

Family of Patented Processes

HIGHSULF™

Selective Removal of H₂S
Enrichment of Acid Gas
Tail Gas Treatment

TKK COMPANY

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*“The beauty of HIGHSULF™ process in its simplicity”
- Dr. Tofik K. Khanmamedov, Inventor*

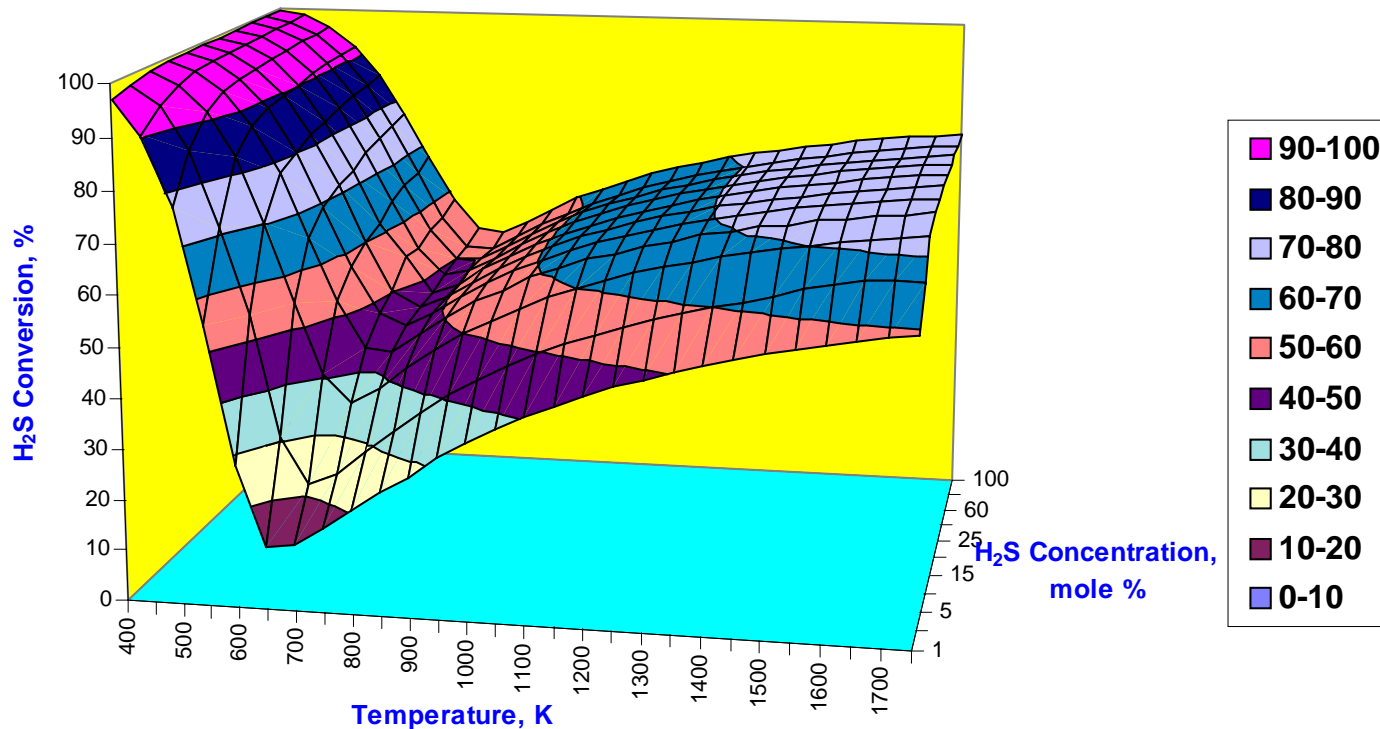
Family of Patented HIGHSULF™ Processes

**Acid Gas Enrichment at
Zero Operating Cost and
Next to Zero Capital Investment**



TKK TECHNOLOGY COMPANY (dba TKK COMPANY) – unique technology engineering company incorporated in Houston, Texas, USA. In alliance with engineering-construction companies we design, fabricate and supply units for amine desulfurization, sulfur recovery, tail gas treatment and other processes globally.

