

SULPHURIC ACID CONCENTRATION



QVF-STANDARD-PROCESS-PLANTS

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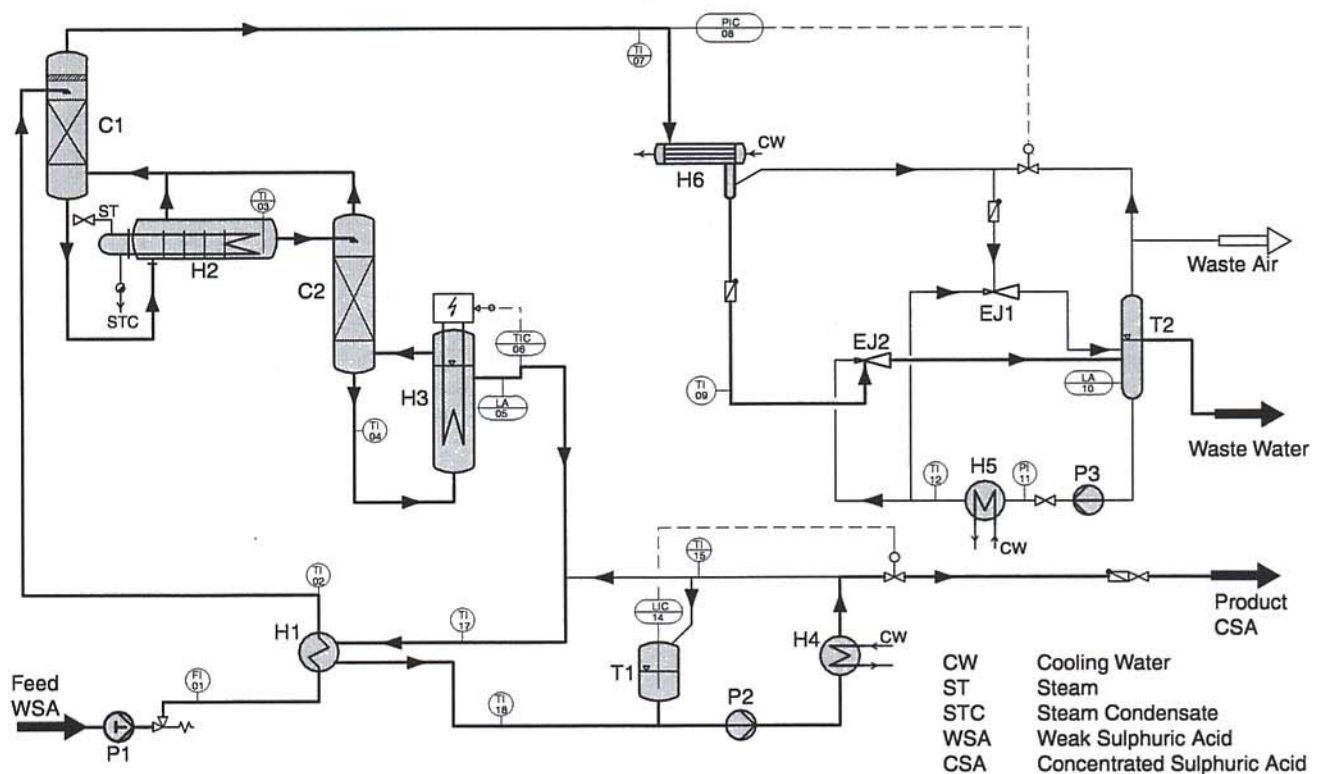
Concentrated sulphuric acid is used within many chemical processes where the consequent dilution of acid occurs. For example concentrated sulphuric acid is used for drying of gases like chlorine, bromine, hydrogen chloride or methyl chloride. If the dilute sulphuric acid is concentrated back to its initial composition, it will be possible to recycle the sulphuric acid to the process and to generate savings in raw material costs and in effluent disposal costs.

STANDARD SOLUTION BY QVF

In the following, standard process plants developed by QVF for concentration of low and medium loads of sulphuric acid are described. Materials of construction for parts wetted with acid are exclusively borosilicate glass, quartz, tantalum, silicon carbide, PVDF and PTFE. Therefore the excellent corrosion resistance across the complete range of con-

centrations. The working pressure is chosen carefully with reference to the temperature difference between the heating agent and the process as well as the temperature of the cooling agent. In addition to heating by means of saturated steam, electrically heating by immersion heating units made of quartz can be useful. Thus the energy for vacuum generation is reduced considerably and it is still possible to condense the vapour by means of ordinary cooling water even for a final sulphuric acid concentration of 96 wt.-% H₂SO₄.

