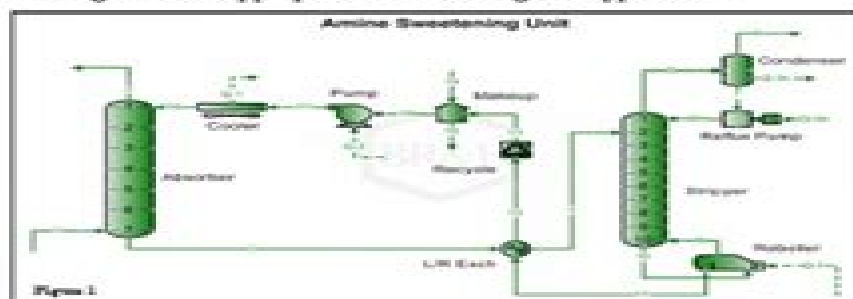


Process Insight: *Selecting the Best Solvent for Gas Treating*

Selecting the best amine/solvent for gas treating is not a trivial task. There are a number of amines available to remove contaminants such as CO_2 , H_2S and organic sulfur compounds from sour gas streams. The most commonly used amines are methanoleamine (MEA), diethanoleamine (DEA), and methyl-diethanoleamine (MDEA). Other amines include diglycoleamine[®] (DGA), diisopropanoleamine (DIPA), and triethanoleamine (TEA). Mixtures of amines can also be used to customize or optimize the acid gas recovery. Temperature, pressure, sour gas composition, and purity requirements for the treated gas must all be considered when choosing the most appropriate amine for a given application.



Primary Amines

The primary amine MEA removes both CO_2 and H_2S from sour gas and is effective at low pressure. Depending on the conditions, MEA can remove H_2S to less than 4 ppmv while removing CO_2 to less than 100 ppmv. MEA systems generally require a reclaimer to remove degraded products from circulation. Typical solution strengths range from 10 to 20 weight % with a maximum rich loading of 0.35 mole acid gas/mole MEA. DGA[®] is another primary amine that removes CO_2 , H_2S , COS, and mercaptans. Typical solution strengths are 50-60 weight %, which result in lower circulation rates and less energy required for stripping as compared with MEA. DGA also requires reclaiming to remove the degradation products.

Secondary Amines

The secondary amine DEA removes both CO_2 and H_2S but generally requires higher pressure than MEA to meet overhead specifications. Because DEA is a weaker amine than MEA, it requires less energy for stripping. Typical solution strength ranges from 25 to 35 weight % with a maximum rich loading of 0.35 mole/mole. DIPA is a secondary amine

that exhibits some selectivity for H_2S although it is not as pronounced as for tertiary amines. DIPA also removes COS. Solutions are low in corrosion and require relatively low energy for regeneration. The most common applications for DIPA are in the ADIP[®] and SULFINOL[®] processes.

Tertiary Amines

A tertiary amine such as MDEA is often used to selectively remove H_2S , especially for cases with a high CO_2 to H_2S ratio in the sour gas. One benefit of selective absorption of H_2S is a Claus feed rich in H_2S . MDEA can remove H_2S to 4 ppmv while maintaining 2% or less CO_2 in the treated gas using relatively less energy for regeneration than that for DEA. Higher weight percent amine and less CO_2 absorbed results in lower circulation rates as well. Typical solution strengths are 40-50 weight % with a maximum rich loading of 0.55 mole/mole. Because MDEA is not prone to degradation, corrosion is low and a reclaimer is unnecessary. Operating pressure can range from atmospheric, typical of tail gas treating units, to over 1,000 psia.

Mixed Solvents

In certain situations, the solvent can be "customized" to optimize the sweetening process. For example, adding a primary or secondary amine to MDEA can increase the rate of CO_2 absorption without compromising the advantages of MDEA. Another less obvious application is adding MDEA to an existing DEA unit to increase the effective weight % amine to absorb more acid gas without increasing circulation rate or reboiler duty. Many plants utilize a mixture of amine with physical solvents. SULFINOL is a licensed product from Shell Oil Products that combines an amine with a physical solvent. Advantages of this solvent are increased mercaptan pickup, lower regeneration energy, and selectivity to H_2S .

