[Hach 2 O] Your formula for water analysis.

Cost Effective Sour Water Stripping

Hach can help you:

- **Eliminate ammonia overstripping**
- **Reduce steam usage**
- **Decrease WWT Plant bacteria costs**

The Problem

Refineries are challenged to properly reuse or dispose of sour water by removing ammonia (NH_3) and hydrogen sulfide (H_2S) from water through a process called stripping. The stripping process uses steam to separate the inorganic compounds from the water due to their different component boiling points (Figure 1). Effective separation of ammonia and hydrogen sulfide increases the operating factor of the sulfur recovery units (SRUs), eliminates plugging in condensers and seals caused by ammonia salts, and prevents catalyst deactivation. In addition, by reducing ammonia in the feed, current SRUs reduce the bottleneck and future SRUs could be smaller in size [1].

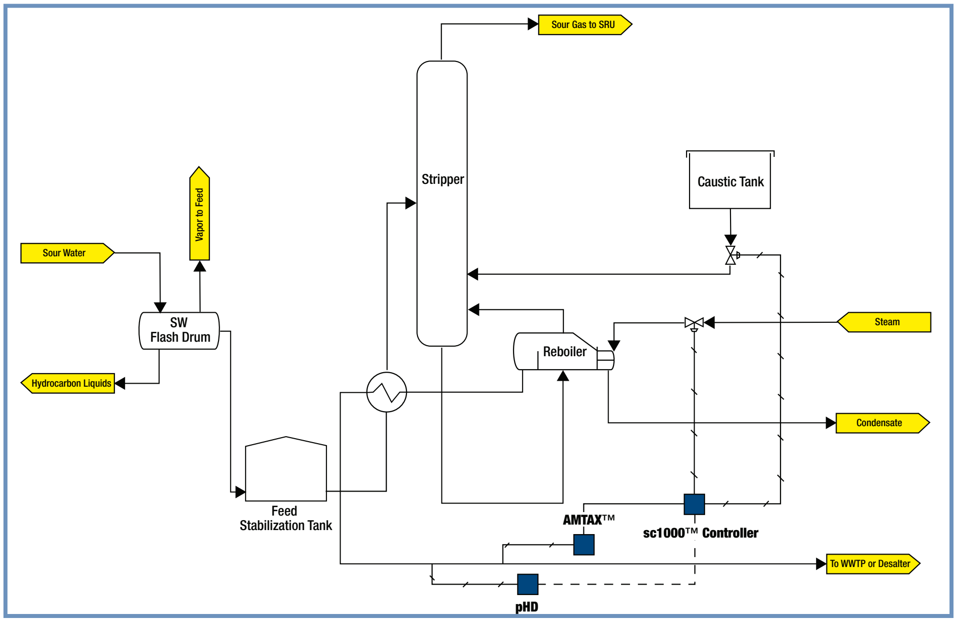


Figure 1: Stripping Process

Currently, the steam rate and sour water ph are the variables in stripping units that are most commonly optimized. An increase in re-boiler steam rate boosts the amount of ammonia and hydrogen sulfide that is stripped from the sour water; however, this comes at a high energy cost. Sour water pH management presents a unique problem since the ideal pH for stripping hydrogen sulfide is below five while effective ammonia stripping requires a pH above ten.

The inability of analytical equipment to provide real time ammonium-N (NH_4–N) content in the stripped water and pH instruments to withstand the poisonous conditions inside the distillation column has caused the industry to rely on "rules of thumb" to operate. The current recommended maximum steam rate for a single stage stripping unit is three pounds of steam per gallon for heated column feed (reflux plus feed) [2] and the ammonia and hydrogen sulfide "compromised" pH is controlled between eight and ten. This strategy does not effectively manage energy costs as steam is usually wasted without stripping any additional ammonia (overstripping). In addition, WWT Plant costs increase as additional ammonia consuming bacteria is needed to meet effluent requirements.

The Solution

The AMTAX™ Ammonia Analyzer can provide the required feedback to optimize the steam use and reduce overstripping in the sour gas stripping column as it can provide fast and continuous ammonium-N measurements in the bottoms distillate. The desired ammonium-N level in the distillate can be used as a set-point in a feedback control loop to the steam input. This will ensure that just the right amount of steam is used to meet environment guidelines and reduce the costs of additional ammonia eliminating bacteria.