In case of a liquid concentration above 75 wt.-% H₂SO₄ it has to be taken into account that the H₂SO₄ content of the vapour increases very steeply. For this reason vapour scrubbing columns are placed upstream to the evaporators in order to minimize the sulphuric acid content of the condensed waste water. The scrubbing columns are equipped



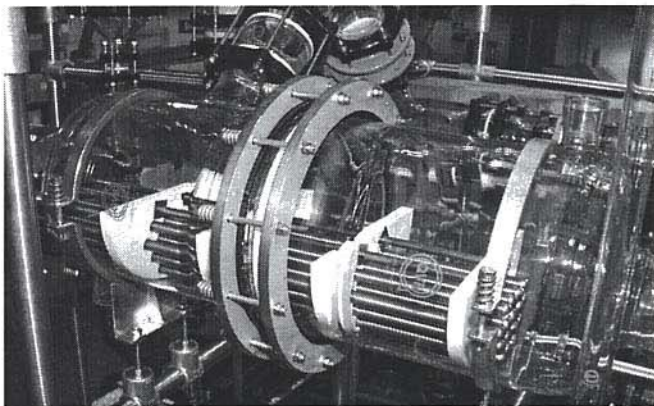
centration ensures reliable operation.

The concentration of sulphuric acid is essentially the evaporation of water. This concentration process is carried out under vacuum in order to decrease the boiling temperature, which is particularly necessary for higher sulphuric acid

with the structured packing DURAPACK® made of borosilicate glass, which enables high capacity, low pressure drop and simultaneously high efficiency mass transfer even for treatment of boiling concentrated sulphuric acid.

PLANT DESIGN

The QVF standard plant for concentration of sulphuric acid is depicted in the flow sheet shown overleaf. Weak sulphuric acid, e.g. sulphuric acid of 80 wt.-% H₂SO₄, is fed by dosing pump P1 via recuperator H1, into scrubbing column C1. In H1 the acid is preheated by means of the concentrated product acid, e.g. sulphuric acid of 96 wt.-% H₂SO₄. In scrubbing column C1 the acidic content of the vapour, produced in evaporator H2 and scrubbing column C2, is washed out. Next the acid enters the horizontal evaporator



horizontal boiler

H2 at one end and leaves it with higher concentration at the other. Evaporator H2 is designed as a horizontal vessel made of borosilicate glass. The lower part of the evaporator is equipped with baffles in transverse direction. In flow direction the baffles approximate to a chamber cascade, and the acid is concentrated step by step within the chambers. Discharge of higher concentrated acid out of horizontal evaporator H2 is done via free overflow and the acid is fed to the top of scrubbing column C2. The aim of column C2 is the first step purification of the vapour rising from evaporator H3. The further scrubbing of acidic content from the vapour out of evaporator H3 is carried out together with the vapour out of evaporator H2 in scrubbing column C1.

Intermediate strength acid from column C2 enters evaporator H3 and leaves this vessel with the desired concentration. The heating of evaporator H3 is maintained electrically by immersion heating units made of quartz, enabling operation at temperatures of 180-220°C. Discharge of high concentrated product acid from evaporator H3 to recuperator H1 is done via free overflow. The horizontal concept of both evaporators and of the free flow acid discharge eliminates the need for any pump in the hot process section.

Vapour from scrubbing column C1 is condensed in condenser H6. Arising condensate leaves the plant via free overflow out of separator T2. Vacuum generation is achieved

by liquid jet pump where the arising condensate is used as working fluid. Due to the use of condensate as working fluid, additional waste streams are avoided.

QVF standard plants for sulphuric acid concentration are equipped with automated process control systems, the operation is through "on screen" control.

ADVANTAGES OF QVF STANDARD-PLANTS

QVF standard plants for sulphuric acid concentration combine the following substantial advantages:

- A plant which is, insulated, pre-assembled to a great extent and requiring only short time for erection on site.
- Small space requirement.
- A low overall height due to the use of the horizontal evaporator.
- No additional waste water streams besides vapour condensate.
- Exclusive application of reliable materials of construction with excellent corrosion resistance.
- No pumps in the "hot" acid section.

Plants of further sizes are available as standard. On request it is possible to provide all standard plants with modifications, e.g. application of glass lined steel instead of glass in the hot acid section.

The following table gives performance figures for standard plants of size 2.

standard-plant; size 2	case 1	case 2
inlet (feed acid) H ₂ SO ₄	60 wt.-%	80 wt.-%
outlet (product acid) H ₂ SO ₄	75 wt.-%	96 wt.-%
maximum capacity feed acid	750 kg/h	250 kg/h
saturated steam 17bara	~ 250 kg/h	~ 80 kg/h
cooling water requirement (20°C - 28°C)	~ 15 m ³ /h	~ 5 m ³ /h
electrical power	~ 18 kW	~ 18 kW
operating pressure (vacuum)	~ 200 mbara	~ 60 mbara
Space requirement (L x W x H)	4 x 2 x 4m	4 x 2 x 4m

Our complete service capability for sulphuric acid concentration is of course far wider than the standard plants presented above. Thus we can offer many different solutions for concentration and purification. Our highly experienced engineers will be pleased to offer an individual proposal tailored to your needs. Please contact us!

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