CASSE1.2018

CONFERENCE ON
ADVANCED SEPARATION SCIENCE AND ENGINEERING

Hanoi, 18/12 - 21/12

BOOK OF ABSTRACTS

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compression, heat exchange unit and membrane skid, etc. Pretreatment removes siloxane and acid gas which may reduce the long-term operation performance of membrane separation due to the sorption on the surface or corrosion of polymer membrane. The pretreated gas is compressed up to 10-20 barg. The multi-stage of membrane modules is tested with small membrane area at the lab-scale study, and the methane concentration of retentate stream was over 96 vol% enough to be put in the liquefied natural gas grid while the carbon dioxide enriched gas stream was permeated at the downstream. Based on the lab-scale studies, the pilot-scale biogas upgrading processes were designed and developed for the biogas upgrading from anaerobic biogas of several municipal wastewater recycling centers. The separation performances and long-term operation performances will be discussed further.

Key Words: Biogas upgrading; membrane based gas separation; CO_2/CH_4 separation; membrane process; LNG grid

Session 1 (continue)

Adsorption/Membrane Separation/Extraction/Supercritical Fluid Technology

Chair: **Prof. Ki Bong Lee + Assoc. Prof. Tran Trung Kien** 702 E-Library

Pre. 1.6 **Thursday, 09.30 – 09.50**

Extraction and separation of Neodymium from used rare earth magnet for preparation of a photocatalyst

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Extended Abstract

Rare earth metals have been used widely in many different fields such as in fluorescence, polishing powder, nuclear, laser applications, fiber optics, superconductors, permanent magnets, capacitors, radar technology… The development of electronic industries recently has led to a large amount of e-waste. Faced with issues of shortage on demand of rare earth metals, many studies have been done in order to recover, recycle and reuse this metals from e-waste.

This paper deals with a process of recovering neodymium from rare earth permanent magnets of used hard disk drivers and synthesizing perovskite $NdFeO_3$ materials to be used as a photo catalyst. The recovering of neodymium consisted of serial steps including heat treatment of NdFeB magnet for magnet removal, leaching, selective crystallization and precipitation. Neodymium was recovered up to 98% in form of neodymium oxalate $Nd_2(C_2O_4)_3$.

Nanocrystalline $NdFeO_3$ perovskite was synthesized by the sol–gel citrate method with Nd:Fe:AC molar ratio of 1:1:3 and at calcination temperature of 650°C. $NdFeO_3$ was characterized by X-ray diffraction, field emission scanning electron microscopes, Brunauer–Emmett–Teller nitrogen adsorption and desorption. The photocatalytic activity of the synthesized material was tested with methylene blue decomposition. The result shows that under visible light, the degradation efficiency of methylene blue has increased up to 70%. This study may be considered as a new approach in both economic and environmental treatment purposes.

Key Words: e-waste; rare earth magnet; neodymium; $NdFeO_3$ perovskite; photocatalyst.

Pre. [illegible] Thursday, 11.20 – 11.40

Membrane-based gas separation for production of high-purity methane and carbon dioxide from envirionmental by-product gases for carbon resources utilization

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Keywords: Membrane process, carbon resources utilization, CO_2/CH_4 separation

Huge amount of by-product gas mixtures (CH_4, CO, CO_2, N_2 H_2, etc.) has been produced from environmental treatment industry, steel industry, and chemical industry in Korea and worldwide. Among the various by-product gases, CH_4 and CO_2 are emitted simultaneously in many food wastes treatment sites and landfill sites. Pilot-scale biogas upgrading process and plant were developed using methane technology for the production of high purity methane and carbon dioxide which could be used for the renewable natural gases and chemical gas resources.

For the design of membrane process and plant, the pure gas permeance and ideal selectivity of polysulfone hollow fiber membranes were measured for CH_4 and CO_2, respectively, under varying pressure(2-10 atm) and temperature(0-25℃). The methane purity and recovery were also obtained as a function of stage-cut(0-1) at the given operation pressure and feed temperature for feed gases of CH_4/CO_2 concentration (10 vol.%/90 vol.%-90 vol.%/10 vol.%).

Based on the pure and mixed gas permeation results, we have developed 4-stage membrane process with recirculation flow operated by one compressor which was designed Excel-based simulation program developed in our research group. We also have constructed the demonstration plant for 100 Nm^3/hr of biogas in an anaerobic site in Paju City, Korea. Using the membrane plant, the methane purity and recovery were investigated for biogas mixture of 70 vol.%CH_4/30 vol.%CO_2 by changing various operating pressure and temperatures, ratios of membrane area in each stage(1:1:1, 1:2:1, 1:3:1) at optimized membrane areas. We confirmed that our four-stage membrane process could successfully produce high purity(>97 vol.%) of methane at high recovery(>95 vol.%) and high purity(>95%) of carbon dioxide at high recovery of >97% from crude biogas mixture under the optimized operation conditions.

Preface

Hanoi University of Science and Technology, Vietnam Association of Chemical Engineering and Korean Institute of Chemical Engineers are honored to welcome all the participants for the 1st Conference on Advanced Separation Science and Engineering, which is organizing from 18th to 21st December 2018 in Hanoi, VIETNAM. At CASSE1.2018, more than 90 scientists, researchers, industrialists and managers from 30 institutions including universities, key research centers, and industrial groups of Korea, Taiwan, Malaysia and Vietnam have already registered as participants. Their contributions are presented in 03 plenary lectures, 17 keynotes, 14 oral presentations and 60 posters which performed in the two parallel sessions.

The main goal of this conference is making a bridge not only between Vietnamese and Korean academic and industry, but also anyone who are doing research and working in the fields related to separation processes. Through sharing research results, displaying ideas, discussion on solutions, participants will be better understanding and updating to new and advanced separation technologies, leading to effective application in their works. Fruitful collaboration between researchers and industry is also expected to be established through this forum.

This important event could not be taken place without the contributions of all participants, the organizing committee and sponsors. I would like to express special thanks to Prof. Chang-Ha Lee for his idea of co-organizing this conference, Prof. Jong-Hak Kim for his valuable advice and experience in co-organizing and all efforts from both of Vietnam and Korea organizing committees. Supports from KIChE and VACE are absolutely essential to the conference with the invitation of more than 70 researchers to participate in the CASSE1.2018. Last, but not least, financial support from PV Oil (Petro Vietnam Group), DKSH Vietnam Co. Ltd and SCIC Co. Ltd are highly appreciated.

Finally, the MOU between School of Chemical Engineering (Hanoi University of Science and Technology - Vietnam) and C1 Gas Refinery R&D Center (Korea) signed at the closing ceremony of this conference under the attendance of all of us might be considered the 1st result of this important event. Hopefully, this MOU will open a new chapter in collaboration and bring mutual benefit to the both of the two countries.

On the occasion of upcoming Christmas and New Year 2019, I would like to wish all of you health, happiness and success!
Thank you!

17 December 2018
Hanoi University of Science and Technology
President
Prof. Hoang Minh Son