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Research Activities of

Faculty Staff & Postgraduates

in Chemical Engineering Departement

2013-2014

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وزارة التعليم العالي والبحث العلمي
وزارة التعليم العالي والبحث العلمي
الجامعة التكنولوجية



النشاط البحثي

لأعضاء الهيئة التدريسية وطلبة الدراسات العليا

لقسم الهندسة الكيميائية

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Research Activities of Faculty Staff & Postgraduates in Chemical Engineering Departement

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Faculty Staff Researches In Chemical Engineering Department

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Experimental Investigation and Thermodynamic Study of Heavy Metal Ions Removal From Industrial Wastewater Using Pomegranate Peel as Natural Adsorbent.

Prof. Dr. Thamer J. Mohammed. Assist. Prof. Dr. Raheek I. Ibrahim. And Aliaa Essam

ABSTRACT

The contamination of water by toxic heavy metals through the discharge of industrial wastewater is worldwide environmental problem. The environmental impact due to their toxicity has led to the enforcement of stringent standards for the maximum allowable limits of their discharge into open landscape and water bodies. Copper is generally considered to be toxic to ratan at concentration exceeding 5 mg/L , imparts color and undesirable taste. The World health organization's guide line for drinking Water based on its staining properties is 1 mg/L . Fruit peel of pomegranate is used as natural resin adsorbent to remove copper ions from wastewater. Peels are dried, crushed and washed several times till the water was clear of all coloration and finally dried in an air oven. After drying the adsorbent was sieved to get the desired particle size. The adsorption capacity is tested and thermodynamic analysis of the system is also included in the study as well as break through which indicates the (feasibility and economic aspects of adsorption process).

دراسة عملية وثرموديناميكية لازالة المعادن الثقيلة من المياه الصناعية باستخدام قشور الرمان كمادة طبيعية

أ.د. ثامر جاسم محمد ، أ.م.د. رحيق اسماعيل ابراهيم ، م.م. علياء عصام

الخلاصة

ان الملوثات السامة الموجودة في المياه الصناعية تشكل مشكلة بيئية في كل انحاء العالم وتشكل ايونات عنصر النحاس احد العناصر السامة للإنسان اذا زاد التركيز عن 5 ملغم/لتر بينما حددت منظمة الصحة العالمية تركيز 1 ملغم/لتر كحد اقصى لعنصر النحاس في مياه الشرب . في هذا البحث يتم استخدام قشور الرمان كمادة مازة طبيعية لازالة ايونات النحاس بعد جمع القشور وتجفيفها وطحنها وغسلها عدة مرات ثم يتم تجفيفها في فرن هوائي ثم يجري نخلها للحصول على حجم دقائق مناسب. يتم إجراء الحسابات على سعة الامتزاز وتحليل ثرموديناميكي للنظام الاضافة الى منحنى والذي يشخص الجوانب العلمية والاقتصادية لعملية الامتزاز

Preparation and Characterization of Activated Carbon From Wheat Kusk and Its Application In Color Removal of Textile Waste water

Assist Prof. Dr. Mohamed I. Mohamed, Assist Prof. Dr. Ana'am A. Sabri, and Dr. Eman J. Taha

ABSTRACT

Among varies industries, textile industry ranks first in usage of dyes for colorization of fiber. As a result, they generate a considerable amount of colored waste water. Among dye removal process, adsorption is proven to be one of the most efficient techniques. The present work aims to investigate the sorption of simulated textile waste water on to wheat husk as that acts as a low cost adsorbent. Batch mode adsorption was performed to investigate the adsorption capacities of this adsorbent by varying initial dye concentration, contact time, adsorbent dose and PH. The equilibrium adsorption data of dye onto wheat husk were analyzed using freundlich and long muir adsorption isotherms. Also the adsorption kinetic data were analyzed using pseudo first order, pseudo second order and Elovich models

ازالة الالوان من الماء الملوث لمعامل النسيج باستخدام قشور الحنطة

أ.م.د. محمد ابراهيم محمد ، أ.م.د. انعام اكرم صبري ، م.د. ايمان جواد

الخلاصة

ان قابلية الكربون المنشط على قصر الالوان قد زادت من اهميته في السنوات الاخيره في ازالة الالوان الملوثة للماء والناجمة من معامل الاصباغ وخصوصا تلك المتعلقة بمصانع انتاج الاقشمة. في هذا البحث يتطلب العمل على انتاج الكربون المنشط من قشور بذرة الحنطة واستخدامه كمادة الممتزة للالوان في تنقية المياه. كما سيتم دراسة خصائص الكربون المنشط الفيزيائية من خلال دراسة الحجم الحبيبي والمساحة السطحية وسعة الامتزاز والكثافة والتركيب المجهرى.

Conversion of “Bagasse” to Bio-Ethanol Through Fermentation to Produce Bio-Fuel and Gasohole

Assist Prof. Dr. Mohamed T. Esa Dr.Shurooq T. Remedhan , Ahlam S. maroof, and
Alyaa E. Mahdi

ABSTRACT

The work involves preparing industrial samples of “Bagasse” through a certain method followed by fermentation under specified conditions then separation of the main product (bio-ethanol) from other by products. The produced “crude” ethanol is to be purified to a certain assay. The progress made so far by the research group was holding the first meeting of the research group during the month of May 2013 to agree on the general steps and stages of the working plan. Also some literature survey has been made using the department library as well as internet search engines like google and Wikipedia. The sample of the feedstock source of the “Iraqi Bagasse” in the form of “beet root” for the laboratory work has been made available from “Ninawa Sugar Factory”. Also the practical work was agreed to be conducted in “Chemical Industries lab and a list of glass wares has been prepared. Now the research group is in the process to prepare the reactor (an aoutoclave)

تحويل "مخلفات الكتلة الحيوية" إلى الإيثانول الحيوي من خلال التخمير لإنتاج الوقود الحيوي

أ.م.د. محمد تقي عيسى، م.د. شروق طالب ، م.م. احلام سعيد ، م.م. علياء عصام

الخلاصة

مخلفات الكتلة الحيوية التي تمثل المنتج العرضي من المعالجة الكيميائية والفيزيائية لقصب السكر وبنجر السكر المستخدم لإنتاج سكر المائدة (السكروز) . ويتم استخدامه كمادة وسيطة وفي الغالب كغذاء للحيوانات في حين يتم حرق الكميات الزائدة منها. تم إجراء الدراسة الحالية على عينات من bagasse مخلفات قصب السكر للصناعات العراقية المنتج من الموصل / مصنع بنجر السكر في نينوى ومن العمارة / مصنع قصب السكر في ميسان حيث يتم جمعها وإعدادها ، ويحدد نوع معين من البكتيريا التي يجري إعدادها لعمليات التخمير. استخدام مفاعل للتخمير وفصل المراحل، ويتم تقييم الإيثانول المنتج باستخدام الطرق الفيزيائية والكيميائية.

Catalytic Phenol Oxidation with Phase Change in Periodically Operated Trickle Bed Reactor

Dr .Farah T. Jasim

ABSTRACT

Periodic operation of fixed bed reactors Industrial fixed bed reactors are usually operated under steady state conditions. However, recent studies have demonstrated that the reactor performance is significantly improved under forced periodic operation conditions both at laboratory and pilot plant scale .The term 'periodic operation' refers to an operation, in which one or more operating parameters liquid flow rate, feed composition or temperatures are periodically varied in time. Since 1989, many studies were dealing with liquid flow, gas flow and composition and reactant feed composition modulation (alpha-methyl styrene , dicyclopentadiene hydrogenation , Oxidation of ethanol and benzyl alcohol) . The enhancement observed in an unsteady state fixed bed reactor operation arises from the alteration of the gas and liquid phases for supply in reactant to the catalyst surface by periodically modifying the conditions of the gas-liquid hydrodynamics (pressure drop, liquid and gas holdup, partial wetting) and mass and heat transfer in the reactor. Only a few works has been dedicated to periodic operation of liquid flow and gas flow and composition applied to the CWAO of phenol in Trickle bed reactors in the last few years. The present study continued to study further points utilizing the advantages associated with periodic operation in order to meet the demands for process intensification to control on the wetting efficiency. Steady State Operation of TBR for CWAO with phase change broader range of operating conditions: LHSV , reaction temperature ,Phenol concentration .Periodic operation of TBR for CWAO with phase change under: liquid flow modulation(phenol feed flow). in broader range of operating conditions of cycle period and cycle split.

أكسدة الفينول بالعامل المساعد بتغيير الطور في مفاعل الطبقة الوشلة بالتشغيل الدوري المتقطع

م.د.فرح طالب جاسم

الخلاصة

تعد المخلفات الصناعية مصدرا من مصادر تلوث مياه الأنهار إذ إن الفضلات الصناعية والمواد والمخلفات الورقية والفضلات الكيميائية والبتروولية وفضلات الصناعات النسيجية والصناعات المعدنية والتعليب وغيرها ، أصبحت هذه الأنهار مصارف لهذه الملوثات الصناعية. ومياه الأنهار في العراق تتعرض بصورة يومية إلى عملية تدمير قد تفوق كل التصورات العالمية. وفي ظل هذا التدهور البيئي تهدف دراستنا لدراسة كفاءة تقنية Periodic operation لمفاعل الطبقة الوشلة لمعالجة المياه الملوثة بالملوثات العضوية "الفينول" التي تطرحها الأنشطة الصناعية. دراسة العوامل المؤثرة لمعالجة تلوث المياه بالمادة الفينول بطريقة Catalytic Wet Oxidation في مفاعل الطبقة الوشلة " Trickle bed Reactor " عند طرق تشغيليه مختلفه ، التشغيل المستقر (Steady State Operation) والتشغيل الدوري (Unsteady Periodic Operation) والمتضمن التقطيع الدوري لمعدل جريان السائل (Liquid Flow Modulation) لبيان إمكانية زيادة كفاءة العمل و تحسين الانتقائية. تضمنت الدراسة العملية نصب جهاز مختبري وإجراء سلسلة من التجارب لدراسة العوامل المؤثرة وهي :-معدل جريان السائل وضغط المفاعل و درجة حرارة المفاعل وعوامل التشغيل الدوري وتشتمل على زمن الدورة الكلي (Period time) على نمطين، البطيء (slow mode) والسريع (Fast mode) ونسبة زمن فتح السائل الى زمن الدورة الكلي (Cycle split).

Absorption of Acidic Gas(CO_2) into Aqueous Ammonia Promoted with Ethanolamine

Dr. Farah T. Jasim

ABSTRACT

Carbon dioxide is the major greenhouse gas in the world that needs to be reduced. There are various technologies used to separate CO_2 from flue gas. These include chemical solvent methods, physical absorption methods, cryogenic methods, membrane systems, biological fixation, and the O_2/CO_2 combustion process. Compared with the chemical plant, power plant has a large flue gas flow, different ingredients, relatively low CO_2 concentration and other characteristics. So the chemical solvent methods are generally recognized as the most effective technologies at present. This requires that the researchers developed a relatively low-cost, low-energy requirement CO capture technology. Among the conventional CO_2 chemical removal processes, the mono-ethanolamine (MEA) process has been comprehensively studied and successfully used in chemical plants for CO_2 recovery. Some of the problems associated with the use of alkanolamines in absorption include oxidative degradation and high vapor pressure. These contribute to solvent losses, degradation product handling, and other negative effects in the process. Aqueous ammonia (NH_3) solutions are now being proposed as an alternative to aqueous alkanolamines based liquid absorbents for PCC. Aqueous ammonia has been shown to achieve higher CO_2 loadings (on a molar and mass basis) than sterically free primary alkanolamines such as mono-ethanolamine (MEA). This is mainly due to the $\text{CO}_2\text{--NH}_3\text{--H}_2\text{O}$ system favoring bicarbonate over carbamate formation, particularly as CO_2 loading increases. Aqueous ammonia has also been shown to require less heat input for desorption than MEA. This is due to the smaller reaction enthalpy for CO_2 absorption and higher CO partial pressure at elevated temperature compared to MEA. Also, ammonia is resistant to oxidative degradation, which is a major benefit when treating oxygen containing gas streams such as those from coal fired power stations. The other main attractive feature is that in the presence of sulphur and nitrogen oxides in the gas stream, the ammonium salts that form may have commercial value as fertilizers. A major drawback in the use of ammonia is its vapor pressure. Due to its small molecular weight ammonia vapor pressure is high (compared to alkanolamines). To address this it has been proposed that the absorption process take place at lower temperatures to reduce losses via volatilization. A series of tests was conducted in a semi-batch reactor (bubble column) that has been developed in this research. CO_2 removal efficiencies of aqueous ammonia promoted with ethanolamine have been studied. To study of the absorption rate, mass transfer coefficient and reaction kinetic type and regime.

امتصاص الغازات الحامضية CO_2 باستخدام محلول الامونيا مع الايثانول امين

م.د.فرح طالب جاسم

الخلاصة

غاز ثاني أكسيد الكربون هو من الغازات الاحتباس الحراري الرئيسية في العالم التي تحتاج إلى تخفيض . هناك العديد من التقنيات المستخدمة لازالة غاز ثاني اوكسيد الكربون من غازات الاحتراق . وتشمل هذه الطرق المذيبات الكيميائية، وطرق الامتصاص الفيزيائي، وأساليب المبردة وأنظمة الأغشية، التثبيت البيولوجي، وعملية الاحتراق . O_2/CO_2 مقارنة مع مصنع للمواد الكيميائية، محطة الطاقة لديها تدفق كبير لغازات الاحتراق، والمكونات المختلفة، وتركيز CO_2 منخفضة نسبيا وغيرها من الخصائص . الامتصاص بالمذيبات الكيميائية هي الأكثر فعالية في الوقت الحاضر لازالة الغازات الحامضية وخاصة غاز ثاني اوكسيد الكربون . وهذا يتطلب اجراء دراسات ليجاد افضل انواع المذيبات والتي تكون بكلفة واطئة وكفاءة عالية في الازاله للغازات الحامضية . وجد من خلال الدراسات ان استخدام الامينات (المونوايثانول امين) من المذيبات ذات كفاءة عالية لكن لديها ضغط بخري عالي وتتفكك بوجود غاز الاوكسجين مما يؤدي الى استبداله بانواع اخرى ذات مقاومه اعلى لغاز الاوكسجين من بين هذه الانواع الكربونات ومحلول الامونيا من افضل الخيارات وجدت . والعيب الرئيسي في استخدام الامونيا هو ضغط بخاره . بسبب ضغط بخاره صغيرة الوزن الجزيئي الامونيا عالية (مقارنة بالمونوايثانول امين) ولمعالجة هذا وقد اقترح أن عملية الامتصاص تتم في درجات حرارة منخفضة للحد من الخسائر عن طريق التطاير . في هذا البحث تتم دراسة عملية امتصاص غاز ثاني اوكسيد الكربون باستخدام محلول الامونيا المطور باستخدام مفاعل العمود الفقاعي.

Experimental Study and Mathematical Modeling of Leaching of Copper From Computer Electronic Waste by Direct Reacting

Dr. Eman J. Taha, Taghreed L. Abdul-Rahm , and Nahla F.

ABSTRACT

Computer electronic wastes are currently being dumped in landfills which are causing a series environmental harm in the form of toxic gases or hazardous compounds. The extraction from electronic waste is both profitable and environmentally. This study aims to design a commercial process to extract copper from electronic waste. The proposed extraction process has been subdivided into two stages 1 physical separation 2 metal recoveries. Stage 1 involve s size reeducation to 1 mm, stage 2 involves the dissolution of metals in acid in different operating condition (time, temperature, concentration of acid, weight of sample).

دراسة عملية مع موديل رياضي في أسترجاع النحاس من مخلفات الحاسبة الألكترونية

م.د ايمن جواد ، م.تغريد لطفي ، م.م. نهلة فاضل

الخلاصة

تسبب مخلفات الحاسبة الألكترونية المتزايدة الأعداد حالياً مخاطر بيئية جدية بشكل غازات سامة او مواد خطرة بيئياً. ويعتبر أستخلاص المعادن من هذه المخلفات الألكترونية عمل مربح و صديق للبيئة. تهدف هذه الدراسة لتصميم عملية تجارية لاستخلاص النحاس من مخلفات الحاسبة الألكترونية وتقسم الى مرحلتين المرحلة الأولى الفصل الفيزيائي و المرحلة الثانية استرجاع المعدن . تتضمن المرحلة الأولى تقليل الحجم الى قطر 1 ملم و تتضمن المرحلة الثانية انحلال المعادن في الحامض عند ظروف تشغيلية مختلفة (زمن ، درجة حرارة ، تركيز الحامض ، وزن النموذج).

Study the Reality of Petrochemical Industry Under Commodity Dumping Period 2004-2011

Mahir A. Abdul Rahman, Wael Salem Jamiel

ABSTRACT

Designed to study stand on the reality of petrochemical industries and analysis of economic performance of its importance and being one of the strategic industries vital and capable and relying on raw materials simple access to many products and high intake of large economic mention of it represents the backbone essential to the various fields of industrial and other economic. Have suffered these industries in light of the growing phenomenon of dumping of the commodity and steadily since 2003, and to this day , in the absence of an active role for the state to adopt the style of a free market economy as well as the weakness of the role of the private industrial sector and its inability to compete with foreign industries similar , which reflected negatively on growth The development of the industrial sector and disable most of its energy production and waste

تحليل واقع الصناعات البتروكيماوية في ظل الاغراق السلعي للمدة 2004- 2011

م. ماهر عزيز، م. وائل سالم جميل

الخلاصة

استهدفت الدراسة الوقوف على واقع الصناعة العراقية للمدة (2004- 2011) ، في ظل غياب دور فاعل للدولة من خلال وضع سياسات اقتصادية وتجارية تركز وبشكل مباشرة على حماية الصناعة العراقية ، فضلاً عن تقديم الدعم الحكومي للصناعة المحلية لمواجهة الاغراق السلعي الذي تتبعة العديد من الدول المصدرة كأحد اساليب التمييز السعري لتوفير الاسواق الخارجية وتحقيق المنافع والارباح ، وقد تفاقمت ظاهرة الاغراق السلعي وبشكل مضطرب منذ عام (2003) في ظل اتباع العراق سياسة الاقتصاد الحر وضعف دور القطاع الخاص الصناعي وعدم قدرته على منافسة الصناعات الاجنبية ، الامر الذي انعكس سلباً على نمو وتطور الصناعة المحلية وتعطيل الطاقات الانتاجية فضلاً عن هدر الموارد الاقتصادية المتاحة .