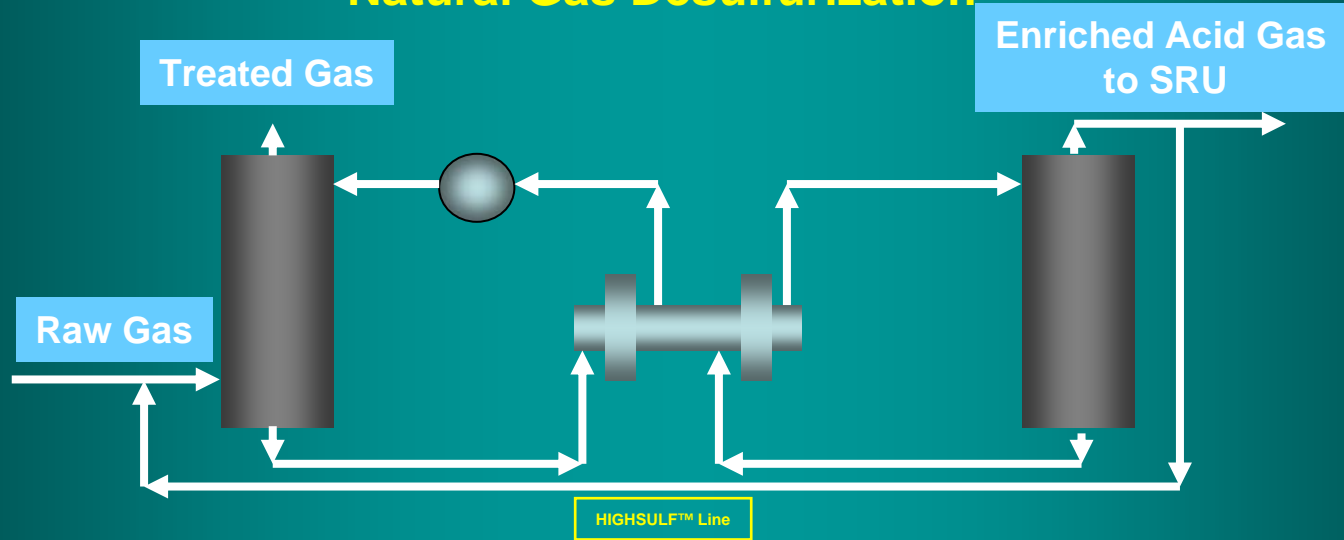
EQUILIBRIUM CONVERSION OF HYDROGEN SULFIDE TO SULFUR VS. TEMPERATURE VS. CONCENTRATION



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For the first time in sulfur world Dr. Tofik K. Khanmamedov expressed unique and complicated thermodynamic of Claus sulfur recovery process in 3d format.

Patented **HIGHSULF™** Process - Natural Gas Desulfurization

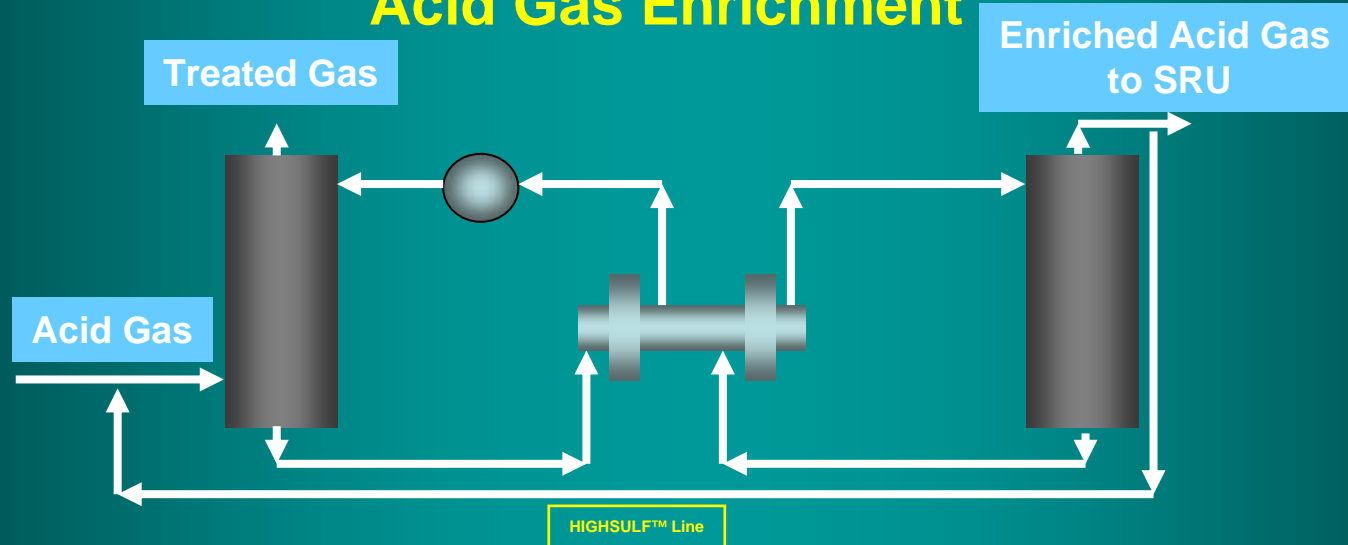


Components	Acid gas composition, mole %	
	Regular MDEA based amine unit	HIGHSULF™ MDEA based amine unit
H ₂ S	35.10	66.20
CO ₂	55.30	27.20
H ₂ O	8.43	6.40
Hydrocarbons	1.17	0.20