Choosing the Best Alternative

Given the wide variety of gas treating options, a process simulator that can accurately predict sweetening results is a necessity when attempting to determine the best option. ProMax[®] has been proven to accurately predict results for numerous process schemes. Additionally, ProMax can utilize a scenario tool to perform feasibility studies. The scenario tool may be used to systematically vary selected parameters in an effort to determine the optimum operating conditions and the appropriate solvent. These studies can determine rich loading, reboiler duty, acid gas content of the sweet gas, amine losses, required circulation rate, type of amine or physical solvent, weight percent of amine, and other parameters. ProMax can model virtually any flow process or configuration including multiple columns, liquid hydrocarbon treating, and split flow processes. In addition, ProMax can accurately model caustic treating applications as well as physical solvent sweetening with solvents such as Coastal AGR[®], methanol, and NMP. For more information about ProMax and its ability to determine the appropriate solvent for a given set of conditions, contact Bryan Research & Engineering.

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Gas Treating With Chemical Solvents

**Giovanni Astarita, David W.
Savage, Attilio Bisio**



Gas Treating With Chemical Solvents:

Gas Treating with Chemical Solvents Giovanni Astarita, David W. Savage, Attilio Bisio, 1983 **Gas Treating with Chemical Solvents** Giovanni Astarita, **Environmental Technologies to Treat Sulfur Pollution** Piet Lens, L. W. Hulshoff Pol, 2000-01-01 Environmental Technologies to Treat Sulfur Pollution Principles and Engineering provides a definitive and detailed discussion of state of the art environmental technologies to treat pollution by sulfurous compounds of wastewater off gases solid waste soils and sediments Special attention is given to novel bioremediation techniques that have been developed over the last 10 years Information density is unique owing to the many figures and graphs 150 tables over 80 and over 1500 cited literature references A detailed subject index helps the reader to find their way through the different technological applications making it the perfect reference work for professionals and consultants dealing with sulfur related environmental bio technologies Contents Part I The sulfur cycle Part II Technologies to Desulfurise Resources Part III Treatment of Waters Polluted by Sulfurous Compounds Part IV Treatment of Gases Polluted by Sulfurous Compounds Part V Treatment of Soils and Sediments Polluted by Sulfurous Compounds Part VI Other Applications of Sulfur Cycle Bioconversions in Environmental Engineering Part VII Problems Related to Sulfur Cycle Bioconversions **Gas Treating** Dag Eimer, 2014-08-25 Gas Treating Absorption Theory and Practice provides an introduction to the treatment of natural gas synthesis gas and flue gas addressing why it is necessary and the challenges involved The book concentrates in particular on the absorption desorption process and mass transfer coupled with chemical reaction Following a general introduction to gas treatment the chemistry of CO₂ H₂S and amine systems is described and selected topics from physical chemistry with relevance to gas treating are presented Thereafter the absorption process is discussed in detail column hardware is explained and the traditional mass transfer model mechanisms are presented together with mass transfer correlations This is followed by the central point of the text in which mass transfer is combined with chemical reaction highlighting the associated possibilities and problems Experimental techniques data analysis and modelling are covered and the book concludes with a discussion on various process elements which are important in the absorption desorption process but are often neglected in its treatment These include heat exchange solution management process flowsheet variations choice of materials and degradation of absorbents The text is rounded off with an overview of the current state of research in this field and a discussion of real world applications This book is a practical introduction to gas treating for practicing process engineers and chemical engineers working on purification technologies and gas treatment in particular those working on CO₂ abatement processes as well as post graduate students in process engineering chemical engineering and chemistry