Study Academic Performance of Chemical Engineering Department According to Accreditation (Abet) Criteria for The Years (2011/2012-2012/2013)

Mahir A. Abdul Rahman, Zainab A. Abdul Razzaq

ABSTRACT

The educational sector and education is one of the essential mounting in the development of society. The progress of nations depends on their possesses of the knowledge advanced technology and educated human for tuncapable of innovation , production , competition and achieve the best rates in the human development and the positive investment for natural resources. In the last quarton of the pastcentury, higher education experienced radical transformation in the teaching methods and trends. This development was as a result of the accelerated quantitative community , which made the education a institution responsible of a ccomma date the revolution changes in the society , and responsible of the clear development in the future , and the challenge of the increasing in learning ; as well as to the world economic challenge . In addition to the educational institution should be the best in activity and orginazation because they are now exactly the society and its goals, because those institutions own. Specialized people are able to this development. For these reasons, the present study aim to study and explaine the positive reflexions to apply the (ABET) characters on the educational matter and its results and the university perprmance in the chemical engineering department to the period from 2011/2012 to 2012/2013. The study also depends on a syllybuses to explain the reality in the department according to (ABET) through out a comparision between the department acheviement in the two years. The study included : the student , syllabus , the educational goals , teaching staff member , the that the academic dependent has essential relationship with the quality of education and the evaluation inside the institution and the educational system in the country .The regular, self assessment in the department leads to avoid the out going out of the goals, and insure the contineousity on the depended national standards. all these factors have an important role to improve treaching as an essential thing to improve the educational programs and its development.

دراسة الاداء الجامعي لقسم الهندسة الكيميائية في ظل معايير الاعتماد الاكاديمي (A B E T) للاعوام (2011 / 2012 - 2012 / 2013)

م. ماهر عزيز ، باحث . زينب عبد الاله

الخلاصة

إن القطاع التربوي والتعليمي يشكل أحد الأعمدة الرئيسة في تطور المجتمع، لذا تقدم الأمم مرهون بما تمتلكه من معرفة وتقانة متقدمة وثروة بشرية متعلمة قادرة على الإبداع والإنتاج والمنافسة وتحقيق أفضل المعدلات في مجال التنمية البشرية والاستثمار الايجابي للثروات الطبيعية. شهد التعليم العالي في الربع الأخير من القرن الماضي تحولاً جذرياً في أساليب التدريس وأنماط التعليم ومجالاته، وقد جاء هذا التطور نتيجة التحولات النوعية في المجتمع بوتائر متسارعة حيث القت على عاتق المؤسسة الجامعية مسؤولية ان تواكب الجهود المبذولة لتجاوز الواقع وتحقيق الطموح ، ومن ناحية اخرى ان تكون رؤية واضحة ودقيقة لما سيحدث في مديات الزمن المقبلة لجمله من التحديات والمتمثلة بتطور تقنيات التعليم وزيادة الأقبال عليه والانفجار المعرفي الهائل، فضلاً عن بروز مجالات المعرفة والبحث العلمي أضافه الى اعتماد المنافسه الأقتصادي في الأسواق العالمي على مدى قدرة المعرفة البشريه على الإنتاج . بالاضافة الى ان المؤسسة التعليمية يجب ان تكون رائدة من ناحية التنظيمات والانشطة لانها الاعمق أدراكاً لواقع المجتمع وبيان اهدافه ، لانها تمتلك من الكفاءات وأصحاب الاختصاص ما يعينها على ان تكون السباقه في ميادين التجديد والتطور . لذا تهدف الدراسة الحالية الى دراسة و بيان الانعكاسات الايجابية لتطبيق معايير (A B E T) على واقع العملية التعليمية ومخرجاتها والاداء الجامعي لقسم الهندسة الكيميائية للفترة 2013/2012-2012/2011 . تم اعتماد منهجية وصفية لغرض وصف واقع قسم الهندسة الكيميائية وفق معايير (A B E T) من خلال عمل مقارنة لاداء القسم للعامين الدراسيين 2013/2012-2012/2011. تطرقت الدراسة الى المحاور التالية:- الطلبة ، المناهج الدراسية ، اهداف البرامج التعليمية ، الهيئة التدريسية ، مخرجات التعليم ، التطوير المستمر ، المرافق والخدمات ، الدعم المؤسسي ، وبيان مدى القدرة على تحسين جودة العملية التعليمية والاداء الاكاديمي. وبينت الدراسة ان مفهوم الاعتماد الاكاديمي يرتبط بشكل اساسي بضمان الجودة والتقييم داخل المؤسسة ونظام التعليم في البلد. هنالك عمل جاد للمؤسسة التعليمية لتفعيل دور كافة الجهات ذات العلاقة بضمان وصول قسم الهندسة الكيميائية لتحقيق اهداف البرنامج التعليمي في ضوء موائمتها مع مخرجات التعليم و يؤدي التقييم الذاتي المنتظم والدوري في القسم الى تقادي الانحراف في مسار البرنامج التعليمي ، وضمان استمراريته في اطار المعايير الدولية المعتمدة. اجراء الاستبيان لتقييم اداء التدريسي والعملية التعليمية من قبل الطلبة والخريجين له اثر جدا كبير في تحسين فاعلية التدريس وكمطلب أساس لضمان جودة البرامج التعليمية وتطويرها بالاضافة الى تطوير فاعلية تعلم الطلبة. ان زيادة الدعم المالي للمؤسسة التعليمية ساهم بشكل كبير في زيادة عجلة التطور العلمي والبحثي للطلبة والكادر التدريسي

Removal of Aniline and Nitro Substituted Aniline from Wastewater by Particulate Nanoporous mcm-48.

Dr. Talib M. Naieff

ABSTRACT

In this research, the Nanoporous MCM-48 will be synthesized and characterized in order to use it as an adsorbent for the removal of adsorbate, such as aniline and nitro substituted anilines, including 2-nitroaniline, 3-nitroaniline and 4-nitroaniline from wastewater. The characterizations of MCM-48 will be checked up by applying XRD, SEM, EDAX, further to testing the active group by Fourier transform spectroscopy FTIR. In order to analysis the experimental results the Langmuir and Freun dlich isotherms were used to model the adsorption equilibrium data. The kinetics of the reaction will be tested by pseudo- first and second order model.

إزالة الأنيلين ومعوذات الأنيلين من المياه الصناعية بواسطة جزيئة المادة النانوية المسامية MCM-48

م.د. طالب محمد نايف

الخلاصة

في هذا البحث المادة النانوية المسامية MCM-48 سوف يتم تحضيرها وفحص خصائصها لغرض استخدامها كمادة ممتزة او مكثفة لإزالة الأنيلين ومعوذات الأنيلين مثل 2-نايتروانيلين، 3-نايتروانيلين، 4-نايتروانيلين من مياه الصرف الصحي او المياه الصناعية. ان تركيب المادة ومميزات السطح الخارجي ايضا سوف يتم دراستها بواسطة الاشعة السينية XRD بالاضافة الى دراسة المسح الالكتروني المجهر SEM وتحليل نسبة العناصر EDAX. بالاضافة الى قياس المجاميع الفعالة بواسطة FT-IR. ولغرض تحليل النتائج العملية سوف يتم تطبيق نموذج لانكماير وفرندليج لنمذجة بيانات توازن الامتزاز. أن حركية التفاعل سوف يتم اختبارها حسب نموذج سيدومن نظام الدرجة الاولى او الثانية.

Improve the Performance of Magnetic Nanoporous MCM-41 for Removal of Pollutants from Wastewater

Assist Pro. Dr. Ghanim M. Alwan , Dr. Talib M. Naieff, Omer S. Mahday

ABSTRACT

The research is aimed to prepare magnetic nanoporous material MCM-41 and study its Physical characterization in order to improve its magnetic properties for study the operating conditions on the separation efficiency of the pollutants of wastewater by adsorption process. The experimental results are analysed so as to building mathematical model of the process and to determine the optimum operating conditions for the magnetic naoporous material.

تحسين أداء التركيب النانوي المسامي المغناطيسي MCM-41 في ازالة الملوثات من المياه الصناعية

أ.م.د. غانم مقبول علوان ، د. طالب محمد نايف، م.م. عمر صباح مهدي

الخلاصة

يهدف البحث الى تحضير ا لتركيب النانوي المسامي MCM-41 ودراسة الخصائص الفيزيائية للمادة النانوية المسامية في تحسين الخواص المغناطيسية للتركيب النانوي المسامي MCM-41 وكذلك دراسة الظروف التشغيلية على كفاءة الفصل للملوثات بعملية الامدصاص او التكتيف. يتم تحليل النتائج العملية في بناء موديل رياضي للعملية و تحديد الظروف التشغيلية والتصميمية المثلى للتركيب النانوي المسامي.

Using Steganography and Genetic Algorithm Along with Cryptography to Produce a less Noise Image

Nahla F. , Nissren N.

ABSTRACT

The issues of maintaining the confidentiality of information are of the most important topic of concern to researchers in data security. The steganography is the art and the science of hiding information so that it cannot be detected unless the person is a party in it. Now steganography is one of the most prevalent ways to deliver confidential information from the sender to wanted person. The proposed method is to create a way to hide the secret information by integrating steganography with genetic algorithm and encryption to produce an image with less noise and clearly more and at same time hide the required information by encrypts the secret information at the least signifying bit of the original image which hide information so that it becomes detectable difficult. The confidential information is recovered after decoding. Mat lab will be used for programming.

استخدام النظرية الجينية و أخفاء المعلومات مع التشفير لإنتاج صورة أقل ضوضاء"

م.م. نهلة فاضل ، باحث اقدم . نسرین نجم

الخلاصة

أن موضوع الحفاظ على سرية المعلومات من أهم المواضيع التي تشغل بال الباحثين في أمنية البيانات ويعتبر أخفاء المعلومات فن وعلم لأخفاء المعلومات بحيث لا يمكن كشفها مالم يكن الشخص طرفا في ذلك زوالن هي من أكثر الطرق أنتشارا في توصيل المعلومات السرية من المرسل الى الشخص المطلوب. البرنامج المقترح هو إنشاء طريقة لأخفاء المعلومات أكثر أمنا و ذلك بدمج طريقة أخفاء المعلومات مع الخوارزمية الجينية وبالتشفير أيضا لتنتج صورة ذات ضوضاء أقل ووضوح أكثر وبنفس الوقت تخفي المعلومات المطلوبة ويتم ذلك بتشفير المعلومات السرية عند البت الأقل أهمية للصورة الأصلية التي تخفي المعلومات بحيث يصبح كشفها صعبا. ويتم أسترجاع المعلومات السرية بعد فك التشفير وسوف يتم استخدام برنامج المثالاب للبرمجة.

Arecent Offline Arabic Handwritten Database

Safa A. Ahmed, Amar M. Ali

ABSTRACT

This paper present database contains 500 forms. These forms are designed for containing all possible Arabic offline characters shape (at beginning, at middle, and at end). Each form contains 28 characters with its possible shape and word for each possible shape. These forms are filled by 500 persons in order to provide different handwritten lines for each character shape. These forms scanned with 300 dpi. This database can be used by the researchers interested in Arabic handwritten recognition to evaluate theirs algorithms. To the best of our knowledge, there is no public comprehensive offline Arabic handwritten text database that is freely available. Hence, this database may address this deficiency in Arabic handwritten text recognition research. This database will be made freely available to interested researchers. In addition, this paper presents a software GUI environment to make the manipulation of the created database easier.

قاعدة بيانات حديثة من الاحرف العربية المكتوبة بخط اليد

م.م. عمار محمد ، م.م. صفا امين

الخلاصة

هذا البحث يعرض قاعدة البيانات مكونة من 500 نموذج . وقد صممت هذه النماذج لاحتواء كل ما يمكن من اشكال الأحرف العربية (في البداية، في الوسط، وفي النهاية). كل نموذج يحتوي على 28 حرفا بكل اشكاله الممكنة، وكلمة لكل شكل ممكن. تمتلئ هذه الأشكال من قبل 500 شخص من أجل توفير خطوط مكتوبة بخط اليد مختلفة لكل شكل حرف. هذه الأشكال الممسوحة ضوئيا مع 300 نقطة في البوصة. ويمكن استخدام قاعدة البيانات هذه من قبل الباحثين المهتمين في تمييز خطوط اليد للغة العربية لتقييم خوارزميات لهم. إلى حد علمنا، لا يوجد حاليا عربي قاعدة البيانات النص عامة شاملة مكتوبة بخط اليد التي هي متاحة مجانا. وبالتالي، قاعدة البيانات هذه قد تعالج هذا النقص في البحوث التعرف على النص المكتوب بخط اليد العربية. وسوف تكون قاعدة البيانات هذه متاحة مجانا للباحثين المهتمين. بالإضافة إلى ذلك، تقدم هذه الورقة واجهة المستخدم الرسومية بيئة البرامج لجعل التعامل مع قاعدة بيانات التي تم إنشاؤها بصورة أسهل.

Recognition Offline Arabic Handwritten Characters Using Neural Network

Safa A. Ahmed

ABSTRACT

Because of the little attention for recognition Arabic handwritten and because difficulty with the Arabic script because of the position of character and diacritic marks associated to Arabic characters. This paper presents new approach for recognition offline Arabic handwritten characters. This approach involves using pack prorogation neural network algorithm and AHC of Arabic handwritten characters database. In this paper, 500 samples for each Arabic handwritten characters which provided by AHC database are used as training sample for pack prorogation neural network algorithm. This approach was tested using 87 Arabic handwritten characters and work with accuracy 71%.

تمييز احرف اللغة العربية المكتوبة بخط اليد باستخدام الشبكات العصبية

م.م. صفا امين

الخلاصة

بسبب الاهتمام القليل بتمييز اللغة العربية المكتوبة بخط اليد وبسبب صعوبة التعامل مع الحرف العربي بسبب موقعه و التشكيل المرتبط بالحروف العربية. يعرض هذا البحث طريقة جديدة لتمييز الأحرف المكتوبة بخط اليد العربية. ينطوي هذا النهج باستخدام خوارزمية الشبكة العصبية وقاعدة بيانات AHC تحتوي على الحروف العربية المكتوبة بخط اليد في هذا البحث يستخدم 500 عينة لكل الأحرف المكتوبة بخط اليد العربية التي تقدمها قاعدة بيانات AHC كما لتدريب خوارزمية الشبكة العصبية. تم اختبار هذه الخوارزمية باستخدام 87 حرفا بخط اليد العربية وكان العمل مع دقة 71%.

Desulfurization of Gas Oil Using A Solar Photocatalytic Microreactor

Asst. Prof. Dr. Mohammad F. Abid

ABSTRACT

Crude oil is the largest and most widely used source of energy in the world. Major portions of the crude oils are used as transportation fuels such as gasoline, gas oil, and diesel fuel. However, such crudes contain sulfur, typically in the form of organic sulfur compounds. Combustion of gasoil and diesel fuel has been identified as one of the major emission sources of polyaromatic hydrocarbons (PAH) in urban areas. As environmental consciousness rises, all countries worldwide introduce more stringent legislation to limit the PAH content of fuels. Currently, hydrodesulfurization (HDS) is used to remove sulfur from hydrocarbons in petroleum refineries which require either increasing reactor residence time, or carrying out reactions in severe conditions (higher temperature and pressure). In the past few years, microreactor technology is presented as a novel technology on which the new concept of production and research will be built upon. By decreasing the equipment size by several magnitude levels, substantial economical benefits, improvement of intrinsic safety, and a reduction of environmental impact can be achieved. The aim of the present study is to investigate the effect of the main operating variables on the desulfurization efficiency using a microreactor initiated by the solar energy at normal temperature and pressure, and comparing the feasibility of the present process with a large-scale commercial one.

ازالة الكبريت من الكاز اويل باستخدام المفاعل الميكروي الشمسي

أ.م.د. محمد فاضل عبد

الخلاصة

النفط الخام هو الأكبر والأكثر استخداماً على نطاق واسع كمصدر للطاقة في العالم. وتستخدم أجزاء كبيرة من الزيوت الخام كوقود النقل مثل البنزين وزيت الغاز ووقود الديزل ومثل هذه الخامات تحتوي على الكبريت، وعادة في شكل مركبات الكبريت العضوية. يعتبر احتراق زيت الغاز ووقود الديزل واحدة من المصادر الرئيسية للانبعاثات الهيدروكربونات العطرية المتعددة الحلقات في المناطق الحضرية. مع ارتفاع الوعي البيئي، فإن جميع البلدان في جميع أنحاء العالم تقوم بتشريعات أكثر صرامة للحد من الهيدروكربونات العطرية المتعددة الحلقات من الوقود. حالياً، يتم استخدام hydrodesulfurization لإزالة الكبريت من النفط والغاز في معامل تكرير البترول والتي تتطلب إما زيادة زمن بقاء المفاعل، أو ظروف تشغيلية شديدة، درجة الحرارة والضغط. في السنوات القليلة الماضية، ويقدم تكنولوجيا مفاعل مايكروي بوصفها تكنولوجيا حديثة متطورة التي سيتم بناء مفهوم جديد للإنتاج والبحوث عليها. من خلال ما سيتم خفض حجم المعدات من قبل عدة مستويات، فوائد اقتصادية كبيرة، تحسين السلامة الذاتية، والحد من الأثر البيئي. الهدف من هذه الدراسة هو دراسة تأثير المتغيرات التشغيلية الرئيسية على كفاءة إزالة الكبريت باستخدام المفاعل المايكروي الشمسي باستخدام الطاقة الشمسية في درجة الحرارة والضغط الجوي اعتيادي، ومقارنة جدوى العملية الحالية بأخرى تجارية واسعة النطاق.

