

POSTER PRESENTATIONS

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(CE)





Crystallization of potassium-nitrate from system $\text{KNO}_3\text{-NaCl-H}_2\text{O}$ in a semi-industrial scale facility

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Abstract: This paper deals with defining optimal process structure of fractional crystallization of granulated KNO_3 from the tri-component system $\text{KNO}_3\text{-NaCl-H}_2\text{O}$. The basic of the process are defined by the authors by solving following components: 1) the synthesis of alternative process structures and verification of the selected structure for the system $\text{KNO}_3\text{-NaCl-H}_2\text{O}$, and 2) kinetics of crystallization of KNO_3 from this system defined by the rate of cooling of the system. This work synthesizes the optimal process structure of crystallization of granulated KNO_3 from the system of $\text{KNO}_3\text{-NaCl-H}_2\text{O}$. Fractional crystallization of this system is based on closed crystallization cycle between the isotherms 95°C and 20°C . The total process is composed of the two mutually connected and well synchronized processes: a) the process of isothermal evaporation at 95°C and NaCl crystallization, b) the process of cooling the system through the contact surface and KNO_3 crystallization (process of crystallization of KNO_3 from this system is shown in balance diagram). The kinetics of KNO_3 crystallization is particularly studied in this work in order to obtain defined size of the crystals in the range of $150\text{-}600\ \mu\text{m}$. Hydrodynamic regimes are also investigated in order to obtain particles of spherical shape.

Sažetak

Ovaj rad se bavi definisanjem optimalne procesne strukture tokom frakcione kristalizacije granularnog KNO_3 iz 3-komponentnog sistema $\text{KNO}_3\text{-NaCl-H}_2\text{O}$. Osnove procesa su definisane od strane autora rjesavanjem sljedecih komponenata: 1) sinteze alternativnih procesnih struktura i potvrde izabrane strukture na sistemu $\text{KNO}_3\text{-NaCl-H}_2\text{O}$, i 2) kinetike kristalizacije KNO_3 iz ovoga sistema, definisanom brzinom hladjenja sistema. U ovom radu je sintetizovana optimalna procesna struktura za kristalizaciju granulisanog KNO_3 iz sistema $\text{KNO}_3\text{-NaCl-H}_2\text{O}$. Frakciona kristalizacija ovog sistema je zasnovana na zatvorenom ciklusu kristalizacije izmedju isoterma 95°C i 20°C . Cjelokupni process se sastoji od dva medjusobno povezana i dobro sinhronizovana procesa: a) process izotermnog isparavanja na 95°C i kristalizacije NaCl -a, i b) procesa hladjenja sistema kroz kontaktnu površinu i kristalizaciju KNO_3 . Kinetika kristalizacije KNO_3 je posebno istrazivana u ovom radu u svrhu dobijanja kristala definisane velicine ($150\text{-}600\ \mu\text{m}$). Hidrodinamicki rezim je takodje proucavan u svrhu dobijanja cestica sfericnog oblika.



Study Of The Cultivation Of Some Microalgae From The District Of Bejaia (Algeria) In A Photobioreactor

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Keywords:

Microalgae,
Photobioreactor,
growth kinetics

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Abstract: Researchers in the field of the valorization of photosynthetic microalgae are constantly in progress since the last decade. These microalgae show important potential in various fields, especially in energy production. Indeed, microalgae prove to be a new source of fuels called biofuels. The aim of this work is the study of the growth of some microalgae from the "Sahel" river located in the region of "Akbou" and the "Illoulen" river situated in the region of "Ighram" (Bejaia - Algeria) in a closed system called a photobioreactor. We aim at isolating a kind of microalgae having important growth kinetics. The study of the growth kinetics of microalgae was conducted on three species; all of them were green: *Ulothrix*, *Cladophorasp* and *Spirogyra*. The influence of physico-chemical parameters (listed below) on the culture of the selected microalgae has been studied: influence of adding CO₂ on microalgae growth, influence of period of exposure to light, influence of bubbling of the culture medium, influence of nutrients adding on the microalgae growth. Obtained results show that the microalgae studied have significant growth kinetics.

