Recovery of PVA Using Polyethersulfone (PES) Hollow Fiber Ultrafiltration Membranes: Part II: Effect of Carboxymethyl Cellulose (CMC) Concentration

Najat J. Saleh  Amel Alhelaly  Jamal M. Ali  Qusay Alsalhy

Abstract
Polyethersulfone (PES) hollow fiber ultrafiltration (UF) membrane with the molecular weight cut-off (MWCO) 20,000 was used for the recovery of polyvinyl alcohol (PVA) from the simulated wastewater. An attempt to study the effect of carboxymethyl cellulose as synthetic warp sizing agents on the PVA recovery was investigated in this case. Experimental results shown that PVA concentration in the retentate of PES hollow fiber membrane were lower with addition of carboxymethyl cellulose (CMC) in PVA solution. Besides, higher trans-membrane pressure from 1.0 to 2.1 bars, solution temperature 50-75°C, and feed velocity 0.16-0.32 m/s, improved the PVA recovery in two different PVA solutions. PES hollow fiber ultrafiltration process was efficient for PVA recovery from the simulated wastewater using PVA solution with low carboxymethyl cellulose (CMC) concentration as synthetic warp sizing agents.

Keywords: Ultrafiltration membrane; hollow fiber; phase inversion method; polyethersulfone; alcohol additive.

الخلاصة
استخدمت (Ultra filtration) (PES) (Molecular weight cut-off) (MWCO) 20000MW من مخلفات المياه تم دراسة تأثير مادة كاربوكسيل ميثيل سيليلوز (CMC) (PVA) في فصل الكحول (PVA) في الدراسة المكشوفة على استرجاع مادة البولي فينيل الكحول (PVA). وشملت النتائج العملية اظهرت بأن PVA في المراقبة المكشوفة من قبل الاغشية المجوفة (PES) كانت أقل مع انخفاض مادة (CMC) إلى (PVA) في حالة الضغط من 1.21bar ودرجة حرارة المحلول (PVA) 50-75 C° وسرعة المحلول الداخل (PVA) 0.16-0.32 m/sec. يتحسين من استرجاع (PVA) من مخلفات المياه التي تحتوي على (PES) الاغشية المجوفة (CMC) تركز والاطم من مادة (CMC).

*Chemical Engineering Department, University of Technology, Alsinaa Road No. 52, Baghdad, B.O. 35010, IRAQ
Email: qusayalsalhy@yahoo.com
Effect of Alcohol as Additives on the Morphology and Separation Performance of Polyethersulfone (PES) Hollow Fiber Ultrafiltration Membranes

Najat J. Saleh Amel Alhelaly Samira N. A. Qusay Alsalhy

Abstract
Hollow fiber ultrafiltration (UF) membranes were prepared using Polyethersulfone (PES), alcohol (n-Propanol) as additive and N, N-dimethylacetamide (DMAc) as a solvent. Asymmetric hollow fiber UF membranes were spun by wet phase inversion method from 17 wt% solids of PES/additive/NMP solutions. The alcohol additive was n-Propanol while the external coagulant was water. Effects of n-Propanol concentrations in the dope solution on morphology and separation performance of PES hollow fiber UF membranes were investigated. UF membranes were characterized in terms of scanning electron microscope (SEM) while UF experiments were conducted using polyethylene glycol (PEG20,000M_w) and poly (vinyl pyridilone) (PVP 40,000M_w) as a solute. It was found that the PES UF membrane morphology changed from long two finger-like structure through a short two finger-like structure to the two void-like structure as n-propanol concentration in the dope solution increased from 5 to 20 wt % using water as a bore fluid; pure water permeation fluxes (PWP) increased from 47 to 201 L/m^2.h.bar while rejections of PEG MW20,000 and PVP MW40,000 for wet-spin PES hollow fiber membranes were decreased with increased of n-propanol concentration up to 20%. Using above method, PES hollow fiber UF membrane with high pure water permeation flux could be prepared while the molecular weight cut-off of PES hollow fiber membranes is approximately 20,000.

Keywords : Ultrafiltration membrane; hollow fiber; phase inversion method; polyethersulfone; alcohol additive;

الخلاصة

اعشية بولمرية مجوفة حضرت من مادة بولي ايثيل سيلفون (PES) وحول البروبانول كمضردة ومادة (wet phase inversion method) كمذيب للبولمر. تضمنت الأغشية تم باستخدام طريقة ذكر المراد (DMAc) لصقلة من مادة PES (PES/additive/NMP) (17%) من مادة المادة المضافة كانت البروبانول بينما الماء استخدم كمذيب خارجي للأغشية. تأثير تركيز البروبانول في محلول PES على البنية الداخلية والخارجية للاغشية واداهما تم التحقق منها في هذه الدراسة.