Removal of Dyes from Synthetic Wastewater by Agricultural Waste

Dr. Jenan A. Al-Najar

ABSTRACT

This work aimed to use low cost adsorbent for the removal of such chemical contaminated in wastewater. These adsorbents will be used is waste agricultural like peel beans and wild plants. These adsorbents will be used directly and or subjected to specific chemical treatment as well. Adsorption technique is one of the most important technologies for the treatment of polluted water from dyes, but seeking for the low-cost adsorbent is the target of this study. Batch adsorption experiments will perform by varying adsorbent dose, pH of the metal ion solution and contact time. The adsorbent capacity will be study in this work as well. Also the physical and morphology characteristic of the adsorbent will be studied such as analyzing the internal structure with scanning electronic microscopy (SEM) and the pore size volume using BET. Also the surface functional group by will be investigated by Fourier transformation infrared spectroscopy techniques. The adsorbents will be analyzed to determine its chemical characteristics such as bulk density, moisture content, ash content, pH, iodine number, porosity, pH, yield percentage and surface area.

أزالة الاصباغ من مياه الصرف الصحي باستخدام المخلفات الزراعية

م.د. جنان النجار

الخلاصة

يهدف البحث إلى استخدام مواد رخيصة الثمن وهي المخلفات الزراعية كمادة ممدصة لغرض إزالة الملوثات الكيميائية من مياه الصرف الصحي. هذه المواد تستخدم مباشرة لغرض معالجة المياه. وكذلك يتم استخدامها بعد معاملتها مع مواد كيميائية. يتم دراسة قابلية هذه المواد لإزالة الملوثات الاصباغ باستخدام تقنية الامتزاز الوحيي Batch adsorption. يتم دراسة تأثير عدد من المتغيرات مثل تركيز الملوثات، حامضية المحلول، زمن وسرعة الامتزاز. كذلك يتم دراسة وتحليل المادة الممتزة من حيث تحليل التركيب الداخلي لهذه المواد، مساميتها، النساحة السطحية وكذلك دراسة التركيب الكينيائي لها وسعتها الامتزازية لمعرفة كفاءتها لعملية الامتزاز.

Effect of Fe_2O_3 In Electricity Generation and Waste Water Treatment Using Microbial Fuel Cell Technology

Qusay J. Rasheed , G. Priya

ABSTRACT

Microbial fuel cells are known to offer great promise for simultaneous treatment of wastewater and energy recovery. In this study we have shown the use 2.5% (0.025 gm) of Fe_2O_3 (heated and non heated) nanoparticles in the wastewater sample that play a major role in both increasing the electricity production as well as treating the wastewater. Characterization of nanoparticles was done using XRD and SEM. The calculated cell parameters are ($a = 4.6208$; $c = 3.0208$). According to the scherrer's equation, the average crystallite size of the product was calculated to be about 35.6 nm as prepare and 24nm for the sample annealed at $300^\circ C$ for 3h. The influence of pH was also studied on both wastewater treatment and voltage output. SEM analysis shows that the particles are spherical shape. Further the wastewater with nanoparticle was adjusted at various pH and pH 5 showed best results for power output and pH 7 showed best reduction in BOD and COD proving the waste water treated to higher percentage.

تأثير من Fe_2O_3 في توليد الكهرباء ومعالجة المياه باستخدام تكنولوجيا خلايا الوقود الميكروبية.

م.م. قصي جعفر ، كانا برييا

الخلاصة

من المعروف أن خلايا الوقود الميكروبية تعد بتقديم حلولاً مستدامة لمعالجة مشاكل مياه الصرف الصحي واستعادة الطاقة. في هذه الدراسة أظهر استخدام (0.025 غرام) من Fe_2O_3 النانوي في عينة مياه الصرف الصحي دوراً رئيسياً في كل من زيادة إنتاج الكهرباء وكذلك معالجة مياه الصرف الصحي. وقد تم دراسة الخواص النانوية باستخدام حيود الأشعة السينية (XRD) وبللمجهر الإلكتروني الماسح (SEM). إذ كانت النتائج هي ($a = 4.6208$; $c = 3.0208$). وفقاً لمعادلة شيرر، تمّت دراسة تأثير المعالجة الحرارية Fe_2O_3 النانوي كما تم احتساب متوسط حجم جزيئات المنتج وكانت حوالي 35.6 نانومتر فيما كان حجم الجزيئات المعالجة حرارياً بدرجة 300 مئوية لمدة ثلاث ساعات حوالي 24 نانومتر. تمّت دراسة تأثير درجة الحموضة على معالجة مياه الصرف الصحي وإنتاج التيار الكهربائي على حد سواء. ويبيّن تحليل SEM أن الجزيئات كروية الشكل. أوضحت نتائج مزج مياه الصرف الصحي مع Fe_2O_3 النانوي في درجات حمضية مختلفة أن درجة الحموضة 5 أظهرت أفضل النتائج لإنتاج الطاقة ودرجة الحموضة 7 الأفضل في خفض الطلب على الأكسجين البيوكيميائية (BOD) والطلب على الأكسجين الكيميائي (COD) وأثبتت قدرتها على معالجة مياه الصرف الصحي بنسبة عالية.

Optimization and Synthesis of Nisin Silver Nanoparticles Under Physical Methods

Qusay J. Rasheed

ABSTRACT

Silver nitrate combined with commercial sigma nisin were used to synthesize nisin-silver nanoparticles; different concentration of nisin at different pH conditions were used to optimize the characterization. 10 µg/ml at pH 6.0 had the greatest observation and the physio-chemical characterization of nisin-silver nanoparticles agreed with that also the results showed that the best method to prepare the nanoparticles (nisin-silver) was sunlight method.

التحسين والتوليف من النايسين- فضة النانوية تحت الطرق الفيزيائية

م.م. قصي جعفر

الخلاصة

استخدمت نترات الفضة جنباً إلى جنب مع بروتين النايسين لتصنيع جسيمات النايسين-فضة النانوية؛ عدة تراكيز من النايسين استخدمت تحت ظروف حامضية متعددة لتحسين خصائص الجسيمات المنتجة باستخدام طرق فيزيائية مختلفة لإنتاجها. وأوضحت الصفات الفيزيوكيميائية التي استخدمت في الدراسة أن تصنيع جسيمات النايسين- فضة النانوية تحت اشعة الشمس أعطى أفضل النتائج مقارنة ببقية الطرق وتركيز (10 ميكروغرام / مل) من النايسين في درجة (6).

Summaries of M.Sc. Students Researches

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Research Title: Numerical Solution to Hydrodynamic Characteristics of Mixing of Multiphase Flow System

Supervisors: Prof. Dr. Thamer J. Mohammed
Prof. Dr. Jalal M. Jalil

Student Name : Zain al abeden Ali Qassim

Introduction

This work presents the numerical solution to hydrodynamic Characteristics of mixing of multiphase flow by computational fluid dynamics (CFD) technique. CFD Simulation is also known as CFD modeling and it is engineering based scientific process module which runs on Computational Fluid Dynamics theory and is applied for resolving different fluid flow related problems like flow velocity, density, temperature, and chemical concentrations for any area where flow is present. It's a numerical method for calculation for nonlinear differential equations describing/relating to fluid flow. CFD simulation is applied in various industries to day in order to achieve flawless product designing by combining computational tools and theory of fluid dynamics.

What is CFD?

Computational Fluid Dynamics (CFD) provides a qualitative (and sometimes even quantitative) prediction of fluid flows by means of

- 1) mathematical modeling (partial differential equations)
- 2) numerical methods (discretization and solution techniques)
- 3) software tools (solvers, pre- and post processing utilities)

CFD enables scientists and engineers to perform 'numerical experiments' (i.e. computer simulations) in a 'virtual flow laboratory'

CFD applications in chemical engineering

CFD modeling is widely used in chemical processes and operating units and it can be summarized as following

- 1) Solid drying systems
- 2) Droplet separation
- 3) Packed bed reactors
- 4) Foam

- 5) Packed columns
- 6) Centrifugal extractors
- 7) Mist eliminators
- 8) Sedimentation
- 9) Cyclone separators
- 10) Mixers
- 11) bubble columns
- 12) Fluidized bed systems
- 13) Particulate systems
- 14) Precipitators
- 15) Dust collection systems
- 16) Solid suspensions
- 17) Continuous stirred tank reactor
- 18) Plug flow reactor
- 19) Distillation columns
- 20) Absorption columns
- 21) Adsorption columns
- 22) Heat exchangers
- 23) Furnaces
- 24) Air coolers

And many other chemical engineering industries

Multiphase flow

As the name suggests it involves the simultaneous flow of mixture of phases such as gas (like bubbles) in a liquid , or liquid (like droplets) in gases and similar such flows.

Even a jet of water falling into a mass of water can be considered as multiphase as the water jet is interacting with air surrounding it.

Why CFD are used to simulate multiphase flow?

Usually multiphase flow systems are quite complex systems due to the interaction among many entities, such as bubbles, drops, or particles immersed in the fluid. This complexity strongly limits the usefulness of purely analytical methods. In a laboratory, it may even be difficult to set up a multiphase flow experiment with the necessary degree of control: the breakup of a drop in at turbulent flow or a precise characterization of the bubble or drop size

distribution may be examples of such situations. Furthermore, many of the experimental techniques developed for single-phase flow encounter severe difficulties in their extension to multiphase systems. For example, even at volume fractions of a few percent, a bubbly flow may be nearly opaque to optical radiation so that visualization becomes problematic. The clustering of suspended particles in a turbulent flow depends on small-scale details which it may be very difficult to resolve. Little information about atomization can be gained by local probes, while adequate seeding for visualization may be impossible. In this situation, numerical simulation becomes an essential tool for the investigation of multiphase flow. In a limited number of cases, computation can solve actual practical problems which lend themselves to direct numerical simulation (e.g. the flow in micro fluidic devices), or for which sufficiently reliable mathematical models exist. But, more frequently, computation is the only available tool to investigate crucial physical aspects of the situation of interest.

Practical Advantages of Employing CFD

The many reasons CFD consulting is being widely used today are as follows:

- 1) CFD foresee performance before adapting or execution in systems
- 2) Without modifying or installing real system or a sample, CFD simulation can forecast which changes in design layout are most vital for improving performance.
- 3) CFD model offers precise and detailed information about operating conditions and design parameters
- 4) The advancement in multiphase technology need wider and detailed information about the flow within an occupied zone while CFD meets the goal better than any other theoretical or experimental methods.
- 5) CFD modeling saves cost and turnaround time and it procures reliable results. This is the reason CFD analysis report is accounted as completely reliable.
- 6) CFD gives an insight into flow patterns that are difficult, expensive or impossible to study using traditional (experimental) techniques.
- 7) This method reduces scale-up problems, because the models are based on fundamental physics and are scale-independent.
- 8) CFD can be used in safety analysis in process industry and units operation, particularly for the prediction of hot spots, catalyst distribution, and thermal uniformity in large scale reactors.

CFD can handle more physics and chemistry–turbulence interaction in many real industrial systems.

Research requirements

Since this research adapts the numerical solution to PDEs that represents the model of the system and that numerical solution is attended by CFD simulation then the main requirements

for this research is a computer with high performance capabilities and a software package , the software

that will used for this propose is **Fortran Power-Station** to solve and visualize the governing equations.

What is the main goal of this research?

The main goals of this research are

- 1) Setting the governing model equations.
- 2) Predication a numerical solution to a multiphase system.
- 3) Determine the error between the numerical solution results and experimental results.
- 4) Visualize the numerical solution of the system.

Generalize the numerical solution so that it can be used to enhance the system performance in future.

Literature review

Since the early 1980s, the general advancement in numerical flow simulation, with the rapid growth in computing power has initiated many studies in two-phase multidimensional flow simulation. Grevet et al.(1982) were among the first in trying to use fundamental numerical techniques to describe the rising of bubble plume in a vessel, using a steady-state Lagrangian type model, assuming a constant slip velocity for the bubbles. They found a good agreement with the experimental observations of the circulating main flow. After the mid-90s, the dynamics flow modeling received more attention when sufficient computation power was available. The pioneering contributions to the transient flow simulation have been made by Lapin and Lubbert (1994 a,b), Becker and Sokolichin (1994). Lapin and Lubbert (1994 a,b) have used both Euler-Euler and Euler-Lagrange approaches to simulate two-dimensional column For the liquid phase flow, laminar conditions were assumed. The gas phase momentum equation was not solved and a constant slip velocity was assumed. The gas phase dispersion was not considered. The authors concluded that the two-fluid Eulerian simulations are very sensitive to false numerical diffusion due to the assumption of laminar

conditions and the non-inclusion of gas phase dispersion. from that date tell now Many researches and discussions has been published in this field by several scientists. Finally, it is important to say that Sokolichin and Eigenberger (1994,1997, 1999, 2004) have made the first pioneering contribution in recent CFD modeling to multiphase flows columns, and together with Delonij, Mudde and Simonin (1997, 1999) and Deen have directed research mainly to study rectangular column systems,

while, Joshi, Ranade, Krishna and Kuipers were among the best who have studied cylindrical column systems.

Case-study

This work presents the study of numerical solution to Hydrodynamic Characteristics of Mixing of Multiphase Flow System

As showing in Figure (1) below

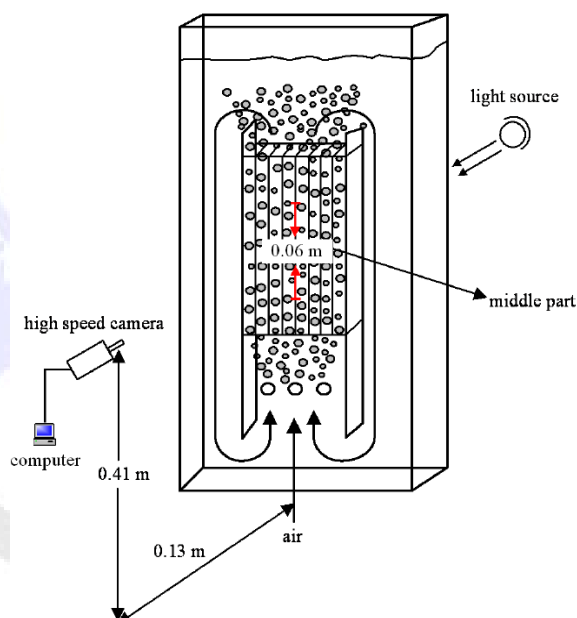


Figure 1: airlift membrane bioreactor

Governing Equations of Fluid Flow

1-Continuity equation:

$$\frac{\partial \rho}{\partial t} + \nabla \cdot \rho \vec{V} = 0$$

2 -Momentum equations:

$$\begin{aligned} \rho \left(\frac{\partial u}{\partial t} + u \frac{\partial u}{\partial x} + v \frac{\partial u}{\partial y} + w \frac{\partial u}{\partial z} \right) &= -\frac{\partial p}{\partial x} + \frac{\partial}{\partial x} \left[\mu \left(2 \frac{\partial u}{\partial x} - \frac{2}{3} \nabla \cdot \vec{V} \right) \right] + \frac{\partial}{\partial y} \left[\mu \left(\frac{\partial u}{\partial y} + \frac{\partial v}{\partial x} \right) \right] + \frac{\partial}{\partial z} \left[\mu \left(\frac{\partial u}{\partial z} + \frac{\partial w}{\partial x} \right) \right] + B_x \\ \rho \left(\frac{\partial v}{\partial t} + u \frac{\partial v}{\partial x} + v \frac{\partial v}{\partial y} + w \frac{\partial v}{\partial z} \right) &= -\frac{\partial p}{\partial y} + \frac{\partial}{\partial y} \left[\mu \left(2 \frac{\partial v}{\partial y} - \frac{2}{3} \nabla \cdot \vec{V} \right) \right] + \frac{\partial}{\partial x} \left[\mu \left(\frac{\partial u}{\partial y} + \frac{\partial v}{\partial x} \right) \right] + \frac{\partial}{\partial z} \left[\mu \left(\frac{\partial v}{\partial z} + \frac{\partial w}{\partial y} \right) \right] + B_y \\ \rho \left(\frac{\partial w}{\partial t} + u \frac{\partial w}{\partial x} + v \frac{\partial w}{\partial y} + w \frac{\partial w}{\partial z} \right) &= -\frac{\partial p}{\partial z} + \frac{\partial}{\partial z} \left[\mu \left(2 \frac{\partial w}{\partial z} - \frac{2}{3} \nabla \cdot \vec{V} \right) \right] + \frac{\partial}{\partial x} \left[\mu \left(\frac{\partial w}{\partial x} + \frac{\partial u}{\partial z} \right) \right] + \frac{\partial}{\partial y} \left[\mu \left(\frac{\partial w}{\partial y} + \frac{\partial v}{\partial z} \right) \right] + B_z \end{aligned}$$

3- Energy equation:

$$\rho \left(\frac{\partial E}{\partial t} + u \frac{\partial E}{\partial x} + v \frac{\partial E}{\partial y} + w \frac{\partial E}{\partial z} \right) = \nabla \cdot (k \nabla T) - \nabla \cdot p \vec{V} + \dot{Q}_v + \dot{Q}_s$$

4- Mass transfer equation:

$$\rho \left(\frac{\partial \omega_\alpha}{\partial t} + (\mathbf{v} \cdot \nabla \omega_\alpha) \right) = -(\nabla \cdot \mathbf{j}_\alpha) + r_\alpha \quad \alpha = 1, 2, 3, \dots, N$$

Multiphase flows Modeling approaches

- 1- Lagrangian specification – Here the observer follows an individual fluid parcel as it moves through space and time. Equations are composed by using this fundamental concept.
- 2- Eulerian specification – It focuses on specific locations in the space through which the fluid flows as time passes.