Handbook of Natural Gas Transmission and Processing Saeid Mokhatab, William A. Poe, John Y. Mak, 2018-10-26 Written by an internationally recognized team of natural gas industry experts the fourth edition of Handbook of Natural Gas Transmission and Processing is a unique well researched and comprehensive work on the design and operation aspects of

natural gas transmission and processing Six new chapters have been added to include detailed discussion of the thermodynamic and energy efficiency of relevant processes and recent developments in treating super rich gas high CO₂ content gas and high nitrogen content gas with other contaminants The new material describes technologies for processing today s unconventional gases providing a fresh approach in solving today s gas processing challenges including greenhouse gas emissions The updated edition is an excellent platform for gas processors and educators to understand the basic principles and innovative designs necessary to meet today s environmental and sustainability requirement while delivering acceptable project economics Covers all technical and operational aspects of natural gas transmission and processing Provides pivotal updates on the latest technologies applications and solutions Helps to understand today s natural gas resources and the best gas processing technologies Offers design optimization and advice on the design and operation of gas plants

Fundamentals of Natural Gas Processing Arthur J. Kidnay, William R. Parrish, Daniel G. McCartney, 2011-01-05 Offering indispensable insight from experts in the field Fundamentals of Natural Gas Processing Second Edition provides an introduction to the gas industry and the processes required to convert wellhead gas into valuable natural gas and hydrocarbon liquids products The authors compile information from the literature meeting proceedings and the

Ullmann's Energy Wiley-VCH, 2015-06-02 Mit einer Sammlung der wichtigsten Artikel aus ULLMANN s Encyclopedia of Industrial Chemistry bietet dieses dreibändige Handbuch unzählige Informationen zu Energieressourcen und Technologien Dabei werden erneuerbare und auch fossile Energieträger gleichermaßen behandelt *Chemicals and Fuels from Biomass via Fischer-Tropsch Synthesis* Joshua Gorimbo, Xinying Liu, Yali Yao, Diane Hildebrandt, 2022-11-18 In an effort to reduce dependency on fossil fuel resources biomass could essentially be converted into chemicals using high capacity processes The Fischer Tropsch Synthesis FTS pathway has been chosen as the focus of this book as it is a mature area and unlike other pathways such as pyrolysis FTS is a potential way of producing fuel hydrocarbons with no sulfur no nitrogen and no heavy metals contamination making it a good choice Integrating technological development and business development rationales to highlight the key technological developments that are necessary to industrialize biofuels on a global scale this book focusses on the key challenges that still hinder the effective biomass use and the realization of zero fossil fuel use Traditional biomass to hydrocarbons pathways are covered showcasing how they are tailored to yield a specific group of chemicals with the aim of reducing downstream processes New developments are considered including process synthesis catalysts and reactors etc Providing an up to date overview of the production of specialty chemicals and fuels from biomass via the Fischer Tropsch Synthesis pathway this title makes an excellent addition to the libraries of academics and practitioners working in catalysis and chemical engineering

Re-Engineering the Chemical Processing Plant Andrzej Stankiewicz, Jacob A. Moulijn, 2003-11-07 The first guide to compile current research and frontline developments in the science of process intensification PI Re Engineering the Chemical Processing Plant illustrates the design integration and application of PI