Sažetak

Istraživači u području valorizacije fotosintetskih mikroalgi pokazuju stalni napredak u posljednjem desetljeću. Ove mikroalge pokazuju značajni potencijal u raznim područjima, posebice u proizvodnji energije. Doista, mikroalge su se pokazale kao novo biogorivo. Cilj ovog rada je proučavanje rasta nekih mikroalgi iz rijeke Sahel koja se nalazi u regiji Akbou i rijeke Illoulen koja se nalazi u regiji Ighram (Bejaia-Alžir) u zatvorenim sistemima poznatim kao fotobioreaktor. Cilj je bioizolirati specifičnu mikroalgu koja ima značajnu kinetiku rasta. Proučavanje kinetike rasta mikroalgi je provedeno na tri vrste zelenih algi: *Ulothrix*, *Cladophora SP* i *Spirogyra*. Utjecaj fizikalno – kemijskih pokazatelja (navedene u nastavku) na kulturi od abranih mikroalgi je ispitivan: Utjecaj dodavanja CO₂ na rast mikroalgi, utjecaj razdoblja izlaganja svjetlu, utjecaj mjehurića zraka u mediju kulture, utjecaj dodavanja nutrijenata na rastu mikroalge. Dobiveni rezultati pokazuju da mikroalge imaju značajan kinetiku rasta.



Liquid-Liquid Equilibria of Ternary Systems: Aqueous Mixtures of Valeric Acid with Several Solvents

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Keywords:

Liquid phase equilibria,
Valeric acid,
Solvent,
Ternary diagram.

Abstract: Valeric acid (n-pentanoic acid) has a very unpleasant odor and it is found naturally in the plant valerian (*Valeriana officinalis*). Volatile esters of valeric acid tend to have pleasant odors and are used in perfumes and cosmetics industry. Some esters are used also as food additives because of their fruity flavors. It is produced industrially by oxidation of amyl alcohol or by fermentation processes and can be found as a subproduct in the manufacture of adipic acid. Also as similar to other carboxylic acids, valeric acid are usually present as a waste product in the aqueous streams of the pharmaceutical, polymer, petrochemical and pulp paper industries. Any valeric acid found undesirably in aqueous solution must be removed and recovered. The economics of the recovery scheme for the removal of acid in diluted aqueous streams is important for the industrial applications, and reliable liquid-liquid equilibrium (LLE) data are required for an efficient design and operation of the related separation equipment. In this study, LLE data of (water - valeric acid – isoamyl alcohol), (water - valeric acid – ethyl valerate) and (water - valeric acid – ethyl caprylate) ternary systems were investigated at 298.15 K and atmospheric pressure, for which no such data were available in literature.

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Sažetak

Valerijanska kiselina (n-pentanskakiselina) ima vrlo neprijatan miris i nalazi se u prirodi u biljci valerijani (*Valeriana officinalis*). Isparljivi esteri valerijanske kiseline najčešće imaju prijatan miris, koriste se u parfemima i kozmetičkoj industriji. Neki esteri se koriste i kao aditivi hrani zbog svog voćnog okusa. Industrijski se dobija oksidacijom amilalkohola ili fermentacijom i kao sporedni produkt u proizvodnji adipinske kiseline. Slično kao i druge karboksilne kiseline i valerijanska kiselina je otpadni produkt u vodama proizvodnog procesa lijekova, polimera, celuloze, papira i petrokemijske industrije. Valerijanska kiselina koja se neželjeno nađe u ovim vodenim otopinama mora biti uklonjena i prerađena. Za industriju je od velike važnosti ekonomičnost prerade razblaženih vodenih otopina radi uklanjanja kiselina i neophodni su pouzdani podaci o tačno/tačno-oj ravnoteži (LLE) za uspješno dizajniranje separacione opreme. Ispitivani su LLE podaci trostrukih sistema ((voda-valerijanska kiselina- izoamilalkohol), (voda-valerijanska kiselina-etilvalerat) i (voda-valerijanska kiselina-etilkaprilat) na 298,15 K i atmosferskom tpritisku, za koje nema dostupnih podataka u literaturi.