The modeling equations are composed keeping in mind the Eulerian and Lagrangian framework, we model the continuous phase by Eulerian method and depending upon the complexity of the flow we consider if the dispersed/ secondary phase can be modeled by either Eulerian or Lagrangian framework. Multiphase flow can be modeled mainly by three different approaches listed below.

- a- **Eulerian – Lagrangian Approach:** Utilises Eulerian framework for the continuous phase and Lagrangian framework for dispersed phases
- b- **Eulerian – Eulerian Approach:** Utilizes Eulerian framework for both the phases

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Chart of Planning Thesis work

Task \ Month	1	2	3	4	5	6	7	8	9	10	11	12
INTRODUCTION												
LITERATURE SURVEY												
MULTIPHASE CFD FUNDAMENTALS												
COMPUTATIONAL MODELING												
RESULTS AND DISCUSSION												
CONCLUSIONS AND RECOMMENDATIONS												

Research Title: Purification of Ethanol Produce by Almosl Staten Company for Sugar Production Using Carbon Nano Filter

Supervisors: Dr. Mohamed Ibrahim
Dr. Adnan Abdul-Jabbar

Student Name: Ahmed Talal Sadik

Abstract

Ethanol is produced from various kinds of substrates. The substrates used for ethanol production vary by different countries due to their different farming conditions 'in Iraq, dates is the dominant substrate of ethanol in private sector factories, while remnants of the sugar industry is the dominant substrate of Ethanol in Iraqi state companies as in Mosul sugar production company (North of Iraq) and Messan sugar production company (south of Iraq). Iraqi ethanol produce by fermentation followed by distillation suffered from odors and impurities. Iraqi Ethanol suffering of having undesirable odor in addition to impurities make it unfit with the national and international standards of the medical uses. Accordingly Iraq imports a large quantity of ethanol for medical uses while Iraq's production goes only for industrial purpose.

Objective of this work

Accordingly the objective of this work is to use the nanotechnology in purification of Iraqi ethanol in order to achieve ethanol having the standards of medical uses. The fantastic properties of Nano- filter allow us to trap poisons, creosotes, heavy metals, insecticides, bad smells and tastes, chemist substances, fusel oil and impurities or undesirable substances in both liquid and gas phase.

Methodology

Description of Project Work Plan

To determine the feasibility and advantages of using the Nano-filtration as a continuous ethanol purifier, needed work will performed following the work plan detailed below.

1. Review existing literature concerning ethanol production and demand, Purification Processes and equipment and ongoing research for unique and new methods of ethanol purification.
- 1-Prepared ethanol using Iraqi date as a substrate by fermentation followed by distillation.
- 2-Using conventional method for primary purification of ethanol

- 3-Preparation and functionalization of carbon nanotubes by CVD technique and preparation of nanoparticles filler by sol gel methods.
- 4- Design and install laboratory unit to model continuous purification by Nano-filtration process. .
- 5-Purify ethanol by Nano-filtration
- 6-Application of Nanotechnology filtration process in purification of ethanol collected from different Iraqi factories (private and state factories).

Characterization

- 1-Gas chromatography (GC) is an analytical technique for volatile and semi-volatile Compounds.
- 2-HPLC for analyze non-volatile compounds or heat sensitive compounds.
- 3-Infrared spectroscopy (IR) is an analytical technique utilizing infrared adsorption can be used for analyzed different compounds in ethanol.
- 4-Olfactometry is a sensory analysis usually coupled with GC.
- 5-SEM analysis for Nano-particles.

Outcome:

- 1-Final report included the method of purification and the design all of the results related to the project of Nano filter
- 2-The rig of filtration process which will be very useful for upscale commercial plant we plan to be install in alcohol Mosul factory. The rig will also very useful for researcher and researcher's students.
- 3-commercially and for intelligent property we have expected to get a results of scientific value.

Justification

Iraqi ethanol product has to meet the international drug specifications as a condition for use in medical purposes. Such problem had previous put forward to resolve by the relevant authorities. Accordingly the solution of this problem will save hard currency and employs a wide range of manpower in Iraq and will have Economic reflection.

Introduction

World ethanol production rose to nearly 13.5 billion gallon in 2006. Today, various kinds of crops are utilized for ethanol production. In the United States, the world biggest ethanol producer, ethanol is mainly produced corn. Brazil, the second biggest ethanol producer, utilizes sugarcane as the ethanol substrate. European countries produce ethanol from beet. Also, intensive studies are going on ethanol production from lignocellulose is biomass.

Ethanol production from lignocellulose biomass could find a way to utilize agricultural waste for ethanol production' Ethanol purification is critical for any kind of purpose. In the industry' purification is

done by mainly distillation. Although distillation is a strong separation technique, it has several disadvantages, mainly its separation capacity of volatile compounds and cost. Not many studies have done on the area of ethanol purification techniques which could take a place However, it is expected that purification techniques for water and wastewater, Such as zonation, adsorption, and gas stripping are applicable to ethanol. Ethanol analysis techniques have been developed to improve the value of ethanol. Gas chromatography (GC) and High performance liquid chromatography (HPLC) are common techniques to identify and quantify components of ethanol. Infrared spectroscopy (IR) is used for quality assurance of ethanol' olfactometry coupled with GC enhances the flavor analysis of alcoholic beverages. With a rapid increase in ethanol production, more extensive researches on ethanol have done recently.

Iraq consider one of the main producer of date in middle east which have more than 20M date palms in addition to sugar cane and sugar beet .Now a large quantity of ethanol produce by fermentation of Juice extracted from date which consider the main substrate of ethanol in Iraqi private sector companies. Meanwhile remnants of the sugar industry is the dominant substrate of Ethanol in Iraqi state companies as in Mosul sugar production company(North of Iraq) and Messan sugar production company (south of Iraq). Iraqi Ethanol produced by fermentation followed by distillation suffering of having undesirable odor in addition to impurities make it unfit with the national and international standards of the medical uses' Accordingly Iraq import a large quantities of ethanol for medical uses whileIraq's production goes only for industrial purposes.

Methods of ethanol purification such as distillation, zonation, adsorption, and gas stripping were failed in removal of undesirable odor and some kind of dissolved organic compounds in Iraqi produced ethanol.

Therefore we found necessary to suggest a nanotechnology process to serve the problem and we possess the technology needed to overcome these problems 'Accordingly we will design and manufacture a pilot plant contains column as a filter consist of a composite of Nano-materials such as carbon nanotubes' activated carbon and high surface area of Nano-particles as a filler. The fantastic properties of Nano-filter allow us to trap poisons, creosotes, heavy metals, insecticides, badsmiles and tastes, chemicals substances, fuseloil and impurities or undesirable substances in both liquid and gas phase.

Treatment ethanol using Nano filtration process aims to achieve an ethanol with the specification should meet the requirements of national and international medical standards.

Statement of the Problem

The state company for sugar industry/Mosul city produces a large quantity of ethanol. The company facing marketing problem due the undesirable odor and impurities ethanol produced unfit with the national international standards of the medical uses make requirements' such problem was previously submitted to our department by company

Letter number 2434 dated 6/12/2012 (copy attached).so the aim of our project is to design a new process for purification of ethanol utilized nanotechnology in order to achieve the desired properties.

Iraqi ethanol produced by fermentation followed by distillation process. Accordingly Iraq imports large quantities of ethanol for medical uses while Iraq's production goes only for industrial purposes.

Methods of ethanol purification such as distillation, zonation, adsorption, and gas stripping were failed in removal of undesirable odor and some kind of dissolved organic compounds in Iraqi produced ethanol.

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Treatment ethanol using Nano filtration process aims to achieve an ethanol with these purification should meet the requirements of national and international medical standards.

Ethanol purification

Purity is a matter of degree. From Merriam-Webster be defined as the act or an instance of purifying or of being purified. From Pharmaceutical technology, purification is the process of removing impurities by sterilization or filtering or any other methods. The important question, then, is not whether a substance is pure but whether a given sample is sufficiently pure for some intended purpose' That is, are the contaminants likely to interfere in the process or measurement that is to be studied. By suitable manipulation it is often possible to reduce levels of impurities to acceptable limit, but absolute purity is an ideal which, no matter how closely approached, can never be attained. Solvents and substances that are specified as pure for a particular purpose may, in fact, be quite impure for other uses. Irrespective of the grade of material to be purified, it is essential that some criteria exist for assessing the purity of the final product. The more common of these include:

Examination of physical properties such as:

- a. Melting point, freezing point, boiling point, and the freezing curve.
- b. Density.
- c. Refractive index at a specified temperature and wavelength.
- d. Specific conductivity.
- e. optical rotation, optical rotatory dispersion and circular dichroism.

ii. Empirical analysis, for C, H, N, ash, etc.

iii. Chemical tests for particular types of impurities.

iv. Physical tests for particular types of impurities:

- a. Emission and atomic absorption spectroscopy for detecting organic impurities and determining metal ions.
- b. chromatography, including paper, thin layer, liquid (high, medium and normal pressure) and vapor phase.
- c. Electrons spin resonance for detecting free radicals.
- d. X-ray spectroscopy.
- e. Mass spectroscopy.
- f. Fluorimetry.

v. Examination of spectroscopic properties

- a. Nuclear Magnetic Resonance.
- b. infrared Spectroscopy (IR).
- c. Ultraviolet Spectroscopy (UV).
- d. Mass spectroscopy.

vi. Electrochemical methods.

vii. Nuclear methods which include a variety of radioactive elements as in organic reagents, complexes or salt.

A substance is usually taken to be of an acceptable purity when the measured property is unchanged by further treatment (especially if it agrees with recorded value). In general, at least two different methods, such as recrystallization and distillation, should be used in order to ensure maximum purity.

Fermentation by-products

Ethanol is produced by yeast fermentation. Although Yeast mainly produces ethanol, it also produces by-product. These by-products need to be removed to obtain pure ethanol. There

are mainly two kinds of by product sources, starch and lignin .starch derived by-products include cyclic and heterocyclic compounds.

Purification techniques

Fermentation by-products are mostly removed by distillation. However products tend to lodge more in ethanol .also, especially for drinking or pharmaceutical purpose, high concentration of ethanol is not required. In this case, further distillation is just waste of energy and money .many studies have done to find a new purification technique of ethanol which can take place of distillation.

Distillation

Distillation is the most dominant and recognized industrial purification technique of ethanol. It utilizes the differences or volatilities of components in a mixture. The basic principle is that by heating a mixture

Low boiling point components are concentrated in the vapor phase.by condensing this vapor, more concentrated less volatile compounds is obtained in liquid phase distillation is one of the most efficient separation techniques. However, it contains several problems. One is separation of volatile compounds .in ethanol production, a distillation tower is designed to separate water and ethanol effectively. Water is obtained from the bottom of the tower and ethanol is obtained from the top of the tower .it is expected that impurities with similar boiling points to ethanol lodge in ethanol even after distillation .second is its cost. Distillation is a repetition of vaporization and condensation. Therefore, it costs a lot

Adsorption

Adsorption is a separation technique utilizing a large surface area of adsorbent .compounds are simply adsorbed on the adsorbent depending on their physical and chemical properties.in general ,bigger particles tend to be adsorbed more due to their low diffusivities. Also, compounds with the similar polarity to the adsorbent surface tend wide ranging pore distribution are favorable since ethanol is polar compounds and various sizes of particles could be contained in ethanol as impurities. From water treatment, activated carbon (Demirbas et al., 2008) and activated alumina (Tripathy and Raichur, 2008) are the most expectable adsorbents.

Ozonation

Ozone is a tri- atomic molecule consisted by three oxygen atoms. Ozone could decompose various kinds of the compounds using its strong oxidation potential. Decomposition of

compounds could result in changed in physical and chemical properties of compounds such as increases in volatility, biodegradability, and a decrease in toxicity. Although oxidation of ethanol could be expected with oxidation, it does not happen under the atmospheric condition (bailey, 1982).thus, ozone can remove impurities without a significant damage on ethanol. There are still some problems, non-oxidizable compounds and ozonolysis by product.it is expected that some compound cannot be oxidized by ozone. These compounds will remain after ozonation. Also, ozonation is an oxidation process are not remove compounds physically .thus, ozonation could generate new compounds, ozonolysis by-product .these compounds should be removed after ozonation by post-ozonation treatments.

Gas stripping

Gas stripping is a separation technique utilizing the differences or volatilities among compounds. The separation efficiency is simply governed by Henry,s law constant

$$H = P_{\text{vap}} / C_{\text{sat}}$$

Where H = Henry,s constant (moles/L atm)

P_{vap} = the partial pressure of the pure compound (atm), and C_{sat} = the saturation concentration of the pure compound in the liquid phase (mols/or mg/L) Henry,s Law constant varies depending on " in" vapor and Liquid phases. It is imagined that compounds with low boiling points can be stripped more easily such as acetaldehyde which is one of the major impurities in ethanol.

Gas chromatography

Gas chromatography (GC) is an analytical technique for volatile and semi-volatile compounds' Many ethanol analyses have done with GC since impurities in ethanol are basically volatile as well as ethanol itself (hide et al., 2001, campo et al., 2007, Rodrigues et al., 2008). A sample is vaporized at an injection port by heat. The sample vapor is sent to column packed with adsorbent or absorbent .inside column, each component in sample is separated depending on the physical or chemical property. The ends of column the concentration, of each component are measured by a detector. There are many kinds of coating of column. A coating should be chosen carefully to detect target compounds. Also, there are many kinds of detectors. Each detector has advantages and disadvantage. Thus, a detector should also be chosen carefully to detect target compounds. Gas chromatography spectrometry (GC-MS) is an integrated system of two analytical equipment. Gas chromatography separates analytic and mass spectrometry identifies them. GC-MS accelerates ethanol analysis with its simultaneous separation and identification capabilities (Garruti et al., 2006)

High performance liquid chromatography

High performance liquid chromatograph (HPLC) is an analytical technique which utilized liquid as the mobile phase instead of gas of GC. . Samples are not heated at the injection port' Thus' non-volatile compounds or heat. Sensitive compounds can be analyzed with HPLG' Many

extensive researches for ethanolanalysis with HPLC have done (Sen .,1995, Yarita., 2002, Alcazar., 2006). (Ferrira et al., 1999)

Infrared spectroscopy

Infrared spectroscopy(IR) is an analytical technique utilizing infrared adsorption. Infrared with different wavelengths are passed through a liquid sample. Adsorbed by a compound, and the absorbability of infrared varies among different compounds and different infrared wavelengths. Samples are identified by comparing absorbability of infrared; IR does not have as high resolution as GC or HPLC. However, the equipment is relatively cheap and analysis is simple and quick. Thus, it utilizes more for quality assurance (Lachenmeier, 2007) and classification purposes (pontes et al., 2006).

Figure 5' Typical FTIR spectra of different commercial alcoholic beverages (Gallignaniet al., 2005)

Olfactometry

Olfactometry is a sensory analysis usually coupled with GC. For a typical GC- olfactometry (GC- o) system, a GC column is connected to a separator where analytic are separated to two ways, olfactometry and a detector such as FID, PID, and MS. Olfactometry is a simple system which is just an open-end column, and a panelist sniffs analytic coming from the column. The panelist records the odor character and intensity of the analyte which correspond with a peak in chromatogram. Olfactometryprovides flavors data rather than stoichiometric chemical data.Itis utilized for alcoholic beverage analysis to develop its flavor.

Objectives

Iraqi Ethanol produced by fermentation followed by distillation suffering of having Undesirable odor in addition to impurities make it unfit with the national and International standards of the medical uses. Accordingly Iraq imports large quantities of ethanol for medical uses while Iraq's production goes only for industrial purposes. Methods of ethanol purification such as distillation, ozonation, adsorption, and gas stripping were failed in removal of undesirable odor and some kind of dissolved organic compounds in Iraqi

produced ethanol. Therefore the aim of this proposal is to suggest a nanotechnology process to solve the problem. We have the technology needed to overcome these problems. Accordingly we will design and manufacture a pilot plant contains column as a filter Consist of a composite of Nano-materials such as carbon nanotubes, activated carbon and high surface area of Nano-particles as a filter.

The fantastic properties of Nano filter will allow us to trap poisons ,creosotes, heavy metals, insecticides, bad smells and tastes, chemical substances, fusel oil and impurities or undesirable substances in both liquid and gas phase. Treatment ethanol using Nano filtration process aims to achieve an ethanol with the specification should met the requirements of national and international medical standards.

The Benefit of the Biology or Chemistry fields and Iraq's scientific community. Ethanol production is a chemical process, fermentation is a bioengineering process and Purification is nanotechnology process or a material science and engineering process. Accordingly the project will directly benefit such fields and we expected to publish a scientific article and register a patent related to Nano-filter which will be very useful for chemical purification process. The outcome of our project will offer the following:

- 1-Final report included the method of purification and the design of Nano filter and all of the results related to the project.
- 2-The rig of filtration process which will be very useful for upscale commercial plant. We plan to be installing in alcohol Mosul factory. The rig will also very useful for researcher and researcher's students.
- 3-Commercially and for intelligent property we have expected to get a results of scientific value.
- 4-Results and conclusion will be very usefulfor researchers in the field of chemistry and biology and it might be add a know how particularly in design of Nano-filtration for chemical process

Research methodology

A-Experiments

- 1-Design and build up the experimental rig.
- 2-preparation of carbon Nano-tubes by CVD reactor.
- 3- Functionalization of carbon nanotubes.
- 4-Blending functionalized carbon nanotubes with Nano -particles of magnesium sulfide and activated carbon.
- 5-construction a glass column packed with Nano blended materials

- 6-fitting the column with in the rig
- 7-Preparation ethanol by yeast fermentation and distillation
- 8-Treatment prepared ethanol by circulation through the Nano-filter.
- 9-collect ethanol produced by state companies (AL Mosul factory) and by treated the same process for comprise

B-Analytical methods

- 1-sEM for investigation of morphology of carbon nanotubes
 - 2-high magnification microscope for studying the homogeneity of blended materials
 - 3-IR and FTIR for studying the functional groups of blended materials
 - 4-FTIR for studying the organic compound in ethanol before and after treatment.
 - 5-Gas chromatography (GC) is an analytical technique for volatile and semi- volatile compounds.
 - 6-HPLC for analyze non-volatile compounds or heat sensitive compounds.
 - 7-Infrared spectroscopy (IR) is an analytical technique utilizing infrared Adsorption can be used for analyzed different compounds in ethanol.
 - 8-olfactometry is a sensory analysis usually coupled with GC.
- The individual and combined competencies of the research team will enable the project to be carried out successfully.