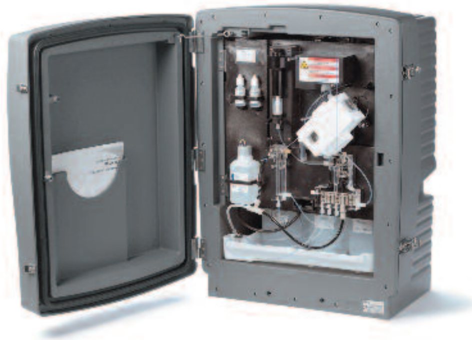
The AMTAX Analyzer uses a similar process to sour water stripping to determine the amount of ammonia in the bottoms distillate. The instrument raises the sample pH with caustic to convert any ammonium ions (NH_4^+, liquid) to ammonia (NH_3, gas). This dissolved ammonia gas content will be measured as a pH shift in a gas sensitive electrode and the reading translated into milligrams per liter (mg/L) of ammonia-N. By using the same analytical method as in sour water stripping, the AMTAX Analyzer's measurements are truly comparable with the process unit, decreasing variability to focus additional efforts in optimizing the column.

Continued on next page.

If further optimization is required, the AMTAX Analyzer can be used in conjunction with our family of pHD Differential pH Sensors. Hach's pHD sensors use a unique Salt Bridge technology and encapsulated construction to extend the working life of the sensor by protecting the reference electrode from harsh environmental conditions.

Both instruments can be used to find the ideal pH and steam flow rate at a constant ammonium-N bottoms distillate. This "sweet spot" could be used as a control loop set-point to maximize both steam and caustic use while keeping an effective ammonium-N concentration.

To enhance the optimization capabilities, both the AMTAX Analyzers and pHD Differential pH Sensors can be matched to Hach's sc1000 controller. The sc1000 can be configured to mix and match up to eight sensors/analyzers. In addition, the controller supports a variety of communication outputs including, but not limited to PROFIBUS DP, MODBUS, and GSM.



Hach Products

AMTAX™

- **Low ammonium-N (NH_4–N) detection limit of 0.02 mg/L**
- **Fast 5 minute response time including sample preparation**
- **Environmentally controlled for rugged, outdoor installations**
- **Designed specifically for easy installation at the measurement point**
- **Low Routine Maintenance**

pHD

- **Unique salt bridge extends the working life of the sensor by protecting the reference electrode from harsh process conditions.**
- **Encapsulated construction protects the sensor's built-in preamp from moisture and humidity, ensuring reliable sensor operation.**
- **Sensor can be located up to 914 m (3000 ft.) from controller**

sc1000™

- **Full featured controller with large color touch-screen display**
- **Accepts up to 8 digital sensors or expanded to a 15 sensor network**
- **Plug-and-play operation**
- **Flexible communication options—MODBUS and PROFIBUS D**

Conclusion

By running to an ammonia-N set point, the Hach Sour Water Stripping solution can decrease the stripping column steam flow rate between one and three thousand pounds per hour (Klb/hr). These conditions can save the facility up to $255K and $240K per year in energy and ammonia consuming bacteria costs, respectively. In addition, the fast and continuous ammonia-N measurements can decrease variability in the distillate to reduce waste water treatment plant process upsets and the time and cost associated with frequent grab samples to verify column efficiency.

References

1. Chevron, "WWT Two Stage Water Stripping," 1998
2. Armstrong, T et al, "Sour Water Stripping," Today's Refinery. http://www.insightengineers.com/articles/SourWaterStripping.pdf (accessed December 11, 2008).

ABOUT THE AUTHORS:

Andres M. Meza *(MBA, General Management, Harvard Business School; B.S. Chemical Engineering, University of Arkansas) has more than three years of experience as a process engineer specializing in waste water treatment plant applications. He currently holds a position as marketing manager for industrial applications, with responsibilities for business development of Hach Company's Chemical and Petroleum Refinery Segments.*

Johnny Robinson *(MS, Chemistry, Texas A&M University; B.S. Microbiology, Texas A&M University) has more than twenty years experience in technical sales and R&D in the chemical processing industry. He currently holds a position with Hach Company as Corporate Account Manager for the Petroleum Refining Industry.*

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