Advantages of HIGHSULF™ process in compare with regular:

- Substantial increases in the concentration of H₂S in the acid gas
- Reduces the size of a new SRU or increases the capacity of an existing one
- Substantially reduces the level of hydrocarbons in the acid gas and leads to an increased life for catalyst in the first reactor of SRU

Patented HIGHSULF™ Process - Acid Gas Enrichment



Parameters	Relative extent of HIGHSULF™ process application in regular amine unit, MDEA				
	0 (Regular)	1	2	3	4
H ₂ S in SRU feed (%)	29.1	33.4	39.5	48.9	67.2
Mass flow to SRU (kg/hr)	665	573	477	377	261
H ₂ S to incineration (ppmv)	0.5	0.6	0.7	1.0	4.1
CO ₂ slip (%)	80.4	84.0	87.8	91.9	96.4

Khanmamedov, T. K., "Superior Gas Sweetening", HYDROCARBON ENGINEERING, Dec, 2003; Khanmamedov, T. K., "Family of HIGHSULF™ Processes", Khimia i Teknologija Topliv i Masel, 6, 2003 (Russia); Khanmamedov, T. K., Weiland, R. H., "Upgrading Acid Gas Streams", SULPHUR, Sept-Oct, 2008; Weiland, R. H., Khanmamedov, T. K., "Acid Gas Enrichment Flow Sheet Selection", SULPHUR, Sept-Oct, 2010; Weiland, R. H., "Acid Gas Enrichment - Maximizing Selectivity", Laurence Reid Gas Conditioning Conference, Norman, OK, 2008; "Acid Gas Enrichment II: Maximizing Selectivity", PTQ Gas, spring, 2008; Khanmamedov, T. K., Weiland, R. H., "Top Treatment", Hydrocarbon Engineering, Dec 2010; Weiland, R. H., Khanmamedov, T. K., "New Strategies for Acid Gas Enrichment", 7th International Conference SOGAT (Abu Dhabi, UAE) 2011; Khanmamedov T. K., Weiland R. H., "New Strategies for Acid Gas Enrichment", SULPHUR 2011, Houston, Texas.

Patented HIGHSULF™ Process - Tail Gas Treatment

Total Sulfur Recovery – 99.9%

Parameters	Relative extent of HIGHSULF™ application in regular Tail Gas Treatment Unit, MDEA*					
	0 (Regular)	1	2	3	4	5
H₂S to SRU (MOL %)	38.6	41.8	46.4	53.6	66.3	71.4
H₂S to Incinerator (ppmv)	5.3	6.4	7.3	9.3	16.6	40.2
CO₂ Slip (%)	58.8	64.2	70.8	78.7	88.5	91.4

*** Generic Methyldiethanolamine**

Khanmamedov, T. K., "Superior Gas Sweetening", HYDROCARBON ENGINEERING, Dec, 2003; Khanmamedov, T. K., "Family of HIGHSULF™ Processes", Khimia i Teknologija Topliv i Masel, 6, 2003 (Russia) Khanmamedov, T. K., Weiland, R. H., "Upgrading Acid Gas Streams", SULPHUR, Sept-Oct, 2008; Weiland, R. H., Khanmamedov, T. K., "Acid Gas Enrichment Flow Sheet Selection", SULPHUR, Sept-Oct, 2010; Weiland, R. H., "Acid Gas Enrichment - Maximizing Selectivity", Laurence Reid Gas Conditioning Conference, Norman, OK, 2008; "Acid Gas Enrichment II: Maximizing Selectivity", PTQ Gas, spring, 2008; Khanmamedov, T. K., Weiland, R. H., "Top Treatment", Hydrocarbon Engineering, Dec 2010; Weiland, R. H., Khanmamedov, T. K., "New Strategies for Acid Gas Enrichment", 7th International Conference SOGAT (Abu Dhabi, UAE) 2011; Khanmamedov T. K., Weiland R. H., "New Strategies for Acid Gas Enrichment", SULPHUR 2011, Houston, Texas.

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