The team includes different specialists and will be for everyone in the team a specific duty will contribute to the success of the mission team.

- 1- Principal investigator specialist in nanotechnology and his mission falling on preparation of Nano-material's, design and manufacture of the filter.
2. While the co. Investigate to specialist in chemical Engineering and will work on the design and manufacturing of fermented and the general rig.
- 3- Graduate student he is specialist in extraction and he will be responsible for purification and collection processes and testing samples'
4. Analysis of the results and written of their reports is the possibility of project team.

All equipment and technology

- 1-Experimental rig for purification of ethanol consist of reservoir' circulating pump, Nano cartridge filter.
 - 2- Distillation unit for ethanol production in laboratory'
 - 3- Laboratory fermenter
 - 4-mixer and hot Plate heater'
- S-Chemical and consumables included all materials and glass Ware.

Project schedule

Task	1	2	3	4	5	6	7	8	9	10	11	12
Order for equipment's and chemicals (first quarter report)												
Experimental set up and operation (Second quarter report)												
Samples collection And investigation (Third quarter Report)												
Results analysis Fourth quarter report												
Final report												

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Research Title: **Dynamic Study of Acid Gas Absorption Using Promoted Absorbent in Bubble Column Reactor**

Supervisors: **Prof . Dr. Safa Al-Naimi**
Dr . Frah T. Jassem

Student Name: **Ahmed Noori Kokaz**

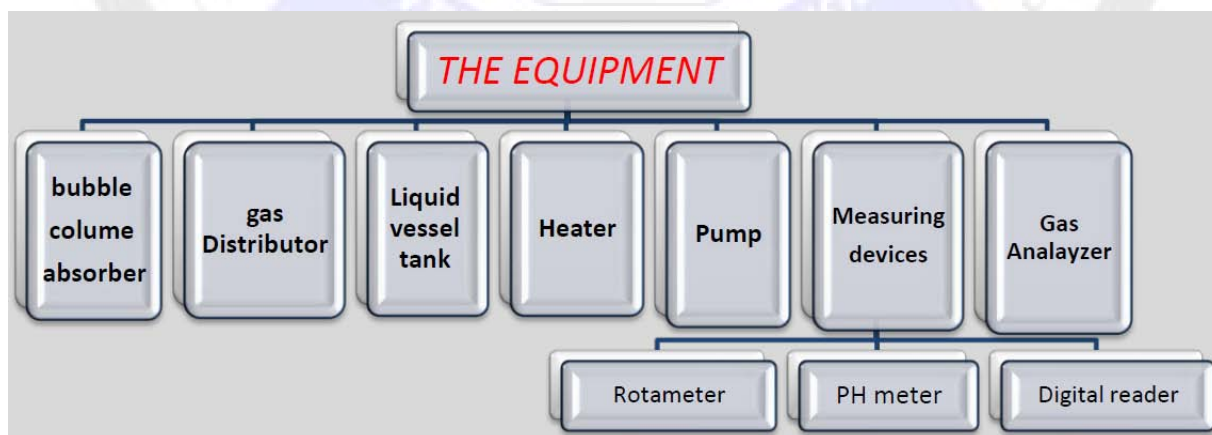
Abstract

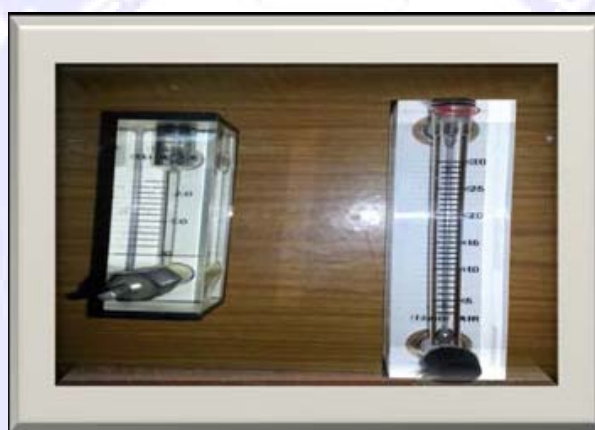
Absorption methods of industrial gas purification from acid components are the most widespread in commercial practice, CO₂ removal method are of special importance because these compounds are present as impurities in many gaseous mixtures. A number of gas purification processes using absorption methods exists, these processes are based on either physical dissolution of gases in liquids or on dissolution combined with chemical reaction in the liquid phase, The cost of purifying a gaseous mixture is generally very high For this reason, the processes of CO₂ absorption are of continuous interest , Many research work is aimed at improving these processes and making them more effective, economically and technologically. Modern technological methods based on physical absorption use highly efficient organic solvents characterised by a relatively high ability to dissolve acid gases and low ability of dissolving other gaseous components, A process using propylene carbonate as a solvent is one of these methods. Gas absorption by chemical solvents such as aqueous solutions of alkanol amines is one of the most effective methods for CO₂ removal, this technology has been used in industry for over half a century, In modern gas treating industries mono-ethanol-amine (MEA), diethanol-amine (DEA) and methyl-di-ethanol mine(MDEA) are the most commonly used alkanolamines . However, in case the costs of regeneration are taken into account, tertiary amines (i.e. MDEA) are much more attractive. Blends of primary or secondary amines with tertiary amines, such as MDEA, are frequently used for the removal of CO₂ from gas mixtures. These 'activated' amine solution sare advantageous, since they combine the high absorptive capacity of the tertiary amines with the high absorption rates achievable with primary or secondary amines. However, the acceleration of CO₂ absorption via the rapid formation of carbamates with primary or secondary amines is usually only required locally within the absorption

column. Inside other parts of the absorption process, homogeneous activating additives can give rise to undesirable side-effects, such as increased corrosion or higher energy demands for regeneration. However ethanolamine has several problems such as high volatility, high oxidative degradation, foam formation and high corrosiveness and a high energy requirement for regeneration . Different from organic amines, aqueous ammonia has recently been considered to have potential as an effective and economic solvent for CO₂ capture since its high loading capacity of CO₂, low corrosion, low cost, and less degradation, and it could remove other acid gas pollutants at the same time, and has also an acceptable CO₂ removal efficiency.(1) Carbonate solvents such as potassium carbonate frequently used for the removal of CO₂ from gas mixtures. However potassium carbonate has a low heat of regeneration, but its rate of reaction is slow compared to amines. (2) Several researchers have shown that the blending of amines accelerates the absorption process. (3), Likewise, many have investigated amine/potassium carbonate blends with some success (4) . Amino acid salt (AAS) systems have been developed for carbon dioxide absorption purposes. Amino acid based solvent systems are of interest because most amino acids have no toxicity issues and are environmentally friendly .(5) Recently, (6) investigated the CO₂ absorption potential of anew absorbent class made by combining an amine and an amino acid to form an amine amino acid salt(AAAS). They found that an AAAS can have improved CO₂ absorption potential compared to an AAS. also found that AAAS does not form precipitate up on loading with CO₂ like many AAS ,which precipitateat high loadings.(7)

Aim

Our research has been focused on the development of mixed solvents composed of absorbents, which have slow absorption rate and large absorption solubility, and promoters as additives to improve the reaction rate





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Research Title: Experimental Study Removal for Harmful Organics from Refinery Wastewater Using Solar Photocatalytic Reactor

Supervisors: Dr. Mohammad F .Abid
Dr. Oroba N. Abdulla

Student Name: Areej falih kazum

Abstract

Large amounts of water are used in a petroleum refinery and, consequently, significant volumes of wastewater are generated (0.4-1.6 times the volume of processed oil). The traditional treatment of refinery wastewater is based on physicochemical and mechanical methods with further biological treatment within the integrated activated sludge treatment unit. With respect to the fact that different concentrations of aliphatic and aromatic petroleum hydrocarbons are present in the wastewater, among which the aromatic fraction is not readily degraded by conventional treatments and is more toxic, there is still a need for advanced techniques to remove these pollutants some of which are known carcinogens. Iraq and other gulf countries is of the sunniest over the world, they have about 300 day of sunshine per year. Iraq received about 5 kWh per meter square per day from sun, this makes solar power available as alternative to fossil sources. Recent laboratory researches have proved the reliability of the proposed process and the availability of sunlight justifies the application of the new detoxification technology. Solar photochemical detoxification technology can provide the environmental wastewater management industry with a powerful new tool to destroy waste with clean energy from the sun. So in our research we aim to design and operate a pilot plant utilizing the solar energy to destroy most of the organic toxic compounds presented in wastewater. This process is the most promising and R&D in this field has grown very quickly during the last years.

Proposal objective

In order of priority, the specific objectives of the proposed research .

- 1- Protect the environment by detoxifying contaminated surface and ground water.
- 2- Reuse the treated wastewater (i.e., applying the zero-discharge principle).
- 3- Power saving by utilizing clean solar energy.

Statement of the Problem

Solar photochemistry technology can be defined as the technology that efficiently collects solar photons and introduces them in an adequate reactor volume to promote specific chemical reactions. The photocatalysis reaction is expressed as,

catalyst



photons

The most important features of this technology making it applicable to the treatment of contaminated aqueous effluents are:

- The process takes place at ambient temperature.
- Oxidation of the harmful substance into CO_2 is complete.
- The oxygen necessary for the reaction is obtained from the atmosphere.
- The catalyst used can be attached to different types of inert matrices.

The treatment of contaminated water necessarily includes the design of an efficient photoreactor which is considered the heart of the process. So in our research we aim to design and operate a pilot plant utilizing the solar energy to destroy most of the organic toxic compounds presented in wastewater.

Literature Survey

Critically analyze relevant and recent literature with a point of view of defining what has been done and what is needed, establishing the need for this project, defining the problem, and establishing the significance and potential contributions of this project.

Fica-Piras, P.(2000)carried out statistical studies on water consumption of petroleum refineries in Brazil, he reported that significant volumes of wastewater are generated(0.4-1.6 times the volume of processed oil).

Robert and Malato(2002) used solar photocatalysis process to detoxify drinking water. They carried out several laboratory experiments to degrade various toxic organic compounds using TiO_2 powder as catalyst. Roberto and Malato concluded that solar photocatalytic mineralization of organic water pollutants has a strong potential in the industrial destruction of toxic organics in water.

Hincapie et al.(2004) have degraded several types of pesticides which are considered priority substance by the European Commission at pilot-plant scale using photo-Fenton and TiO_2 photocatalysis driven by solar energy. They reported that almost complete mineralization and total detoxification were always attained. It has been demonstrated that evolution of chloride could be a key- parameter for predicting toxicity of chlorinated compounds.

Javier et al.(2007) carried out an experimental study at pilot-plant scale to determine the effect of iron, hydrogen peroxide and titanium dioxide in the solar photo degradation of dichloroacetic acid in a combined TiO_2 /photo-Fenton process. They reported that iron is the most important factor influencing the reaction rate, which suggested that in strongly acidic solutions, the Fenton mechanism controlled the process even at such low iron concentration. They observed that in the absence of hydrogen peroxide, the activity of the combined Fe/ TiO_2 system is similar to that of the photo-Fenton. Consequently, the analysis of pilot-plant operation economics took not only the degradation rate, but also the cost of chemicals into account.

Amat et al.(2007) conducted experiments on degradation of toxic compounds presented in wastewater. They used rosolic acid as model compound to check the efficiency of different advanced oxidation processes in the a batment of dyestuff having triphenyl methane structure. In their study, different solar photocatalysts were employed,namly Fe(III), Cr(III), Cr(VI) and TiO_2 . They observed that the best results were obtained using Fe(III), as this experimental conditions, nearly complete elimination of the dye could be accomplished; however, TiO_2 also showed a good performance. They reported that the reaction could be scaled-up using a solar plant for water detoxification with rather promising results.

Marcos et al.(2009) have studied the degradation of simulated winery wastewater in a pilot-scale parabolic collector(CPC) solar reactor. They measured the total organic carbon(TOC) reduction by heterogeneous photocatalysis(TiO_2) and homogeneous photocatalysiswith photo-Fenton. The influence of TiO_2 concentration(200 or 500 mg/L) and also of combining TiO_2 with H_2O_2 or $\text{Na}_2\text{S}_2\text{O}_8$ on heterogeneous photocatalysis was also evaluated. They concluded that by using a combining process of photo-Fenton reaction with heterogeneous photocatalysis will give the best results of toxicity reduction of total polyphenols to 92%.

Shashi et al.(2009) conducted experiments to investigate the biodegradability of actual industrial (textile) wastewater using solar photocatalysis. They treated effluents using TiO_2 as photo catalyst in a shallow pond slurry type reactor. The results showed 96% colour removal and 96% COD reduction, along with enhancement in the biodegradability of the effluent from 0.3 to 0.6 at optimized reaction conditions(i.e., 0.1% catalyst loading, pH of 5.5 and an oxidant concentration of 1 ml/200ml) and a solar UV intensity of 26 W/m^2 .

Experimental Design and Procedure

- 1- Detailed design calculations of the pilot plant are prepared.
- 2- Borosilicate glass tubes (used as tubular reactors) are arranged on a solar CPC (i.e. compound parabolic concentrators) which installed at a certain position to gain the maximum solar energy.
- 3- Integrated system consisted of stirred tanks, pumps, pipes, valves, Instrumentations, and on-line analysis system, all connected to the reactor array.
- 4- Contaminated water with toxic organic compound is added to the stirred tank together with a specified catalyst which will be recycled from the product tank to the feeding tank (i.e., no further amount of catalyst will be added).
- 5 -As pumping starts, the contaminated water will pass the reactor array where solar photochemical reaction occurred to destroy the toxic .

Research Title: Removal of Pollutants from Aqueous Solution by Functionalized Mesoporous Material

Supervisors: Assist Prof. Dr. Ana'am A. Sabri
Dr. Talib M. Naieff

Student Name: Dalia Basil Abdul Rajab

Background

Human activities generate a large quantity of various pollutants into the environment. Many places are contaminated by heavy metals, organic compounds and other hazardous materials, which deleteriously impact the ecosystem [1]. A variety of technologies for aqueous pollutants treatment are available, including conventional coagulation, chemical precipitation, membrane separation, reduction, ion-exchange, as well as adsorption.[2,3] Among these technologies, adsorption is the most versatile and plays a significant role due to its easy operation and effective cost[4].

Scientific Context

Various types of sorbents have been proposed for the removal of pollutants, for example, activated carbon [5], zeolites [6], montmorillonite[7], and mesoporous silica [8]. Among them, mesoporous silica, first synthesized in 1992 [9], are good candidates for the adsorptive removal of pollutants since these materials have high surface area, large and uniform pore size, and tunable pore structure as shown in figure (1).

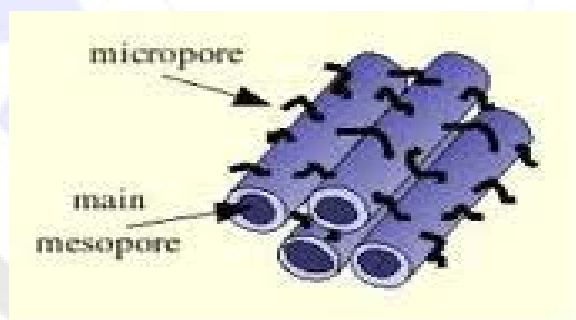


Figure 1: Schematic diagram for structure of SBA

Mesoporous silica SBA-15 was effective for the adsorption of neutral and acidic pollutants in acidic media [8], though its effectiveness was significantly reduced at a neutral pH because of its low point of zero charge. This shortcoming, fortunately, may be overcome by altering the surface chemistry of mesoporous silica by means of grafting with suitable functional groups as shown in figure (2) [10].

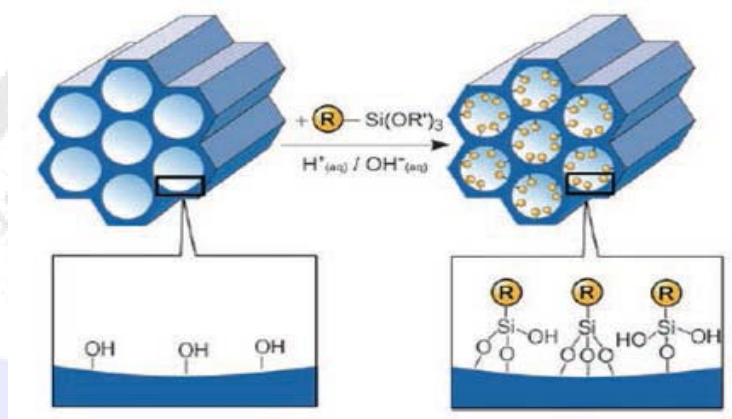


Figure 2 Grafting methods for organic modification of mesoporous silica material with organic functional group [10].

Aims: preparation and characterization of mesoporous material SBA-15, In order to use it for the removal of aqueous pollutants in batch and fixed bed column and comparative the adsorption process findings with other types of adsorbents such as activated carbon.

Objective

1. Nanoporous material SBA-15 and functionalized SBA-15 will be prepared and characterized using established methods.
2. The characterizations of Nanoporous SBA-15 before and after functionalization will study in details such as XRD, SEM, EDAX, BET surface area and FT-IR.
3. The adsorption isotherm will performed at equilibrium conditions according Langmuir, Freundlich and Temkin isotherms.
4. The pseudo-first-order kinetic and the pseudo-second-order kinetic will investigate to study the kinetics of the adsorption process.

