



Process Simulation of Dimethyl Ether Synthesis from Methanol Using Honeywell UniSim Design R490

Shubham Berad¹, Pankaj Shinde², Sanket Pawar³, Atifuzzama Qazi⁴

Undergraduate student, Chemical Engineering, Dr. D Y Patil Institute of Engineering Management and Research, Akurdi, Pune, India¹⁻⁴

Abstract: Implementing dimethyl ether in order to blend in LPG has led to remarkable profits. The present work focuses on the simulation of the synthesis of dimethyl ether from methanol using Honeywell's UniSim Design R490. Dimethyl ether is considered a green energy source as an additive for diesel fuel. This is preferred for the next clean energy production, and dimethyl ether is chosen because its demand is increasing due to its remarkable properties. The indirect method of producing methanol and using it as a raw material for the synthesis of DME is quite useful for large commercial production. However, current work will demonstrate methanol as a feed and dimethyl ether as an end product. Shell and tube heat exchanger at different operation conditions show that important calculated LMTD and minimum approach values are feasible for good heat transfer while minimizing power consumption.

Keywords: Dimethyl Ether, Methanol, Process Simulation, Shell and Tube Heat Exchanger, Heat Integration, Process Simulation Software, Honeywell UniSim Design

INTRODUCTION

Due to the current issues with global environmental contamination and the availability of energy, dimethyl ether (DME), a multiple-use product sourced from multiple processes, has drawn increasing attention. DME has several uses, such as an alternative to LPG. A large application area of DME is in aerosol propellant and solvent, as it is less toxic, chemically inactive, and has better solubility of polar as well as non-polar compounds. [1]

The experimental research on the diesel engine running on a significant proportion of DME exhaust has found no smoke, less noise, and fewer NOX emissions.

[2] Moreover, it signifies that DME has great combustion properties. Likewise, DME has a high heating value due to its low saturation steam pressure and physical characteristics that are equivalent to those of liquefied petroleum gas. [3] There has been speculation that DME may be used as a domestic fuel.

Dimethyl ether, abbreviated as DME, is a commercially produced fuel that doesn't occur naturally in petroleum. Due to the absence of sulfur, DME has an increased oxygen concentration and a small amount of carbon, and it burns cleanly and does not release particulate matter (PM) or sulfur oxides (SOx) during combustion. Because of its low emissions during combustion, it has great potential as a renewable energy source in the future. [4]

The Asia-Pacific market for dimethyl ether is expected to have a 10.5% CAGR until 2028.

Figure 1 shows the expected CAGR for the DME market in the Asia-Pacific region. China, Japan, and India are among the top producers in the Asia-Pacific region. China is the largest producer among countries in Asia. From the below chart, it can be seen that the year 2020 has shown a gradual decrease in size due to the COVID-19 outbreak. But as the situation came to a stable level, it has shown a steady rise due to the rising demand for global crude oil for the production of fuel.[5]

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Angelo Basile, Francesco Dalena



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Applications in Design and Simulation of Sustainable Chemical Processes Alexandre C. Dimian, Costin Sorin Bildea, Anton A. Kiss, 2019-08-08 *Applications in Design and Simulation of Sustainable Chemical Processes* addresses the challenging applications in designing eco friendly but efficient chemical processes including recent advances in chemistry and catalysis that rely on renewable raw materials Grounded in the fundamental knowledge of chemistry thermodynamics chemical reaction engineering and unit operations this book is an indispensable resource for developing and designing innovating chemical processes by employing computer simulations as an efficient conceptual tool Targeted to graduate and post graduate students in chemical engineering as well as to professionals the book aims to advance their skills in process innovation and conceptual design The work completes the book *Integrated Design and Simulation of Chemical Processes* by Elsevier 2014 authored by the same team Includes comprehensive case studies of innovative processes based on renewable raw materials Outlines Process Systems Engineering approach with emphasis on systematic design methods Employs steady state and dynamic process simulation as problem analysis and flowsheet creation tool Applies modern concepts as process integration and intensification for enhancing the sustainability