Preparation and Characterization of Activated Carbon From Various Agricultural Wastes by Chemical Activation

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Keywords:

Activated carbon,
Chemical activation,
zinc chloride,
phosphoric acid.

Abstract: Activated carbon is well known as a porous material, with large specific surface area. It has been widely used for separation of gases, recovery of solvents, removal of tastes and odours from domestic and industrial water supplies, and a catalyst supports¹. Due to the current problems of environmental pollution, the use of activated carbon is increasing. In the carbonization process, moisture and volatile matter in the raw material is removed by heat treatment in inert atmosphere and the basic pore structure is formed. Activation process is an oxidation process. This is performed in two different method, physical and chemical. Generally, the physical activation is carried out by water vapor and carbon dioxide. Chemical activation is achieved with chemical substances such as phosphoric acid, zinc chloride, sulfuric acid, potassium hydroxide and potassium carbonate²⁻⁴. In this study; activated carbon from nutshell, orange peel, and melon seeds has been successfully produced by chemical activated process using zinc chloride and phosphoric acid as activating agents. The effect of activation temperature, activation time, surface morphology and yield were studied. Functional groups of activated carbon were determined by FTIR analysis and the surface porosity of the material was examined by SEM. And also activated carbons were used acetic acid adsorption. The results of adsorption were applied adsorption isotherm charts.

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Sažetak

Aktivno karbon je poznat kao aktivni materijal sa velikom specifičnom površinom. Primjena aktivnog karbonsa je velika u separaciji gasova, prečišćavanju rastvarača, uklanjanju ukusa i mirisa iz sistema za vodosnadbjevanje domaćinstava i industrije i kao pomoć u obavljanju funkcija katalizatora¹. Zbog prisutnih problema sa zagađenjem okoliša, upotreba aktivnog karbonsa je u porastu.

U procesu karbonizacije, vlaga i volatilna materija u sirovom materijalu se uklanja zagrijavanjem u inertoj atmosferi pri čemu se stvara osnovna porozna struktura. Proces se odvija u dvije različite metode, fizičkoj i hemijskoj. Fizička aktivacija se izvodi sa vodenom parom i karbon dioksidom. Hemijska aktivacija se postiže sa hemijskim supstancama kao što su fosfatna kiselina, cink hlorid, sulfatna kiselina, kalij hidroksid i kalij karbonat²⁻⁴. U ovom radu aktivni karbon je uspješno dobiven hemijski aktiviranim procesima iz ljuske oraha, kore narande i sjemenki dinje sa cink hloridom i fosfatnom kiselinom kao aktivnim agensima. Ispitivan je uticaj aktivacione temperature, vremena aktivacije i površinske morfologije i prinosa reakcije. Funkcionalne grupe aktivnog karbonsa su određene FTIR analizom dok je površinska poroznost materijala ispitana SEM metodom. Aktivni karbon je ispitivan i adsorpcijom sirćetnom kiselinom. Rezultati adsorpcije su korišteni za kreiranje adsorpcione izoterme.



Extraction of Glycolic Acid Using Trioctylamine (TOA) and Tridodecylamine (TDA) Mixture in Different Diluents

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Keywords:

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Reactive extraction,
Amine mixture

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Abstract: Extraction of glycolic acid has been investigated from aqueous solutions by five different solutions of trioctylamine (TOA)-tridodecylamine (TDA) mixtures at 298 K. The initial organic phases were prepared by the dissolution of TOA-TDA mixture in the solvents to produce solutions with 0.194-1.163 mol/L concentration range. Dimethyl phthalate (DMP), methyl isobutyl ketone (MIBK), 2-octanone, 1-octanol, and cyclohexyleacetate (CHA) were selected as solvents. In this study, effect of solvent type and amine mixture concentration on recovery of glycolic acid has been investigated. Distribution and equilibrium data for design of separation equipments have been obtained as a result of batch extraction of glycolic acid. It has been calculated distribution coefficients (D), loading factors (Z), extraction efficiency (E). The maximum removal of glycolic acid has been obtained as 81.39 % with DMP and 1.16 mol/L initial concentration of TOA-TDA mixture.