principles and structures for the development and optimization of chemical and industrial plants This volume updates professionals on emerging PI equipment and methodologies to promote technological advances and operational efficacy in chemical biochemical and engineering environments and presents clear examples illustrating the implementation and application of specific process intensifying equipment and methods in various commercial arenas *Encyclopedia of Chemical Processing and Design* John J. McKetta Jr,1995-06-26 Written by engineers for engineers with over 150 International Editorial Advisory Board members this highly lauded resource provides up to the minute information on the chemical processes methods practices products and standards in the chemical and related industries **Fundamentals of Natural Gas Processing, Third Edition** Arthur J. Kidnay,William R. Parrish,Daniel G. McCartney,2019-10-01 Offering indispensable insight from experts in the field Fundamentals of Natural Gas Processing Third Edition provides an introduction to the gas industry and the processes required to convert wellhead gas into valuable natural gas and hydrocarbon liquids products including LNG The authors compile information from the literature meeting proceedings short courses and their own work experiences to give an accurate picture of where gas processing technology stands today as well as to highlight relatively new technologies that could become important in the future The third edition of this bestselling text features updates on North American gas processing and changing gas treating requirements due to shale gas production It covers the international nature of natural gas trade LNG economics and more To help nonengineers understand technical issues the first 5 chapters present an overview of the basic engineering concepts applicable throughout the gas oil and chemical industries The following 15 chapters address natural gas processing with a focus on gas plant processes and technologies The book contains 2 appendices The first contains an updated glossary of gas processing terminology The second is available only online and contains useful conversion factors and physical properties data Aimed at students as well as natural gas processing professionals this edition includes both discussion questions and exercises designed to reinforce important concepts making this book suitable as a textbook in upper level or graduate engineering courses **Natural Gas Processing** Alireza Bahadori,2014-05-05 Natural gas is considered the dominant worldwide bridge between fossil fuels of today and future resources of tomorrow Thanks to the recent shale boom in North America natural gas is in a surplus and quickly becoming a major international commodity Stay current with conventional and now unconventional gas standards and procedures with Natural Gas Processing Technology and Engineering Design Covering the entire natural gas process Bahadori s must have handbook provides everything you need to know about natural gas including Fundamental background on natural gas properties and single multiphase flow factors How to pinpoint equipment selection criteria such as US and international standards codes and critical design considerations A step by step simplification of the major gas processing procedures like sweetening dehydration and sulfur recovery Detailed explanation on plant engineering and design steps for natural gas projects helping managers and contractors understand how to schedule plan and manage a safe and efficient

processing plant Covers both conventional and unconventional gas resources such as coal bed methane and shale gas Bridges natural gas processing with basic and advanced engineering design of natural gas projects including real world case studies Digs deeper with practical equipment sizing calculations for flare systems safety relief valves and control valves

Petroleum and Gas Field Processing Hussein K. Abdel-Aal, Mohamed A. Aggour, Mohamed A. Fahim, 2003-07-03 The immediate product extracted from oil and gas wells consists of mixtures of oil gas and water that is difficult to transport requiring a certain amount of field processing This reference analyzes principles and procedures related to the processing of reservoir fluids for the separation handling treatment and production of quality petroleum oil and gas products It details strategies in equipment selection and system design field development and operation and process simulation and control to increase plant productivity and safety and avoid losses during purification treatment storage and export Providing guidelines for developing efficient and economical treatment systems the book features solved design examples that demonstrate the application of developed design equations as well as review problems and exercises of key engineering concepts in petroleum field development and operation

Rules of Thumb for Chemical Engineers Stephen M Hall, 2011-03-31 This new edition of the most complete handbook for chemical and process engineers incorporates the latest information for engineers and practitioners who depend on it as a working tool New material explores the recent trends and updates of gas treating and fractionator computer solutions analysis Substantial additions to this edition include a new section on gasification that reflects the many new trends and techniques in the field and a treatment on compressible fluid flow This convenient volume provides engineers with hundreds of common sense techniques shortcuts and calculations to quickly and accurately solve day to day design operations and equipment problems Here in a compact easy to use format are practical tips handy formulas correlations curves charts tables and shortcut methods that will save engineers valuable time and effort The standard handbook for chemical and process engineers All new material on pinch point analysis on networks of heat exchangers and updates on gas treating in process design and heat transfer Hundreds of common sense techniques and calculations

Contamination Control in the Natural Gas Industry Thomas H. Wines, Saeid Mokhatab, 2021-11-25 Contamination Control in the Natural Gas Industry delivers the separation fundamentals and technology applications utilized by natural gas producers and processors This reference covers principles and practices for better design and operation of a wide range of media filters and systems to remove contaminants from liquids and gases enabling gas industry professionals to fulfill diverse fluid purification requirements Packed to cover practical technologies diagnostics and troubleshooting methods this book provides gas engineers and technologists with a critical first ever reference geared to contamination control Covers contamination control methods and equipment specific to the natural gas industry Includes guidelines on fundamentals and real world technologies used today Gives engineers better design and operation with rating methods standards and case histories

Modeling, Control, and Optimization of Natural Gas Processing Plants William A. Poe, Saeid