5. Desorption kinetics and regeneration are also will examine to explore the practical usefulness of the adsorbent and its possible reuse in a batch and fixed bed continuous column sorption process.

Methodology: The proposed project has been designed for a period of 12 months, where the durations for the different phases of the project are shown below in brackets.

Phase 1: Adsorbents Preparation (months 1-2): SBA-15 type nanoporous silicas will be prepared using the liquid crystal templating (LCT) method. Organic surfactant molecules e.g. Tetraethylorthosilicate, will function as templates forming an ordered organic-inorganic composite material. The surfactant will then be removed by calcination in air leaving a porous silicate network. The formation of the inorganic-organic composites is based on electrostatic interactions between the surfactant and silicate species, whereby the silica condenses around the surfactant molecules. The amine functionalized SBA-15 will prepared by 3-aminopropyltrimethoxysilane (APTES 99%).

Phase 2: Characterization (months 2-3): Both Adsorbents pure SBA-15 and functionalized SBA-15 will be extensively analyzed to confirm their properties. The following is a list of the techniques that will be used and the information that will result:

- Nitrogen adsorption porosimetry, surface area, pore volume and pore size distribution.
- X-ray diffraction (XRD), cubic/hexagonal ordering of pore walls.
- Scanning electron microscopy (SEM), particle size and morphology.
- Fourier-transform infrared spectroscopy (FTIR).

Phase 3: Adsorbents Testing (months 3-5): The adsorption process will be studied using the batch; and fixed bed continuous column sorption process.

Phase 4: The properties of the produced pollutants will be analyzed according to the American Standard Test Method (ASTM) so as to measure the amount or concentration of pollutants.

UV spectrophotometer.

Dissemination

The successful outcome of this project is considered to be of sufficient scientific merit to warrant a number of publications in high-impact journals. Dissemination will also occur through publications in other peer-reviewed scientific journals and via posters and presentations at conferences.

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Research Title: Effect of Overheating on the Corrosion of Steam Boilers Pipes

**Supervisors: Assist. Prof. Dr. Shatha A. Sameh
Assist. Prof. Dr Abdul Khaliq F.Hamod**

Student Name: Zainab Z. Mohammed

Corrosion has always been an unavoidable part of petroleum refining and petrochemical operations. Although certain materials problems are caused by other factors, a predominant number are due to various aspects of corrosion. Corrosion.

problems increase operating and maintenance costs substantially. Scheduled and unscheduled shutdowns for repairing corrosion damage in piping and equipment can be extremely expensive, and anything that can be safely done to keep a process unit on stream for long periods of time will be of great benefit. A large proportion of corrosion problems are actually caused by shutdowns. When equipment is opened to the atmosphere for inspection and repair, metal surfaces covered with corrosion products will be exposed to air and moisture. This can lead to pitting corrosion and stress corrosion cracking unless preventive measures are implemented. When equipment is washed with water during a shutdown, corrosion can be caused by pockets of water left to dry. Most petroleum refining and petrochemical plant operations involve flammable hydrocarbon streams, highly toxic or explosive gases, and strong acids or caustics that are often at elevated temperatures and pressures. Among the many metals and alloys that are available, relatively few can be used for the construction of process equipment and piping (Ref 1). These include carbon steel; some cast irons; certain low-alloy steels and stainless steels; and, to a much lesser degree, aluminum, copper, nickel, titanium, and their alloys. This article will present the considerations and concerns involved in selecting materials for process equipment in refineries and petrochemical plants. In addition, specific information on mechanical properties, corrosion, stress-corrosion cracking (SCC), erosion, and corrosion control will be provided.

Statement of The Problem

The general problem of the basic elements of a steam plant is focused in this research. Steam is generated in a boiler from which it passes into the steam main. The steam main feeds the steam into a turbine or engine or it may pass into some other plant such as heaters or process machinery. After expending through the turbine or engine or passing through some other

plant, if the plant is working on “dead-loss” system, then the exhaust steam passes away to the atmosphere. This system is very inefficient and is rarely adopted in modern plant. It is used in the steam locomotive since in this case the plant needs a sufficient place for the complex steam recovery equipments, which can be installed in power station. If steam recovery plant is installed then the exhaust steam passes into a condenser where it is condensed to water, called condensate [1].

Boiler pipes can be defined as the part of the boiling system that carries the steam from the boiler where the steam generated in wet state to the steam main. If however, superheated steam is required, then the wet steam is removed from the steam space and is piped into a super heater. These pipes must be sealed reliable and working properly without any burst or leakage during the working time. The proper working of these pipes required the following:

1. Uniform thickness of the steel pipe without any leakage or burst.
2. Little or no scaling inside surface with no existence of any flow choking along the pipes.
3. An advance heat transfer across the thickness.
4. Capability to withstand the hot stem pressure without any deformations such as swelling.

It known that these pipes actually corroded and swelling up until the burst occurs. The changes into the pipe material properties can lead to disaster consequences as mentioned above where the burst can be so expected machined onto their surfaces. Ultimately, a pipe will simply wear out-of tolerance overtime and use; however, several failures, such as heat overheating and gross cracking, may cause the pipes to fail before they should.

Purpose of Study

A variety of testing and background research on topics such as metallographic, hardness, erosion, and corrosion testing has provided several possible solutions to the failure analysis problem. Visual inspection has revealed oxide inclusions near the suspected failure initiation points.

Review of the Literature

Anees U. Malik et al [2], studied the leakage that observated from the roof tubes on the second pass of boilers 6, 7 and 8 of Jeddah phase – 3 plant, pipes were examined a surficial cracks and pits on the fire side of the tube wall.

Zhang Baoyou et. al. [3], studied the rupture of a boiler pipe by using chemical analysis, scanning electron microscope, and energy dispersive spectroscopy. The results show that excess temperature caused by obstruction of stream flow was associated with the bubble clusters on the bore surface, which resulted in the creep deformation responsible for elongated grains and

wall thinning. The pipe burst because the high temperature strength was below the designed standard.

Weili-wa et. al. [4], studied the metallographic and metallic materials of three boilers burst tube in accident, which provide a basis for diagnosis and determine the common cause of the boiler tube burst accidents, and also set a foundation for the prevention measures of the steam boiler tube burst accident. By analysis and comparison of the components, macroscopic and microscopic morphology of three blast tubes, the major cause of the boiler tube burst is too high wall temperature of boiler tube. Because the circulated water in steam boiler have more carbonate content, the carbonate was crystallized in the wall of tube at the point of the overheated section, so the thermal resistance increases and the boiler tube wall temperature grows and metal performance failures, finally the accident of steam boiler tube burst happens.

Chen qi-sheng et. al. [5], investigate the tube burst accident in the oil field. It not only influences the length of boiler life, but also creates the huge economic loss. In view of tube burst accident arising from factory of production crude oil, based on the examination data, the reason of burst has been analyzed and the final conclusion also has been draw. The preventive measure and the identical accident were prevented.

Methods and Procedures

أختيار عينات معدنية ملائمة لتحاكى الوحدات الصناعية ذات العلاقة وفق أبعاد محددة تخضع للمواصفة القياسية الخاصة بأجهزة الفحص، فحص نماذج من تلك العينات لتحديد خواص الأكسدة والبنية المجهرية والخواص الميكانيكية المطلوبة، بعدها أجرا فحوصات الأكسدة والفحوصات المجهرية والميكانيكية لجزء من تلك العينات بعد تعريضها الى ظروف مختلفة تحاكي الظروف الجوية والتشغيلية الحقيقية ، ومناقشة التباين الحادث في التصرف لربط التأثير البنيوي على كل من التصرف الحراري والميكانيكي ، كما يمكن بعدها تصنيع مجموعة عينات أخرى معاملة بطبقات طلاء مقترحة ومحاولة الحصول على منحنيات الأكسدة لتلك العينات ، لتحديد مدى أثر طبقات الطلاء الموظف في رفع مقاومة السطوح المعدنية من الوجهتين الميكانيكية والحرارية وتأثرها بالظروف التشغيلية وأيضا ربط ذلك بالخواص الميكانيكية ومحاولة أيجاد سبل عملية للحماية ودراسة الجدوى الاقتصادية لتلك الطرائق محاولين تطبيقها في واقعنا العملي.

Sampling

In this study two type of stainless steels (304SS and 316 SS) , low alloy steel (Type T22-ASTM) and Inconel 600 alloy (nickel-base superalloy) were used. The nominal compositions of these alloys are tested. Spectrochemical analysis for 316SS, 304S and for Inconel 600 alloy (nickel-base superalloy) was carried out at (The spectrochemical analysis for low alloy steel (Type T22-ASTM) was carried out using metals analyzer type 1650 (ARUN Technology, Germany) , The low alloy steel (Type T22-ASTM) and Inconel 600 alloy (nickel-base superalloy) alloys samples were cut into squares shape with dimensions

(20 mm × 20mm × 4mm). The stainless steel samples 304SS and 316 SS0 were cut into a disc shape with diameter 10mm and thickness 3.5 mm. Small hole of 2 mm diameter was drilled in each sample for holding. All surfaces, including the edges were wet ground using 120, 220, 320, 600, 800, and 1200 grit silicon carbide papers. These samples were then cleaned with water, degreased with acetone and then ultrasonically cleaned for 30 places along the length to a precision ± 0.01 mm using a calibrated micrometer. The weight of each sample was measured using a Mettler microbalance (Switzerland) with an accuracy of ± 0.1 mg. The balance was calibrated frequently using standard weights. Prior to weighing, all samples were held overnight in glass desiccator in order to eliminate any effect of humidity on the sample weight determination.

Instrumentation

- Cutting machine
- Grinding –polishing
- Optical microscopy
- Scanning electron microscopy
- Atomic force microscopy
- Furnaces
- Microhardness tester
- Hardness tester
- Ultrasonic pundit tester
- Tensile test instrument
- Wear test instrument
- Potentiostat tester

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Research Title: Study of Fluidizing System Behavior Using Nano-Partical

Supervisor: Assist Prof. Dr. jamal M. Ali

Student Name : Sara Talal

Introduction

Gas fluidization of small solid particles has been widely used in a variety of industrial applications because of its usual capability of continuous powder handling, good mixing, large gas-solid contact area and very high rates of heat and mass transfer. It was understood that normal fluidization of such powders is extremely difficult. These are however influenced by the particle size, its cohesiveness, bed height and aspect ratio. The fluidization behavior of particles is strongly related to their physical properties such as the size and density. A better understanding of the fluidization behavior or of nanoparticle agglomerates is therefore of great importance in applications involving mixing, transporting, modifying the surface properties (coating) and downstream processing of nanoparticles to form nano composites. Nanoparticle handling and processing technologies have received widespread attention recently because of the increased use of nanoparticles in the manufacture of drugs, cosmetics, foods, plastics, catalysts, and energetic and other advanced materials. The fluidizing materials are Al_2O_3 and SiO_2 , Al_2O_3 is one of the most widely used ceramic materials because of its excellent physical, thermal and chemical properties, but its intrinsic brittleness and relatively poor reliability make the toughening of alumina ceramics an important and challenging area. SiO_2 is one of the most materials used in many industrial applications. Nanoparticles are very attractive for various industrial applications due to their chemical, optical, biological and electrical characteristics such as surface and interface effect, high transparency and high dispersion. However, even for the homogeneously fluidized bed nanoparticles, relatively large powder elutriation occurs at the high gas velocities required to fluidize the nanoagglomerates. This loss of particles may hinder the applicability of fluidization of nanoparticles agglomerates in industrial process. In order to solve the elutriation problem, the fluidization of agglomerates of nanoparticles enhanced by applying external forces, like magnetic particles moving under the effect of a magnetic field, vibration of the bed, fluidization assisted by sound or fluidization under high gravity forces simulated by rotating bed are also found in the literature.

Objective of This Work

The objective of this work is to study the hydrodynamics of fluidized bed behavior of nanoparticle materials such as Al_2O_3 and SiO_2 .

The minimum fluidization velocities and different superficial velocities will be measured during this work, in addition to the pressure differential and bed voidage throughout the bed.

Experimental Methods

A schematic diagram of the experimental fluidization system is shown in **Figure 1**.

The system consists of two fluidized bed columns made of a acrylic material. The columns are of an inner diameter of 45mm and 75mm with height of 100cm. The fluidized is a vertical transparent column with distributor plate from porous ceramic material. The fluidized medium is air passing on the silica gel particles to remove any humidity in the air. The flow of fluidizing air is measured by a set of rotameters. The pressure drops along the fluidizing column is measured using a digital differential pressure meter. An ultrafine mesh filter is located at the gas outlet to filter out any elutriated nano particle agglomerates.

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Research Title: The Use of Advanced-New Conventional-Technologies to Improve the Properties of Heavy and High Sulfur Crude

Supervisor: Prof. Dr. Neran K. Ibrahim

Student Name: Alya'a Mohammed Auad

Abstract

Heavy oil is a strategic, global hydrocarbon resource for the next century due to rising energy demand and rapidly depleting conventional oil supplies. HTL, or “Heavy-to-Light”, is a heavy oil upgrading process that converts heavy, viscous crude oil to lighter, transportable and more valuable synthetic oil. HTL operates economically at a significantly smaller minimum scale and at a fraction of the per-barrel costs as compared with conventional technologies. In addition, by-products from HTL upgrading are converted to significant amounts of valuable energy that is captured and utilized on-site.

The present work relates to a method for deasphalting heavy crude oil containing asphaltenes and/or oil refinery residues using solvents and ultrasonication energy resulting in an upgraded higher value synthetic crude oil which may be further upgraded by a chemical process. The vigorous sonication will be used in the current process to enhance solvent extraction of the non-asphaltene fraction from the HCO through enhanced mass transfer as a result of the sonication and secondary effects such as cavitation. The sonication device is a sonicating probe in direct contact with fluids. The treated oil expected to have less sulfur, lower viscosity, and a higher API gravity. In addition, the remaining sulfur can thereby converted to a different sulfur species that can be more easily separated. The deasphalted HCO/solvent mixture may advantageously be used as the feedstock for a chemical oil upgrading process. The chemical process uses one or more oxidants in the presence of an acid.

Background

Crude oil serves as major source of energy in the world today as compared to other fuels such as coal and electricity. The most important use of crude oil is as source of fuels for domestic and industrial application. It has become the major raw material for the petrochemical industry for the manufacture of detergents, pharmaceuticals, fertilizers, synthetic fibers and many other products needed for human existence. It is also used for the manufacture of technical white oils, emulsifiers and insulating oils (Sabarathinam, 2005).

Crude oil is a mixture of a very large number of different hydrocarbons molecules, which are organic compounds of carbon and hydrogen atoms that may include from one to 60 carbon atoms, along with inorganic compound called heteroatom: sulphur, nitrogen, and trace metals such as iron, nickel, copper, vanadium etc (Erikh et al., 1984; Ram, 2006).

The properties of hydrocarbons depend on the number and arrangement of the carbon and hydrogen atoms in the molecules. The most commonly found molecules are alkanes (linear or branched), cycloalkanes, aromatic hydrocarbons, or more complicated chemicals like asphaltenes (OSHA, 1993).

In petroleum systems, asphaltenes and resinous substances comprise a major portion of the interracially active component of the oil (Abdulrahman et al., 2006a).

Each petroleum variety has a unique mix of molecules, which define its physical and chemical properties, like color and viscosity (OSHA, 1993). Crude oil differs from one another in a large number of chemical and physical properties, many of which play an important part in their refining and subsequent sale as refined products (Hanni, 2004).

Heavy crude are distinguish from lighter ones by their physical properties: higher viscosity, and specific gravity, as well as heavier molecular composition. It is dense and viscous due to the high presence of naphthenes and paraffines (Petroleum- Wikipedia, 2007).

Heavy crude oil contains greater proportions of higher-boiling constituents such as lubricating oil (motor oils, lubricants, engine oil, cylindrical oil, and gear oil), greases and wax, and residue (residual fuel oils, coke, tar and asphalt). In addition, more aromatic, and heteroatom – containing (N, O, S and metals) are contained in heavy petroleum than light petroleum (Speight, 2001).

Consequently, heavy crude are often priced at a discount to lighter ones, probably due to increased refining costs, low proportions of lower- boiling fractions, and high sulphur content.

The refining process rearranges hydrocarbon structures and bounding patterns into different hydrocarbon molecules and compounds. Therefore, in the refining process, the type of hydrocarbon (paraffinic, naphthenic, or aromatic) is significant rather than its specific chemical compounds. These hydrocarbon molecules are separated by fractional distillation at an oil refinery to produce gasoline (petrol), jet fuel, kerosene, and other hydrocarbons such as 2,2,4 – trimethyl pentane (isooctane) widely used in gasoline (OSHA, 1993).

Heavy oil refers to any crude oil having a gravity of less than 20 °API. Heavy oil is estimated to account for nearly 50% of total remaining global recoverable oil resources, with 2.0 trillion barrels of heavy oil and 2.3 trillion barrels of conventional oil recoverable for future production. Heavy oil resources are encountered globally, with major reserves in Canada, South America, Russia, China and the Middle East. One important benefit afforded by the development of these resources is that the majority of the recoverable volume has

already been discovered, thus minimizing exploration risk. Although heavy oil represents nearly half of the world's total recoverable resources, current global heavy oil production constitutes only 12% of the total oil supply.

Furthermore, the production of heavy oil is a contemporary trend -- of the 1.0 trillion barrels of oil produced to date, a mere 0.01 trillion barrels has been contributed by heavy oil.

The large disparity between total recoverable heavy oil estimates and the amount that has actually been produced can be attributed to the many challenges encountered in producing and monetizing heavy oil deposits. Economic development of heavy oil resources is hampered by production and transport challenges resulting from the crude's high viscosity as well as the cost of pre-processing prior to final refining. Thermal recovery methods can consume energy equal to 25% of the total energy present in the produced volume of heavy oil itself, which detracts from the project economics and increases emissions into the environment. Operators are burdened with having to reduce the viscosity of the extracted heavy oil before it can be transported to markets, typically through blending with costly diluents. Another obstacle to economic production is the inherently lower market value of heavy oil due to the presence of high quantities of residual oil in the whole crude.

