

Process Design Technical Note

TECHNICAL NOTE HYDROGEN SULPHIDE SCRUBBING

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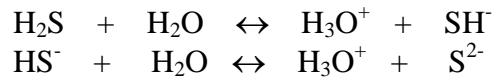
1.0 Hydrogen Sulphide Scrubbing

Atomic weight	34.08
Melting point	-85.5°C
Boiling point	-60.3 °C

1.1 Reactions of H₂S

1.1.1 Dissolution

H₂S behaves as a very weak acid in aqueous solution



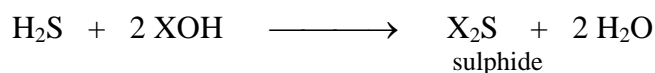
The second dissociation constant is low compared with the first, so essentially only SH⁻ ions are present.

Solubility in water:	7.10 g/l @ 0°C
	5.30 g/l @ 10°C
	3.98 g/l @ 20°C

1.1.2 Vapour pressure of H₂S

Temperature °C	Vapour pressure kPa
-20	562
0	1049
20	1814
40	2937
60	4480

1.1.3 Scrubbing



1.1.4 Caustic solutions

The reaction outlined above take place with NaOH and KOH.

1.1.5 Solubilities

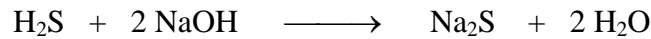
	Solubility in water @ 10°C g/l
Na ₂ S	154
K ₂ S	soluble

If concentrations in the gas are high KOH is preferred to avoid the possibility of crystallisation; otherwise, NaOH is suitable with appropriate scrubber liquor changes before blockages can occur.

1.2 Heat of Reaction

1.2.1 NaOH

Heats of formation, ΔH_f @25°C	H ₂ S (g)	-4.77 kcal/mole
	H ₂ S (aq)	-9.38
	NaOH (aq)	-112.19
	Na ₂ S (aq)	-105.17
	H ₂ O (l)	-68.32

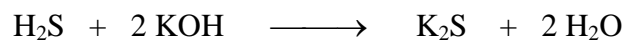


$$\begin{aligned}\text{Heat of reaction} &= -(4.77 + (2 \times -112.19)) + (-105.17 + (2 \times -68.32)) \\ &= 229.15 - 241.81 \\ &= \underline{-12.66 \text{ kcal}}\end{aligned}$$

i.e. **13 kcal/mole hydrogen sulphide** exotherm

1.2.2 KOH

Heats of formation, ΔH_f @25°C	H ₂ S (g)	-4.77 kcal/mole
	H ₂ S (aq)	-9.38
	KOH (aq)	-114.96
	K ₂ S (aq)	-110.75
	H ₂ O (l)	-68.32



$$\begin{aligned}\text{Heat of reaction} &= -(4.77 + (2 \times -114.96)) + (-110.75 + (2 \times -68.32)) \\ &= 234.69 - 247.39 \\ &= \underline{-12.70 \text{ kcal}}\end{aligned}$$

i.e. **13 kcal/mole hydrogen sulphide** exotherm

1.3 Alternative methods

Aqueous monoethanolamine can be used to scrub hydrogen sulphide and mercaptans. These can be subsequently regenerated easily from the resultant liquor.