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Abstract

Sour Water is a water that contains a hydrogen sulfide (H_2S) and ammonia (NH_3) components. Removal of these components is essential before the water can be used. This can be done by sending the sour water to a stripping tower where heat, in the form of steam, or nitrogen (N_2) is applied in order to release these components by reduce the solubility of NH^{4+} and HS^- in the water phase. An innovative idea is proposed to reduce the acidity of raw sour water through sour stripper off-gas enhancement. This innovative idea leads to significantly enhance raw water quality, and consequently minimize acid gas flaring. Through capitalizing on enhancing the sour water stripper off-gas quality, the daily routine flaring can be reduced by eliminating the off-gas flare from Sour Water Stripper through utilizing the existing system. This document demonstrates the proposal of a new Gas Recovery System (FGRS) that will be installed in the plant to maintain the daily flaring below 1.0 MMSCFD.

The raw water enters the sour water stripper package to reduce H_2S and NH_3 content to the desired concentrtion using steam or nitrogen as a stripping agent as illustrated in Figure 1. The stripping agent is supplied through ratio-flow controller on the stripping agent line to accommodate the water inlet to the Stripper. Sour water stripper off-gas flowing at the top of the column is design to be routed to the Low Pressure (LP) Flare.

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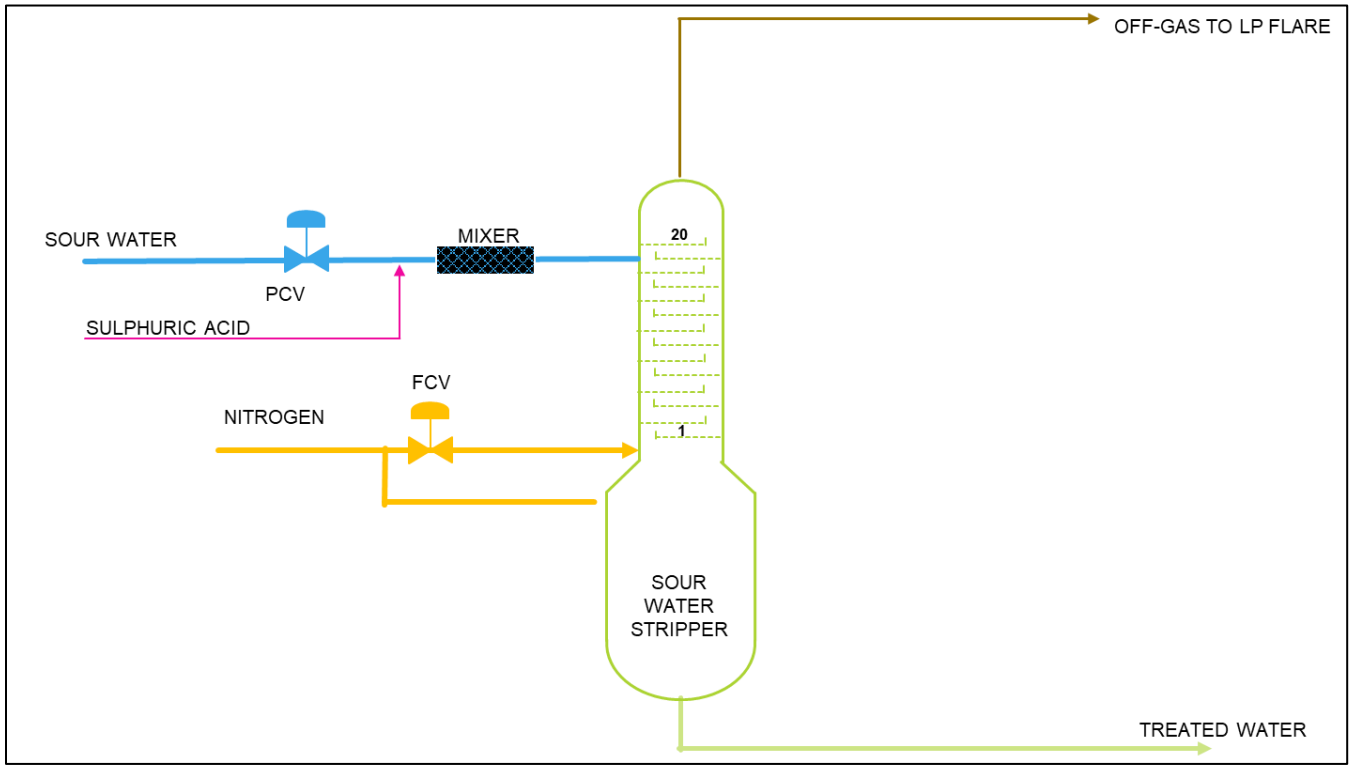

Figure 1: Schematic of topical sour water stripper

The proposed idea is to significantly improves sour water stripper off-gas quality through capitalizing on the existing system and route the sour water stripper off-gas to acid gas compressor (AGC) utilizing ejector to recompress the off-gas flow to the desire suction pressure of AGC. The ejector will utilize the available residue gas as a motive fluid Figure 2.

