical environments. The InPro 4260i benefits from a solid electrolyte and an open junction instead of a diaphragm so that fouling of the junction is minimized. Fitting a retractable housing, such as the InTrac 777, allows any maintenance work to be conducted without interruption to the process.

Additional benefits come from the inclusion of Intelligent Sensor Management (ISM) technology. ISM functionality includes Plug and Measure for fast, error-free start-up, and on-board diagnostics that predict when maintenance will be required.

### Cost savings

An in-line pH measurement solution from METTLER TOLEDO will not only verify that the amine sweetening process is doing its job, it will ensure that steam and energy at the stripper is not being wasted or that fresh amine is being misapplied.



InPro 4260 i pH electrode showing the open junction and Xerolyt EXTRA solid polymer electrolyte