Methanol Angelo Basile, Francesco Dalena, 2017-10-31 *Methanol Science and Engineering* provides a comprehensive review of the chemistry properties and current and potential uses and applications of methanol Divided into four parts the book begins with a detailed account of current production methods and their economics The second part deals with the applications of methanol providing useful insights into future applications Modeling of the various reactor systems is covered in the next section with final discussions in the book focusing on the economic and environmental impact of this chemical Users will find this to be a must have resource for all researchers and engineers studying alternative energy sources Provides the latest developments on methanol research Reviews methanol production methods and their economics Outlines the use of methanol as an alternative green transportation fuel Includes new technologies and many new applications of methanol

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development Illustrates several examples of design and analysis of integrated energy systems Discusses performance assessment and optimization Uses illustrative examples and global case studies to explain methodologies and concepts

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Computed Aided Process Engineering Valentin Plesu, Paul Serban Agachi, 2007-05-24 The 17th European Symposium on Computed Aided Process Engineering contains papers presented at the 17th European Symposium of Computer Aided Process Engineering ESCAPE 17 held in Bucharest Romania from 27-30 May 2007. The ESCAPE series serves as a forum for scientists and engineers from academia and industry to discuss progress achieved in the area of Computer Aided Process Engineering CAPE. The main goal was to emphasize the continuity in research of innovative concepts and systematic design methods as well as the diversity of applications emerged from the demands of sustainable development. ESCAPE 17 highlights the progress in software technology needed for implementing simulation based tools. The symposium is based on 5 themes and 27 topics following the main trends in CAPE area: Modelling Process and Products Design Optimisation and Optimal Control and Operation System Biology and Biological Processes Process Integration and Sustainable Development. Participants from 50 countries attended and invited speakers presented 5 plenary lectures tackling broad subjects and 10 keynote lectures. Satellite events added a plus to the scientific dimension to this symposium. All contributions are included on the CD-ROM attached to the book. Attendance from 50 countries with invited speakers presenting 5 plenary lectures tackling broad subjects and 10 keynote lectures.

29th European Symposium on Computer Aided Chemical Engineering Anton A. Kiss, Edwin Zondervan, Richard Lakerveld, Leyla Özkan, 2019-06-28 The 29th European Symposium on Computer Aided Process Engineering contains the papers presented at the 29th European Symposium of Computer Aided Process Engineering ESCAPE event held in Eindhoven The Netherlands from June 16-19 2019. It is a valuable resource for chemical engineers chemical process engineers researchers in industry and academia students and consultants for chemical industries. Presents findings and discussions from the 29th European Symposium of Computer Aided Process Engineering ESCAPE event.

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Integrated Design and Simulation of Chemical Processes Alexandre C. Dimian, Costin Sorin Bildea, Anton A.

Kiss, 2014-09-18 This comprehensive work shows how to design and develop innovative optimal and sustainable chemical processes by applying the principles of process systems engineering leading to integrated sustainable processes with green attributes Generic systematic methods are employed supported by intensive use of computer simulation as a powerful tool for mastering the complexity of physical models New to the second edition are chapters on product design and batch processes with applications in specialty chemicals process intensification methods for designing compact equipment with high energetic efficiency plantwide control for managing the key factors affecting the plant dynamics and operation health safety and environment issues as well as sustainability analysis for achieving high environmental performance All chapters are completely rewritten or have been revised This new edition is suitable as teaching material for Chemical Process and Product Design courses for graduate MSc students being compatible with academic requirements world wide The inclusion of the newest design methods will be of great value to professional chemical engineers Systematic approach to developing innovative and sustainable chemical processes Presents generic principles of process simulation for analysis creation and assessment Emphasis on sustainable development for the future of process industries **14th International Symposium**