بينما التجربة التي تم تمت باستخدام بولي ايثيلين (ULTRA FILTRATION) (SEM) بالاغشية وصفت بلادة (ultra filtration) كمذيبات. من النتائج تم ايجاد (PVP) (40000MW) وفلي فينيل برويليد (PEG) (20000 MW) تغير في تركيب الأغشية من طبقتين طويلتين نوع الأصبع إلى طبقتين قصيتين نوع الأصبع ومن ثم إلى طبقتين نوع كلازام تركيز النوري في محلول البروبانول من (Void) (201) - (47) ل/م^2.ساعة.بار (PWP) (201) - (47) ل/م^2.ساعة.بار (PWP) زاد من (Void) تستخدم الطريقة اعلاه يمكن الحصول على معلم تدفق عاليا للماء النقى ويمكن استخدام هذه الأغشية لفصل كميات المواد المذابة التي تمتلك وزن جزيئي أكثر من (2000).

*Chemical Engineering Department, University of Technology, Alsinna Road No. 52
Baghdad, I.O. 35010, IRAQ
Email: quayalsalhy@yahoo.com

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Study of Catalysts Deactivation in Isomerization Process to Produce High Octane Gasoline

Khalid A. Sulaiman, Hayam M. Abdul-Rahem, Amal Th. Jaber, and Lubay Th. Suwaly

Chemical Engineering Department - University of Technology - Iraq
Chemical Engineering Department - College of Engineering - University of Al-Nahrain - Iraq

Abstract

In this study the isomerization of desulfurized light Iraqi petroleum napthha (Al-Dura Refinery) with boiling point range of 37 to 124 °C , 80.5 API specific gravity and 68.2 octane number has been investigated. Two types of catalysts were prepared (Pt/HX and Pt/SrX) by impregnation of 0.8 wt% Pt on 13X-zeolite. The catalyst activity and selectivity toward isomerization, and catalyst deactivation were investigated.

The isomerization unit consisted of a vertical tubular stainless steel reactor of 2 cm internal diameter, 3 cm external diameter and 68 cm height. The operating pressure was atmospheric for all experimental runs. The liquid flow of light-naphtha was 0.4 L/h, and the catalyst weight was 50 gm. H2/H:C ratio used was 4 for all experimental runs. The isomerization process was studied at different temperatures of 250, 270, 275, 300, 325, and 350 °C. It was found that, the optimum isomerization temperature is 270 °C.

The isomerization activities and selectivities as a function of time showed high activity at the beginning of reaction and were deactivated rapidly. This indicates that the deactivation of Pt/HX and Pt/SrX results from the blocking of pore mouth by the deposited carbon. The following deactivation decreasing order, Pt/HX > Pt/SrX was found. On the other hand, Pt/HX catalyst shows higher activity and selectivity than that of Pt/SrX.

It was concluded that, only an average of 90 wt% of the carbon atoms feed into the reactor (light napthha) is detected in the product stream due to formation of coke deposits which leads to catalyst deactivation. The results clearly showed that hydrogen is necessary for the hydrogenation of olefins in order to prevent oligomerization reaction that leads to coke formation and catalyst deactivation.

Keywords: catalytic isomerization, light-napthha, Pt/HX and Pt/SrX catalysts, deactivation.

Introduction

Due to a heightened awareness of the environmental problem worldwide, expectations of clean and unleaded gasoline and world demand for gasoline have been increasing. Catalytic isomerization is regarded one of the most important processes in oil refineries which produce clean and high octane gasoline. Isomerization converts n-butane, n-pentane and n-hexane into their respective isoparaffins of substantially higher octane number. The common feedstock for isomerization process is the light straight run napthha, which consists of the lighter fraction C5/C6 [1, 2]. In general, a catalyst may lose its activity or its selectivity due to poisoning, fouling, sintering and loss of active species [1]. One of the most challenging tasks in the design and operation of industrial catalytic processes is the prevention, or at least the control, of catalyst deactivation. Loss of catalyst activity is often accompanied by a loss in selectivity. This leads to greater formation of undesired by-products such as carbon oxides, poor utilization of raw materials, waste of energy, and increased pollution [3,4]. Thus, solving deactivation problems is of paramount importance for the economic and ecologic performance of the process industry. Understanding deactivation mechanisms could