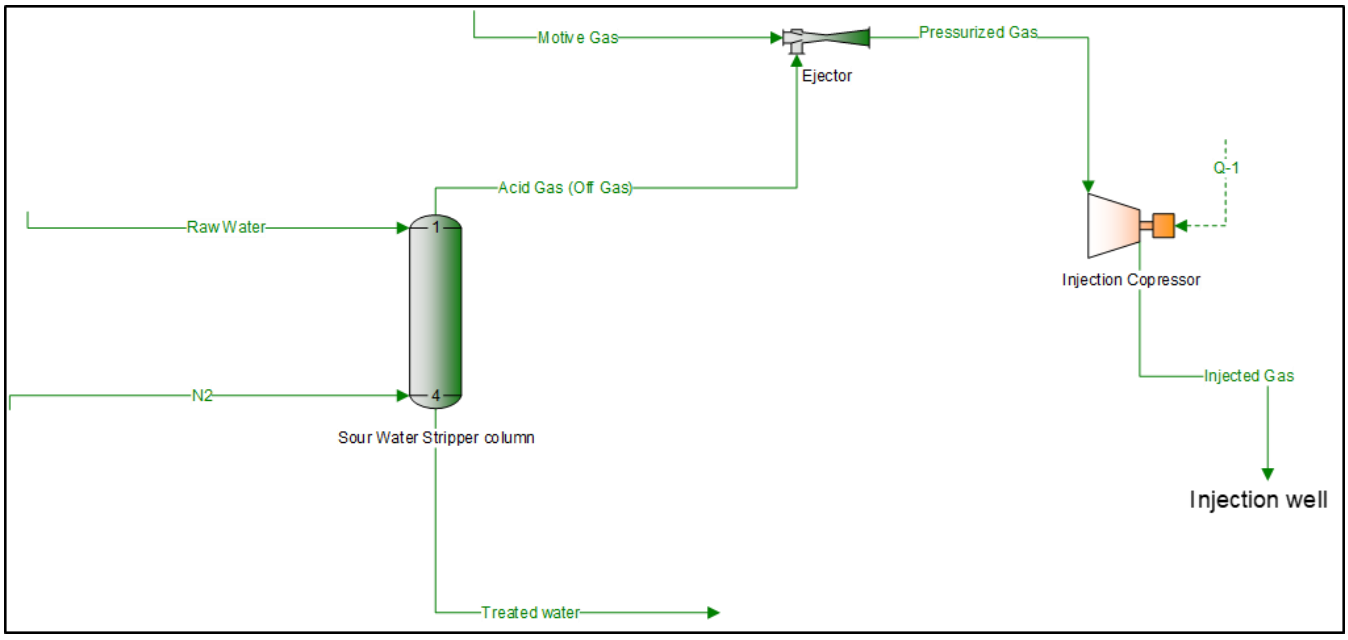

Figure 2: Schematic of proposed idea to ceases acid gas flaring

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The operating pressure of the water stripper column is usually less than 5 psig. Therefore, the proposed idea creates a vacuum which aids to enhance the efficiency of sour water stripper to strip more H_2S and NH_3 as well as ceasing acid flaring and reduces the plant emissions of harmful substance to environment such as SOx and NOx.

Off-gas recompression innovative idea was proposed to be utilized due low CAPEX and OPEX and to increase the pressure of the sour water stripper off-gas to be routed AGC suction header. This type of technical idea requires a motive gas which lies between the original motive fluid pressure and incoming suction fluid to be utilized to pressurize the sour water stripper off-gas. The proposed drive gas is to take a slipstream from residual gas header where the pressure is within the desire target. Moreover, a control valve shall be installed to control the flow of sour water stripper off-gas to the ejector and also can be used during machine trip where the sour water stripper off-gas will be routed to LP flare. Furthermore, a safety valve (ZV or XV) and a control valve shall be installed on the motive gas line to control the flow of the residual gas (motive gas) and during machine trip is to protect the low-pressure equipment downstream from pressurization scenario. Figure 3 shows the design schematic for the proposed idea.