This residual oil must be blended into lower value heavy fuel oils or processed through a "bottom-of-the-barrel" conversion unit at a refinery, giving heavy oil a lower market value which is reflected in light-heavy crude price differentials.

The conventional approach to heavy oil upgrading has been limited to solutions involving very large, capital-intensive upgraders, such as those with coking facilities. These solutions, however, require massive minimum scale and do not address the upstream challenges associated with accessing an economic fuel source for steam production and transport of heavy oil from the field.

All of these encumbrances have left many heavy oil assets around the world economically or technically stranded.

Sulfur in Crude Oil

Sulfur is the most abundant element in petroleum after carbon and hydrogen. The average sulfur content varies from 0.03 to 7.89 mass% in crude oil (Mehran et al. [2007](#)). The sulfur compounds can be found in two forms: inorganic and organic. Inorganic sulfur, such as elemental sulfur, H_2S and pyrite can be present in dissolved or suspended form (Agarwal and Sharma [2010](#)). Organic sulfur compounds such as thiols, sulfides, and thiophenic compounds represent the main source of sulfur found in crude oil. Some of the important classes of organic sulfur compounds are shown in Fig. [1](#).

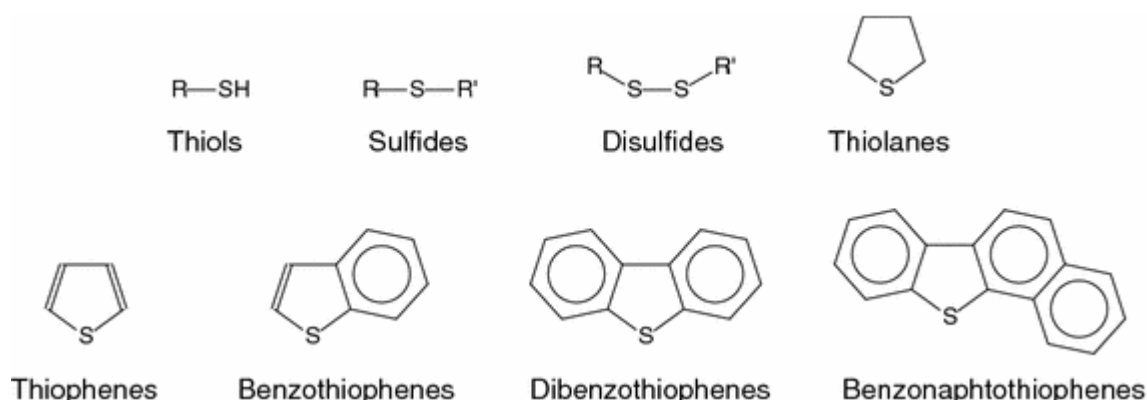


Fig. 1 Important classes of sulfur-containing compounds in crude oil (R = alkyl)

Crude oils with higher viscosities and higher densities usually contain higher amounts of more complex sulfur compounds. The aliphatic acyclic sulfides (thioethers) and cyclic sulfides (thiolanes) are easy to remove during a hydrodesulfurization process or by thermal treatment. On the other hand, sulfur contained in aromatic rings, such as thiophene and its benzologs (e.g. benzothiophene, dibenzothiophene, benzonaphthothiophene) are more resistant to sulfur removal by hydrodesulfurization and thermal conversion (Gray et al. 1995).

Rising energy prices and depleting resources of conventional crude oil are turning attention toward the vast global resources of heavy oil, extra heavy oil, and bitumen.

The traditional method for removing sulfur from oil involves hydrotreating, entailing capital-intensive investments in high-pressure, high-temperature hydro-desulfurization (HDS) units as well as boilers, hydrogen plants, and sulfur recovery units. The deeper the desulfurization required, or the heavier or more sour the crude used for feed, the more expense involved.

If the sulfur content of oil can be reduced before it goes into the separator or pipeline, there are many benefits. For example, it may meet pipeline specifications without having to add more expensive oil blends to the stream to increase value.

It is well known that solvent deasphalting can be used to upgrade heavy crude oil (HCO), to a synthetic crude oil (SCO) via enhancement of its chemical and physical properties such as:

- increased API gravity
- decreased viscosity
- decreased nickel content

- decreased vanadium content
- decreased sulfur content

Asphaltenes are defined as the part of the HCO or refinery residue precipitated by addition of a low-boiling paraffin solvent.

Deasphalting involves the solubilization of non-asphaltenes and the precipitation of asphaltenes, i.e. molecules insoluble in the deasphalting solvent.

API gravities above 19 and viscosities below 350 centistokes are particularly desirable for purposes of product pipelining.

Nickel contamination in oil refineries can come from two sources:

- 1- Corrosion of stainless steel (e.g. via the presence of hydrogen chloride or naphthenic acids)
- 2- Nickel organometallic compounds (e.g. porphyrins) in the asphaltene portion of bitumen.

Nickel, a hydrogen scavenger, causes catalyst fouling via coke formation due to dehydrogenation of alkanes to olefins in refinery catalytic crackers. Therefore SCO containing less nickel is more valuable.

Vanadium contamination in oil refineries can come from vanadium organometallic compounds (e.g. porphyrins) in the asphaltene portion of bitumen.

Vanadium destroys catalytic cracker catalysts by altering their crystal structure to non-catalytic forms. Therefore SCO containing less vanadium is more valuable.

The process of deasphalting has two purposes: to initiate upgrading of the HCO, by an average quantity of 4-5 API, as per prior technical evaluation as well as to remove a substantial quantity of sulfur from the HCO to the precipitated, insoluble asphaltene fraction.

Methodology

The current proposed process comprises of the following key unit operations:

- Intense agitation of the HCO/solvent mixture using sonic energy "sonication", where very intense mixing happens in the cavitation zone generated by the ultrasound resulting in efficient separation of asphaltenes from the HCO/solvent mixture.

The energy and fluid dynamic conditions and energy intensity produced by sonication devices, is advantageous for chemical process operations. Sonication enhances process reactions by causing intense mixing and other fluid dynamic effects such that sonication improves the selectivity or efficiency of the desired chemical or physical reaction.

The method exhibits improved solvent deasphalting, without excessive blending and dilution, by virtue of much faster deasphalting at low solvent to oil ratios, including separation of asphaltenes from deasphalted oil (in contrast to prior art methods) .

The cavitation induced as oil and additives stream through the reactor and past the ultrasonic probe leads to the creation of bubbles at the sites of refraction owing to the “tearing” of the liquid caused by the negative pressure of the intense sound waves. The bubbles then oscillate under the effect of positive pressure, growing to an unstable size as the wave fronts pass. The bubbles eventually burst, generating excess heat and pressure in and around every micrometer- and sub micrometer-sized bubble. This happens in a matter of “nanoseconds, and each bubble behaves as a micro-reactor, accelerating the chemical reaction described earlier owing to the heat released and localized pressures obtained.

- Separation of the HCO from the asphaltene solids via physical separation e.g. decantation, filtration, centrifugation, etc.
- Chemical oxidation of asphaltene stripped HCO/solvent mixture. The proposed technology works by taking the sulfur, chemically bound to some of the molecules in the crude oil, and oxidizing it using hydrogen peroxide — a classic oxidant — together with the ultrasound. On a molecular level, the hydrogen peroxide donates one of its two oxygen atoms to the sulfur to form water as the byproduct.

The oxidation reaction may be quenched through absorption of generated polar compounds and sulfur compounds by passing the deasphalted HCO/solvent/reagent reaction product through a natural clay and activated carbon mixture that removes excess and/or unconsumed oxidation reagents.

- Removal of solvent from the asphaltene stripped HCO/solvent mixture to create a solvent free SCO. Distillation may be used to remove solvent from the HCO/solvent mixture after removal of precipitated asphaltenes so as to create a deasphalted and solvent free synthetic crude oil (SCO).
- Recycling of the solvent for further processing of raw HCO.

Chemicals

- Crude oil: Al-Ahdab or East Baghdad
- Solvent : pentane, hexane or iso-octane
- Acid: Acetic acid or hydrochloric acid.
- Oxidant: Hydrogen peroxide combined with iron oxide
- The sorbent: Natural clay or activated carbon

Equipments

- Reactor
- Sonication probe
- Vacuum filter
- Separator
- Distillation Column



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Heavy oil refers to any crude oil having a gravity of less than 20 °API. Heavy oil is estimated to account for nearly 50% of total remaining global recoverable oil resources, with 2.0 trillion barrels of heavy oil and 2.3 trillion barrels of conventional oil recoverable for future production. Heavy oil resources are encountered globally, with major reserves in Canada, South America, Russia, China and the Middle East. One important benefit afforded by the development of these resources is that the majority of the recoverable volume has already been discovered, thus minimizing exploration risk. Although heavy oil represents nearly half of the world's total recoverable resources, current global heavy oil production constitutes only 12% of the total oil supply. Furthermore, the production of heavy oil is a contemporary trend -- of the 1.0 trillion barrels of oil produced to date, a mere 0.01 trillion barrels has been contributed by heavy oil. The large disparity between total recoverable heavy oil estimates and the amount that has actually been produced can be attributed to the many challenges encountered in producing and monetizing heavy oil deposits. Economic development of heavy oil resources is hampered by production and transport challenges resulting from the crude's high viscosity as well as the cost of pre-processing prior to final refining. Thermal recovery methods can consume energy equal to 25% of the total energy present in the produced volume of heavy oil itself, which detracts from the project

economics and increases emissions into the environment. Operators are burdened with having to reduce the viscosity of the extracted heavy oil before it can be transported to markets, typically through blending with costly diluents. Another obstacle to economic production is the inherently lower market value of heavy oil due to the presence of high quantities of residual oil in the whole crude. This residual oil must be blended into lower value heavy fuel oils or processed through a “bottom-of-the-barrel” conversion unit at a refinery, giving heavy oil a lower market value which is reflected in light-heavy crude price differentials. The conventional approach to heavy oil upgrading has been limited to solutions involving very large, capital-intensive upgraders, such as those with coking facilities. These solutions, however, require massive minimum scale and do not address the upstream challenges associated with accessing an economic fuel source for steam production and transport of heavy oil from the field. All of these encumbrances have left many heavy oil assets around the world economically or technically stranded.

Research Title: Re-Refining Of Used Lubricant Oil By Solvent Extraction

**Supervisors: Assist Pro. Dr. Adnan Abdul-Jabbar
Dr. Adil Sh. Hammadi**

Student Name: Ghassan Rokan Daham

Introduction

Considered treatment and recycling motor oil used important industries for its contribution to benefit from raw materials (waste) and recycled , thereby reducing the waste of economic resources available on the one hand and reduce pollution environment on the other hand The idea of the proposed project to study the best ways to re- refining used oil , which include assembled and purification of solids , metals and impurities and recycled again to extract oil base that can be used for the production of lubricating oils and certain thus contributing to supplement the national economy and the development of the production process and provide alternatives to currently used methods .

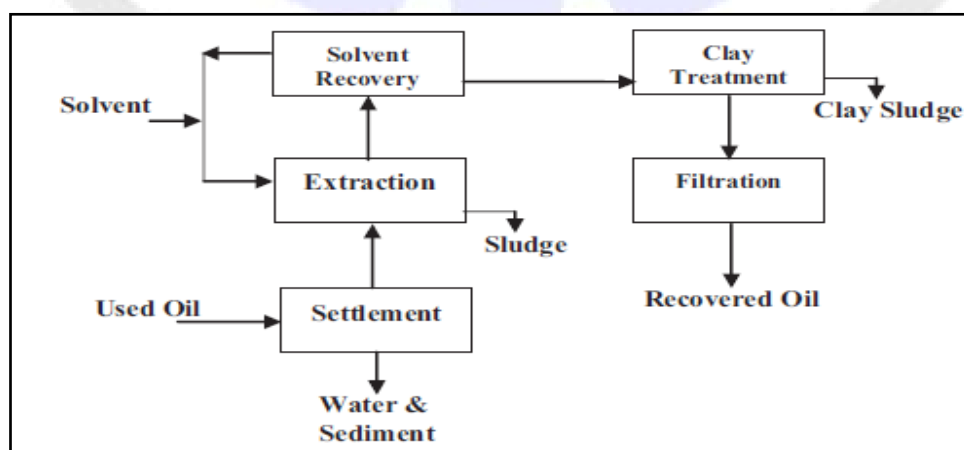
Statement of the problem

The recycling of used oils is becoming increasingly important year after year with the continued global development in the design of engines and machines in order to give a better performance under harsh operating Living situation.

So, the process of the production of lubricating oils must be always in constant evolution in order to comply with recent trends in the design of machines and equipment and machines used in all sectors.

Search scheme

Work steps can be illustrated through the following chart :



Search steps

Includes the following steps :

A -- The first step: collecting adequate amounts of used lubricating oils from reliable sources and based on the results of the process of working hours (operating life) of oil user.

B -- the second step : test lubricating oil user Methods of Analysis of World Records

C -- The third step : filtration process using a filtration system designed to separate solid impurities insoluble in oil user , and then conduct all tests iPods automated analysis of modern knowledge of ingredients and quantities of these impurities and its impact on the operational life and efficiency of the oil.

D -- Step four: process of vacuum distillation and pressure different to find the best operating conditions for the separation of water and light component petroleum in oil user , group, and examine the quality and quantity of the laboratory to find the best way to take advantage of the refineries , on the other hand will hold all the tests referred to in the second stage above. Oil output from the vacuum distillation stage

E -- Step Five: process of extraction of oil output from the vacuum distillation using different solvents such as furfural and MEK and various alcohols and find the best batch of temperature and the ratio of solvent / oil ratios and mixing dual solvents and others. And conducting all the required tests on the oil extraction process after all for the purpose of comparison and scientific measurement accuracy .

Aim & Objectives:

The aim of the present work is to extract the base oil from the used lubricant oil by using re-refining the used oil by using vacuum distillation and extraction the base oil by using solvent such as , MEK, Furfural and mixed of them.

The study includes the following :

- a- Studying the effect of vacuum pressure on the properties of distillate (carbon residue and ash content) and on the yield of oil .
- b- Studying the effect of operating variable (extraction temperature and solvent to oil ratio) on extract properties (carbon residue , ash content and viscosity index)
- c- Make a comparison between the performance of MEK , furfural solvent and mixed of them . And Use available additives and to obtain the minimum amount of these additives which gives the high quality product of lubricant oil. As well as reduce the amount of used oil and disbursed in the sewers and in the natural environment .And the achievement of economic benefit to the process of recycling used oil and supplement the resources of the Iraqi economy, other than contributing to raise the value of the Iraqi economy Compared with other countries.

Significance of the research

The importance of this research is concentrated in the following:

- 1- recycling of used oil generated from equipment and converted to oil lubrication indispensable to the protection of all rotating parts of machinery or equipment .
- 2- take full advantage of Used Lubricating Oils , which have some of the companies and bodies disposed of through the sewer network , causing serious environmental pollution as well as the high costs of wastewater treatment .

It is through these points illustrated the importance of establishing projects that serve the environment through waste recycling and can thus preserving the environment from pollution next to contribute to the benefit of these raw materials for the production of industrial accessories useful and economic benefit.

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Research Title: Experimental Study and Simulation of Advanced Oxidation Processes for Wastewater Treatment

Supervisors: Assist. Prof. Dr. Mohammad F. Abid
Assist. Prof. Dr. Ghanim M. Alwan

Student Name: Lamyaa Adnan

Introduction

The treatment of effluents is one of the major social, economic and political problems of our days. As consequence, many researchers have focused their scientific interests in environmental issues. The objective of the so-called green chemistry is mainly directed to emerging technologies by designing environmentally benign processes. Conventional biological processes have associated significant disadvantages, such as inhibition of microorganisms by certain pollutants, impossibility to treat high concentrations of organic compounds and production of sludge, which is another source of pollution. Advanced oxidation processes (AOPs) are alternatives in this domain. Catalytic wet air oxidation (CWAO) is one of the most economically and technologically viable AOP for wastewater treatment and has been successfully applied to the oxidative decomposition of organic and/or inorganic materials in wastewater (Kim, 2010). The selected process is a suitable technique for wastewaters with high COD value (Chemical Oxygen Demand) from 10 to 150 g L⁻¹. Hazardous wastes can also be treated and energy recovery is possible (Debellefontaine et al. 1996).

Proposal objectives

In order of priority, the specific objectives of the proposed research,

- 1-Protect the environment by detoxifying contaminated surface and ground water.
- 2-The study covers the most important aspects of CWAO such as catalyst performance, process operation, complex reaction kinetics and reactor modelling.
- 3-Results of the present study may be used as a data base for design a water remediation system according to AOPs fundamentals.

Statement of the Problem

Large amounts of water are used in a petroleum refinery and, consequently, significant volumes of wastewater are generated (0.4-1.6 times the volume of processed oil) (Fica-Piras 2000). The

traditional treatment of refinery wastewater is based on physicochemical and mechanical methods with further biological treatment within the integrated activated sludge treatment unit. With respect to the fact that different concentrations of aliphatic and aromatic petroleum hydrocarbons are present in the wastewater, among which the aromatic fraction is not readily degraded by conventional treatments and is more toxic, moreover sulfur compounds such as hydrogen sulfide, thiosulfates and mercaptans can present serious wastewater problems for refiners. There is still a need for advanced techniques to remove these pollutants (Stepnowskia et al. 2002, Salmanov et al. 2008). In this study, catalytic wet air oxidation of a simulated refinery wastewater that contains various organic matters was investigated in a laboratory scale fixed bed reactor. The aim of this project is to determine the optimum operating conditions for the reaction of organics in the wastewater with oxygen or air using AC catalyst. For this purpose, the effects of temperature, gas flow rate, liquid space velocity and initial concentration of organics on the conversion of at constant pressure and the effect of pressure on the conversion of various organics at constant temperature were investigated..Also formulating a feasible mathematical model which could be utilized for design, scale-up, and simulation of AOPs processes.