Mokhatab,2016-09-09 Modeling Control and Optimization of Natural Gas Processing Plants presents the latest on the evolution of the natural gas industry shining a light on the unique challenges plant managers and owners face when looking for ways to optimize plant performance and efficiency including topics such as the various feed gas compositions temperatures pressures and throughput capacities that keep them looking for better decision support tools The book delivers the first reference focused strictly on the fast growing natural gas markets Whether you are trying to magnify your plants existing capabilities or are designing a new facility to handle more feedstock options this reference guides you by combining modeling control and optimization strategies with the latest developments within the natural gas industry including the very latest in algorithms software and real world case studies Helps users adapt their natural gas plant quickly with optimization strategies and advanced control methods Presents real world application for gas process operations with software and algorithm comparisons and practical case studies Provides coverage on multivariable control and optimization on existing equipment Allows plant managers and owners the tools they need to maximize the value of the natural gas produced

Green Solvents II Ali Mohammad,Dr. Inamuddin,2012-03-19 The conventional solvents used in chemical pharmaceutical biomedical and separation processes represent a great challenge to green chemistry because of their toxicity and flammability Since the beginning of the 12 Principles of Green Chemistry in 1998 a general effort has been made to replace conventional solvents with environmentally benign substitutes Water has been the most popular choice so far followed by ionic liquids surfactant supercritical fluids fluoruous solvents liquid polymers bio solvents and switchable solvent systems Green Solvents Volume I and II provides a throughout overview of the different types of solvents and discusses their extensive applications in fields such as extraction organic synthesis biocatalytic processes production of fine chemicals removal of hydrogen sulphide biochemical transformations composite material energy storage devices and polymers These volumes are written by leading international experts and cover all possible aspects of green solvents properties and applications available in today s literature Green Solvents Volume I and II is an invaluable guide to scientists R D industrial specialists researchers upper level undergraduates and graduate students Ph D scholars college and university professors working in the field of chemistry and biochemistry

Food Engineering Handbook Theodoros Varzakas,Constantina Tzia,2014-12-02 Food Engineering Handbook Food Engineering Fundamentals provides a stimulating and up to date review of food engineering phenomena Combining theory with a practical hands on approach this book covers the key aspects of food engineering from mass and heat transfer to steam and boilers heat exchangers diffusion and absorption A complement to Fundamentals of Petroleum Refining Mohamed A. Fahim,Taher A. Al-Sahhaf,Amal Elkilani,2009-11-19 Fundamentals of Petroleum Refining presents the fundamentals of thermodynamics and kinetics and it explains the scientific background essential for understanding refinery operations The text also provides a detailed introduction to refinery engineering topics ranging from the basic principles and unit operations to overall refinery economics The book covers important topics such as

clean fuels gasification biofuels and environmental impact of refining which are not commonly discussed in most refinery textbooks Throughout the source problem sets and examples are given to help the reader practice and apply the fundamental principles of refining Chapters 1 10 can be used as core materials for teaching undergraduate courses The first two chapters present an introduction to the petroleum refining industry and then focus on feedstocks and products Thermophysical properties of crude oils and petroleum fractions including processes of atmospheric and vacuum distillations are discussed in Chapters 3 and 4 Conversion processes product blending and alkylation are covered in chapters 5 10 The remaining chapters discuss hydrogen production clean fuel production refining economics and safety acid gas treatment and removal and methods for environmental and effluent treatments This source can serve both professionals and students on undergraduate and graduate levels of Chemical and Petroleum Engineering Chemistry and Chemical Technology Beginners in the engineering field specifically in the oil and gas industry may also find this book invaluable Provides balanced coverage of fundamental and operational topics Includes spreadsheets and process simulators for showing trends and simulation case studies Relates processing to planning and management to give an integrated picture of refining

Solvent Processes in Refining Technology James G. Speight, 2023-12-12 This book focuses on the various solvent processes that are used in crude oil refineries It presents the differences between each type of process and discusses the types of feedstock that can be used for the processes This accessible guide is written for managers professionals and technicians as well as graduate students transitioning into the refining industry Key Features Describes the various steps that are necessary for the solvent treatment of various feedstocks in crude oil refineries Brings the reader up to date and adds more data Provides an extensive glossary Considers next generation processes and developments

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