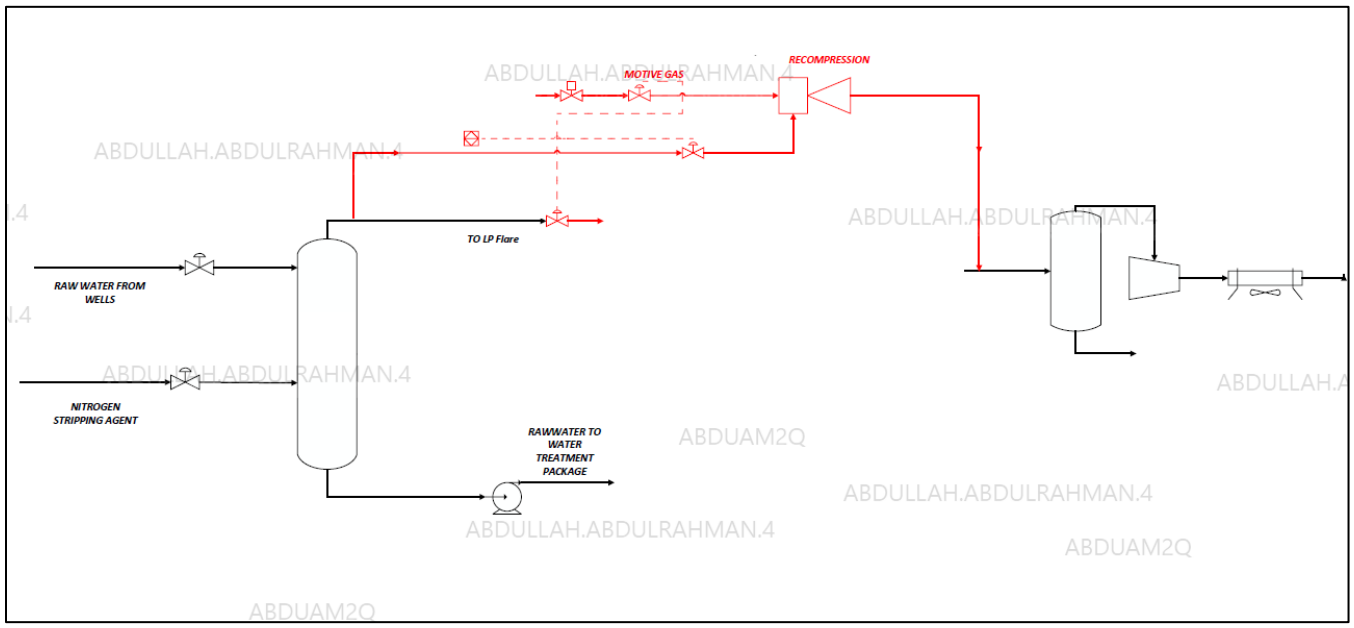

Figure 3: Detail drawing for the proposed idea

A case study for sour water stripper column with sour water entering column at flowrate of 271.5 GPM with 200 ppm H_2S content and using nitrogen as stripping agent was simulated with new proposal ideas utilizing ProMax® (version 5.0) process simulation software available from Bryan Research & Engineering, LLC having headquarters in Bryan, Texas, USA. The simulation reveals that the ejector helps to enhance the stripping efficiency where H2S content was lowered in the treated water till Zero ppm_w. Moreover, 0.436 MMSCFD of acid gas that was designed to be routed to flare and releases harmful emissions was ceased and transformed to a useful stream. The results are summarized in Table 1.

Table 1: Simulation Result

Parameter	Sour water	Stripping agent	Treated water	Off gas	Motive Gas	Re-compressed gas to AGC
Pressure	102 psig	85 psig	17.7 psig	1 psig	370 psig	60 psig
Temperature	95 ^{0}F	95 ^{0}F	95 ^{0}F	95 ^{0}F	118 ^{0}F	102.7 ^{0}F
Flowrate	271.5 GPM	0.4 MMSCFD	271.3 GPM	0.436 MMSCFD	4.13 MMSCFD	4.57 MMSCFD
H_2S Content	200 ppm_w	0 ppm_w	0 ppm_w	31330 ppm_w	0 ppm_w	2989 ppm_w

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