Literature Survey

WAO is a destructive wastewater treatment process where pollutants of the wastewater are oxidized with oxygen containing gas (typically air or oxygen) at elevated temperatures (125 °C - 300 °C) and pressures (0.5 - 20 MPa) to CO₂, water and also to intermediates which are usually carboxylic acids (Mishra et al. 1995). The severe conditions (high temperature and pressure) of WAO can be reduced and the efficiency of the process can be considerably improved by the use of heterogeneous catalysts (Levec and Pintar, 2007).

Supported noble metal (Pt, Ru, etc.) catalysts are developed and tested in order to improve the efficiency of the catalytic oxidation (Duprez et al. 1996, Oliviero et al. 2000). Ruthenium supported on ceria with high oxygen storage and exchanging capacity has shown to be a very effective catalyst in CWAO (Mikulová et al. 2007a, 2007b).

Fortuny et al. (1998) demonstrated that activated carbon (AC) alone, without the help of any catalytic species, can effectively oxidize phenol solution in a trickle bed reactor without the presence of any active metal.

Eftaxias (2002) conducted a CWAO process for phenol degradation in a trickle bed reactor utilizing various types of catalysts (Pt, AC, and CuO). He studied catalyst activity and the kinetic mechanism of each catalyst.

Experimental Procedure

Continuous oxidation of harmful organics was conducted in a packed bed reactor performing in a fixed bed reactor. The equipment consists of an SS-316 tubular reactor, 30 cm long and 1.3 cm id filled with usually 7.7 g of AC ($D_p=0.5\text{mm}$) is heated by an electric heater with a temperature controller ($\pm 1^\circ\text{C}$). Independent inlet systems for gas and liquid feed permit the experiments to be performed at variable liquid to gas flow rate ratios. The liquid feed, which is a simulated wastewater of petroleum refinery, is stored in a 5 dm³ sst. tank, which is connected to a high-pressure metering pump that can dispense flowrates between 0.01 and 0.3 dm³ h⁻¹. The air used as oxidant comes from a cylinder equipped with a pressure controller that allows the operating pressure to be constant. A flow meter coupled with a high precision valve is used to measure and control the gas flowrate. The liquid and gas streams are mixed and then passed through a heating coil order to reach the reaction temperature. The mixture enters the reactor down flow or up flow over the AC bed, which is placed between two sintered metal discs. The exited solution goes to a liquid –gas separation and sampling system. Regularly, liquid samples were taken out for analysis.

Research Title: Modeling and Simulation of Inverse Three Phase Fluidized Bed Characteristics Using MATLAB

**Supervisors: Assist. Prof. Dr. Zaidoon M.
Dr. Amer A.**

Student Name: Nasma Balasim

Aim

Our research has been focused on the Characteristics of individual phase holdup, bed porosity and bubble properties such as size, rising velocity and frequency in a three-phase inverse fluidized bed by studying the Effect so gas and liquid velocities and particle density (particle kind) on the bubble properties.

Introduction

Fluidization is a technique through which fine solid particles behave like a fluid through contact with liquid or gas or both. Under the fluidized state, the fluidized state, gravitational pull force on solid particles is offset by the fluid drag force. In fluidized condition particles remain in a semi-suspended condition. The term 'fluidization' is usually associated with two or three phase systems, in which solid particles are fluidized by a liquid or gas stream flowing in the direction opposite to that of gravity. In these classical fluidized bed systems, the solid particles have a higher density than the fluid. Fluidization where the liquid is a continuous phase is commonly conducted within upward flow of the liquid in liquid-solids systems or with an upward co-current flow of the gas and the liquid in gas-liquid-solid systems. Under these fluidization conditions, a bed of particles with a density higher than that of the liquid is fluidized with an upward flow of the liquid counter to the gravitational force of the particles.

Inverse Fluidization

When the density of the particles is smaller than that of the liquid and the liquid is the continuous phase, Fluidization can be achieved by down flow of liquid, it is called Inverse Fluidization. Considering a bed of solid particles floating on a fluid surface, when a liquid or a gas is passed at a very low velocity down through the bed of particles, the particles start to move and there is a pressure drop. Increasing the fluid velocity steadily, the pressure drop and the drag on the individual particles increases and eventually the particles move more

vigorously and get suspended in the fluid. The particles float or sink depending on their density relative to the fluid/suspension. If the density of solid particles and continuous liquid phase is almost same then fluidization is only achieved by counter-current flow of gas and this type of fluidization is called solid-liquid-gas inverse fluidized bed.

Classification

If we only take into consideration the processes where the liquid is the continuous phase, two configurations are possible. The first case generally involves particles with a density higher than that of the liquid. It is known as mode E-I-a in Fan's (1989) classification. This kind of a reactor is widely used at the industrial scale, and well described in the literature (Wild et al.,

1984; Murayama and Fan, 1985). In the second case, solid particles may have a density lower than the liquid: this kind of reactor is commonly named inverse three-phase fluidized bed (referred as mode E-II-a by Fan), or inverse three-phase turbulent bed where the fluidization is only ensured by the gas flow (Comte et al., 1997).

Literature Review

Fan, Muroyama, & Chern (1982) were the first to study the hydrodynamic characteristics of inverse fluidized bed using low density particles of different diameter and density. They proposed correlations to predict bed expansion and gas holdup.

The use of fluidized bed equipment in Industrial applications is gaining importance, with respect to the food and the pharmaceutical industry and also in petroleum refining.

The main reasons for the success is the ability of fluidized bed to perform a number of unit operations (mixing, drying, coating, granulating, mass transfer, heat transfer, separation, leaching). With the development of fluidized bed, coal combustion and the recent interest in the use of fluidized beds for waste utilization and for dry solids separation, the potential applications of multi-component fluidized beds are on the rise. It is because, the fluidized particles though uniform in size at beginning, may change due to the attrition, coalescence and chemical reaction, thereby affecting the quality of fluidization. Therefore proper characterization of the bed dynamics for the binary and the multi-component mixtures in gas solid systems is an important pre-requisite for their effective utilization, where the combination of particle size, density and shape influence fluidization behavior.

Advantages Of Inverse Fluidization:

Inverse fluidization has got many advantages over the existing technique of fluidization. A few of them are as follows;

Low Energy Consumption

The inverse fluidization is achieved by a stream of fluid falling from the top and it is fluidizing in the direction of gravity against buoyancy. Hence not a very high velocity of inlet flow is required as in case of traditional fluidization. The minimum fluidization velocity is lower in this case. Also it takes lesser energy to pump a fluid to force the particles in this case. Hence viewing on a larger scale, at the industrial level, it can save a lot of energy. Such energy efficient processes are the need of today when energy crisis is at its peak.

High turbulence

In inverse fluidization, a big advantage is the achievement of higher turbulence, which is aided by an initial collision of fluid inlet with the bed particles, leading to foaming. This higher turbulence is the key in better mixing, and more solid randomness which leads in higher heat transfer rates. Better the turbulence better will be mass transfer rates between solids and gases (3-phase inverse fluidization) which improve the performance of a chemical reactor.

Gas-solid contact in gas-liquid-solid inverse fluidization

The traditional fluidization is inefficient for the gas solid cases of mass transfer or mixing and often many alternatives have to be used for the purpose. Inverse fluidization can promote contacting of solid and gas. A better mass transfer between gases and solids is expected in a 3-phase setup, improving the performance of the chemical reactor.

Erosion of vessel

Inverse fluidization was seen to be achieved at a lower velocity of the inlet flow, comparative to traditional fluidization, it can be directly predicted that the equipment parts will definitely have a longer life in the case of inverse fluidization. This helps in reducing run-time costs to industries.

Economical

The above four advantages show the efficiency of the process. Yet there are a few more ways how this process becomes economical. Firstly particles of the bed have to be lighter than the medium fluid. That does not mean particles of heavy materials cannot be used. A simple way is to use hollow particles, this gives a lighter particle and also the surface area available for a particle is more than that of a solid particle from a given amount of material. These hollow catalysts or bed particles can make the process further economical and

useful for a wide range of fluid; especially lighter fluids with lesser viscosity. In spite of the various advantages, the efficiency and quality of fluidization is adversely affected in cylindrical beds due to the particle size reduction results in entrainment, limitation of operating velocity in addition to other demerits like slugging, non-uniform fluidization associated with such beds.

Applications Of Inverse Fluidized Beds

The various applications of inverse fluidized bed are:

1. An important application of liquid-solid fluidized beds has been developed recently in biotechnology, namely, immobilized biocatalyst bioreactors.
2. Inverse fluidization finds main application in environmental engineering for waste water treatment and in biochemical engineering.
3. Environmental engineering in biological reactors (Legile et al).
4. Efficient control of biofilm thickness and ease of re-fluidization in case of power failure. These significant advantages found many applications of inverse fluidized beds in biochemical processes like ferrous iron oxidation and aerobic and anaerobic biological wastewater treatment like treatment of wine distillery waste-water. (Garcia Calderon, Buffiere, Moletta, & Elemaleh, 1998).
5. Minimum carryover of coated microorganisms due to less solids attrition

Previous studies on hydrodynamics of liquid-solid inverse fluidization

- 1- Ulagana than and Krishnaiah studied the hydrodynamic characteristics of two-phase inverse fluidized bed reactor with 12.5 to 20 mm diameter in a 75 mm column. They presented equations to predict 'minimum fluidization velocity' and fenning friction factor.
- 2- Femin et al. studied the pressure drop and bed expansion in a two-phase inverse fluidization column with 6 mm Low Density Poly Ethylene particles and Poly Propylene particles.
- 3- Nikov and Karamanev have reported mass transfer studies in liquid inverse fluidized bed reactor. They found that the mass transfer rate is independent of superficial velocity and particles and strongly depends on the density of the particles.

Experiment

Experimental setup:

A schematic diagram of the experiment setup is shown in fig1.

The column is transparent and made up of QVF with an outer diameter 10.5 cm.

Height of column is 1.25m, with an inlet at the top and an outlet at the bottom. The flow of the fluid (water) through this opening was controlled by use of valves. Water pumped through rota meters to the top of the column. Equal spaced pressure tapping's were mounted on the column wall and were connected to manometers. The distributor was used at both openings of the column. A motor driven reciprocating Pump is used to pump the water at the top of column. A distributor is used to assure the uniform flow of liquid into the column. Two rota meters are used in series to control the flow of liquid

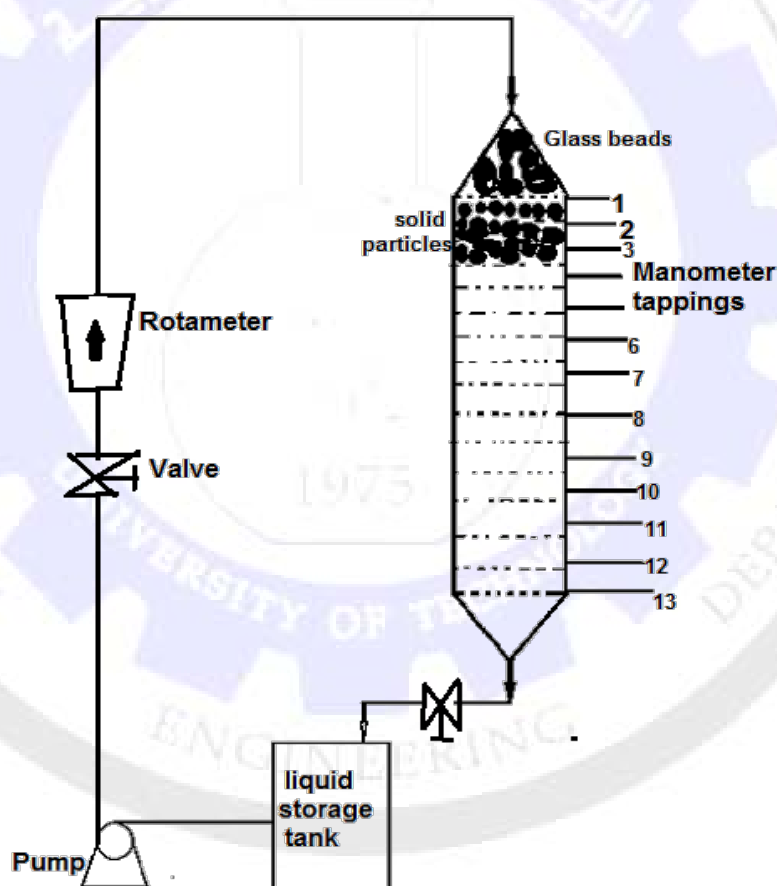


Fig. 1 Schematic diagram of experimental Set-up



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Research Title: Optimization Study for the Preparation of Nano Silica Using Precipitation Process and Its Application In Rubber Reinforcement

Supervisors: Assist Prof. Dr. Ana'am A. Sabri
Assist Prof. Dr. Najat J. Saleh

Student Name: Ali Haitham Salim

Introduction

The improvement of the mechanical properties (reinforcement) of elastomeric material by addition of rigid fillers represents one of the most important aspects in the field of rubber science and technology. The concurrent enhancement of stiffness (elastic modulus) and possibly of elongation at break due to the presence of rigid particles derives from hydrodynamic effects mainly depending not on the filler volume fraction but also affected by the filler shape. Factor concerning the field of fillers having dimensions in nanometric scale. polymer matrix nano composites have attracted extraordinary attention in the last decade on the basis of their excellent mechanical and barrier properties compared to the conventional micro composites , usually at very low filler content . Layered silicates , ceramic nanoparticles (such as silica , titania ,zirconia, etc), carbon nano fibers and nano tube are typical example of materials used as nanosize reinforcing additive .

Object

- 1- Rice husk (RH) , an in expensive waste material , was used to produce silica and nano silica by precipitation method .
- 2- The synthesized silica will be characterized by (SEM , BET , XRD ,FTIR,TEM)
- 3- The performance of the synthesized nanosilica as a reinforcing filler in Various kind of rubber compound, will be investigated using the commercial silica as the reference material .

Make statistical analysis for experimental results .

Equipment

1. Air oven
2. Reflux equipment
3. programmable furnace
4. rolling (metalworking)

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Current Research of M.Sc.

No	Research M.Sc.	Student Name	Supervisors
1-	Synthesis, Characterization, and Application of Nanosilica	زكية عبد الحسين يوسف	أ.م.د. نجاة جمعة صالح م.د. عامر عزيز
2-	Enhanced pool boiling heat transfer rates using nanomaterials	خيرية مطر عيسى	أ.م.د. جمال مانع علي
3-	Effect of Operating Variables on Drag Reduction Phenomenon by Polymeric Additives	ليث مجيد عبود	أ.د. عصام كامل
4-	Applications of Numerical Methods in, Galvanic Corrosion of Coupled Metals	بسمة محمد كاظم	أ.م.د. جمال مانع علي
5-	Sea Water Desalination by Membrane Distillation	سمراء رفعت خليل	أ.م.د. قصي فاضل م.د. صلاح سلمان
6-	Effect of particle and floc size on water treatment by physico-chemical process	مهند ابراهيم فرحان	أ.د. ثامر جاسم محمد
7-	Phase equilibria for extraction of phenolic pollutants from industrial wastewater using liquid membrane technique	انور جاسم محسن باهض	م.د. خالد فرهود
8-	Optimization of the Factors Affecting the Production of Nanosilica From Iraqi Sand and Its Industrial Application	علي داود سلمان جاسم	أ.م.د. نجاة جمعة صالح م.د. رحيق اسماعيل ابراهيم
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10-	A nanoporous SBA-15 as adsorbent for removal of organic pollutant from wastewater	رغد عدنان حبش حسن	أ.م.د. أنعام أكرم م.د. طالب محمد نايف
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12-	Treatment and Reclaiming of Iraqi Oil Field Produced Water by Flotation Column and Membrane Technology	هدى كاظم حسن زامل	أ.د. ثامر جاسم محمد أ.م.د. قصي فاضل
13-	Study the Corrosion Behavior of Carbon Steel in Presence of CO ₂ Gas in Oil Pipelines	نضال أحمد شاكر	أ.م.د. شذى أحمد م.د. شروق طالب
14-	Comparison Study Of Gas-Adsorption Activity Between Some Bulk And Nanocatalyst Powders	حيدر هاشم مهدي	أ.م.د. شهرزاد رفعت أ.م.د. عبد الكريم السامرائي
15-	Application of Lab View and Genetic Algorithm for Controlling of A plate Heat Exchanger.	ايمن فوزي زوين حمد	أ.م.د. زيدون محسن شكور



No	Research M.Sc.	Student Name	Supervisors
16-	Desulfurization of Diesel Fuel by Adsorption on Activated Carbon	سمر خالد خليل ابراهيم	أ.د. نيران خليل إبراهيم
17-	Advanced Oxidative Desulfurization of Fuel Oils	جعفر مازن جعفر حسين	أ.د. نيران خليل إبراهيم م.د. ولاء عبد الهادي
18-	Modified Multiwall Carbon Nanotubes for Organic Wastewater Treatment	ضياء عبد الرسول حسين	أ.م.د محمد إبراهيم أ.م.د عدنان عبد الجبار
19-	The effect of LSM Corrosion Protection on Al and Al Alloys	هبة خميس اسماعيل	أ.م.د شذى أحمد
20-	Hydrodynamics and Kinetic Study in an Ebulated-Bed Reactor for the (Heavy Oil) H-oil Unit	هالة حسين حسن عباس	أ.م.د محمد فاضل د. شاكر محمود
21-	Preparation and Characterization of Nanocatalyst for Desulfurization of (Vacuum Gas Oil) VGO	محمد احمد شهاب احمد	أ.م.د محمد إبراهيم أ.م.د عدنان عبد الجبار