



The CONTACTOR™

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Water-washing Amine Unit Feed to Remove HCN

From time to time, refineries attempt to remove HCN from a sour gas stream before the gas reaches the amine unit. The method usually tried is a water wash column using a high volume *recirculating* wash water stream with a small purge or blow-down, plus a water makeup stream. The intention is to add this blow-down to the SWS feed. Anecdotally, the finding invariably reported is “It doesn’t work!” In this issue of The Contactor, we set out to dissect this scheme in order to determine the reasons for success or failure.

Figure 1 is a typical process flow scheme embodying the elements of water washing. As a specific example, this particular column contains 20 valve trays sized for 70% of jet and downcomer flood. The total water circulation rate (Stream 31) is 100 gpm to which 5 gpm of fresh water is added as Makeup and from which 5 gpm is purged.

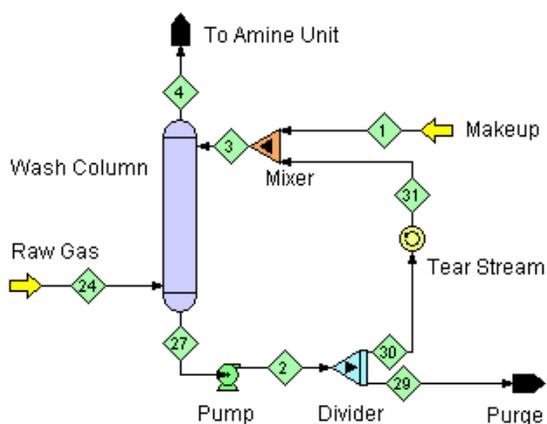


Figure 1 Water Wash to Remove HCN

Table 1 shows the raw gas analysis and the conditions of temperature, pressure, and flow rate. The key components HCN and ammonia are modeled by the ProTreat® simulator based on their mass transfer rates.

Table 1 Raw Gas Conditions and Analysis

Temperature (°F)	100
Pressure (psig)	180
Flow (MMscfd)	55
Composition	
H ₂ S (mol%)	12.36
HCN (ppmv)	100
NH ₃ (ppmv)	1,000
Methane (mol%)	36.14
Ethane (mol%)	9.27
Propene (mol%)	2.06
Propane (mol%)	2.06
1-Butene (mol%)	1.03
n-Butane (mol%)	1.03
Hydrogen (mol%)	36.04

ProTreat simulation shows that although 80% of the ammonia can be removed by a 5 gpm makeup rate of water wash, only 3.9% of the HCN can be taken out. If the makeup and purge rates are increased to 10 gpm, 7% of the HCN and 92.6% of the ammonia are removed. On the other hand, if the recycle flow is eliminated altogether and 5 gpm of fresh wash water alone is used, 4.1% of the HCN and 100% of the ammonia are removed. *Even with 100 gpm of fresh water and no recycled flow, only 37% of the HCN is removed, and using 40 trays instead of 20 does not improve this result.* HCN removal is controlled by its water solubility, not by its buildup in the recirculating water; furthermore, its reactivity with ammonia is completely swamped by the much higher H₂S concentration. We conclude that water washing a sour gas to remove HCN is truly futile.

To learn more about this and other aspects of gas treating, plan to attend one of our seminars. Visit www.protreat.com/seminars for details.

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