Sažetak

Ekstrakcija glikolne kiseline izvedena je iz pet vodenih otopina smjese trioktilamin (TOA) tridodecilamin (TDA) na 298 K. Osnovne organske faze su pripremljene otapanjem smjese TOA-TDA u otapalima, tako da njihova koncentracija bude u rasponu od 0,194-1,163 mol/L. Dimetilftalat (DMP), metil-izobutilketon (MIBK), 2-oktanon, 1-oktanol, i cikloheksilacetat (CHA) su izabrani kao otapala. U ovom radu je ispitan uticaj vrste otapala i koncentracije smjese amina na rikaveri ekstrahirane glikolne kiseline. Distribucija i ravnotežni podaci za projektiranje opreme za separaciju nastali su kao rezultat serije ekstrakcija glikolne kiseline. Izračunati su koeficijenti distribucije (D), faktori punjenja (Z) i efikasnost ekstrakcije (E). Maksimalna količina ekstrahirane glikolne kiseline je 81.39%, i to sa DMP i početnom koncentracijom TOA-TDA smjese od 1.16 mol/L.



Supercritical fluids for polymer processing: The interfacial tension (IFT) at the CO₂ + PEG interface

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Keywords:

Phase equilibrium,
interfacial tension (IFT),
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Capillary Rise (CR) method.

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Abstract: Knowledge of basic thermodynamic and transport data like phase equilibria, density, viscosity, dielectric constant, diffusion coefficient and interfacial tension is of fundamental importance for process design in order to satisfy economical requirements. Despite these data are widely reported in literature for pure substances, no data are available for mixtures of known compositions under pressure. Binary system of polyethylene glycol (PEG)/CO₂ as a model system to study the interactions of polymers with SCF at elevated pressures was taken under research. In the present work the interfacial tension at the (PEG)/CO₂ interface for PEGs of different molecular weights, ranging from 200 to 600, has been determined experimentally by a technique developed to study the interfacial interactions of the liquids in equilibrium with gas in a glass-windowed equilibrium cell by the Capillary Rise method.

Effect of pressure, temperature and molecular weight of polymer on the interfacial tension was investigated by using the method adapted to the measurement conditions and sample properties.

Obtained results were compared to literature data and the discrepancy was lower than 2.4 %.

Sažetak

Poznavanje osnovnih termodinamičkih i prijenosnih podataka kao što su fazna ravnoteža, gustoća, viskoznost, dielektrična konstanta, koeficijent difuzije i međupovršinski napon od suštinske je važnosti za dizajniranje procesa kako bi se zadovoljili ekonomski zahtjevi. Iako ima mnogo ovih literaturnih podataka za čiste supstance, nema dostupnih podataka za smjese poznatog sastava pod pritiskom. Ispitivan je binarni sistem polietilen glikol (PEG)/CO₂ kao model za proučavanje interakcije polimera sa SCF na povišenim pritiscima. U ovom radu, eksperimentalno je određivan međupovršinski napon (PEG)/CO₂ za PEGs molekularne mase u rasponu od 200-600, tehnikom koja je razvijena da prouči međupovršinske interakcije fluida u ravnoteži s gasom u zastakljenoj ravnotežnoj ćeliji, za što je korištena kapilarna-Rise metoda. Metoda kojom je ispitivan utjecaj pritiska, temperature i molekularne mase polimera na međupovršinski napon prilagođena je uvjetima mjerenja i svojstvima uzorka. Dobiveni rezultati su upoređeni sa literaturnim i odstupanje je niže od 2,4%.