on Process Systems Engineering Yoshiyuki Yamashita, Manabu Kano, 2022-06-24 14th International Symposium on Process Systems Engineering Volume 49 brings together the international community of researchers and engineers interested in computing based methods in process engineering The conference highlights the contributions of the PSE community towards the sustainability of modern society and is based on the 2021 event held in Tokyo Japan July 1-23 2021 It contains contributions from academia and industry establishing the core products of PSE defining the new and changing scope of our results and covering future challenges Plenary and keynote lectures discuss real world challenges globalization energy environment and health and contribute to discussions on the widening scope of PSE versus the consolidation of the core topics of PSE Highlights how the Process Systems Engineering community contributes to the sustainability of modern society Establishes the core products of Process Systems Engineering Defines the future challenges of Process Systems Engineering

Process Modelling and Simulation in Chemical, Biochemical and Environmental Engineering Ashok Kumar

Verma, 2014-10-17 The use of simulation plays a vital part in developing an integrated approach to process design By helping save time and money before the actual trial of a concept this practice can assist with troubleshooting design control revamping and more Process Modelling and Simulation in Chemical Biochemical and Environmental Engineering explores effective modeling and simulation approaches for solving equations Using a systematic treatment of model development and

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Zukünftige Kraftstoffe Wolfgang Maus,2019-04-13 Das Buch ist als Kompendium angelegt und deckt das Wissen von Gesetzes Verbands und Wirtschaftssektoren ab die für die zukünftige nachhaltige Mobilität von entscheidender Bedeutung sind 1 Regulatorische und umweltpolitische Randbedingungen 2 Energiebereitstellung Sektorkopplung wirtschaftliche Bedeutung 3 Nachhaltige Kraftstoffe für die Energiewende im Transport Verkehrssektor 4 Anwendung synthetischer Otto und Dieselmotorkraftstoffe **20th European Symposium of Computer Aided Process Engineering** Sauro Pierucci,G. Buzzi Ferraris,2010-06-03 ESCAPE 20 is the most recent in a series of conferences that serves as a forum for engineers scientists researchers managers and students from academia and industry to present and discuss progress being made in the area of Computer Aided Process Engineering CAPE CAPE covers computer aided methods algorithms and techniques related to process and product engineering The ESCAPE 20 scientific program reflects the strategic objectives of the CAPE Working Party to check the status of historically consolidated topics by means of their industrial application and to evaluate their emerging issues Includes a CD that contains all research papers and contributions Features a truly international scope with guest speakers and keynote talks from leaders in science and industry Presents papers covering the latest research key topical areas and developments in computer aided process engineering CAPE **23 European Symposium on Computer Aided Process Engineering** Fazel Moradi,Mohammad Kazemeini,Leila Vafajoo,Moslem Fattahi,2013-06-10 Dimethyl ether DME as a clean fuel seems to be a superior candidate for high quality diesel fuel in near future In this study a comprehensive three dimensional dynamic heterogeneous model developed to simulate the flow behavior and catalytic coupling reactions for synthesis of the DME from hydrogenation of the CO and CO₂ dehydration of methanol to dimethyl ether and water gas shift reaction in a fixed bed reactor For this purpose a CFD simulation was articulated where the standard k model with 10% turbulence tolerations implemented Then the concentration and temperature profiles along the reactor were determined It was revealed that under conditions considered a single phase physiochemical system under equilibrium existed for which simulations were performed Ultimately generated results of the model under appropriate industrial boundary conditions compared with those of others available in the open literature to verify the developed model Then the effects of various operating parameters including the pressure temperature and flow rate of the feed to the reactor upon the DME production as well as selectivity were examined The CFD modeling results generated from the present work revealed reasonable agreement with obtained data of these authors and other experimental available in the open literature which considering the complexity of the task performed was rather satisfying **27th European Symposium on Computer Aided Process Engineering** ,2017-09-21 27th European Symposium on Computer Aided Process Engineering Volume 40 contains the

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