Резюмета на научната продукция

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ИИХ – БАН

Публикации в списания

M. P. Lazarova,
Technologies for the removal of humic substances from surface waters,
Scientific works of UFT, LIX-2012, pp.601-604, 2012.

Abstract: Surface waters serve as the main source for drinking water in many countries. These waters are characterized with high content of humic substances, resulting in yellow-brownish colour, can cause odour and taste, increases corrosion and biofilm growth in the distribution network, and when water is disinfected it is a precursor to the formation of halogenated compounds which are carcinogenic. Because of health related reasons as well as better water quality, there is a need of efficient and reliable methods for removal of humic substances from drinking water sources.

M. P. Lazarova, D. S. Yankov,
Membranes for bioethanol recovery by pervaporation,
Scientific works of UFT, LIX-2012, pp.802-805, 2012.

Abstract: Bioethanol is considered the most promising biofuel due to its high energy value and may be used to replace refined petroleum in the future. When it is produced from lignocellulosic materials, low concentration bioethanol is gained and it has to be recovered and concentrated. Cost effective separation technologies are needed to reduce the energy demand for the production process. The membrane process pervaporation shows to be a highly potential method for the achievement of this goal. New materials for suitable membranes are essential for the successful application of pervaporation for the production of fuel-grade ethanol.

Madlena Lazarova, Krasimir Dimitrov,
Integrated process for recovery of alkaloids from yellow horn poppy,
University of Ruse “Angel Kanchev”, Scientific works, Chemical technologies, 50(9.1), pp. 56-59, 2011.

Abstract: The recovery of aporphine alkaloids from yellow horn poppy was studied. For this, solid-liquid extraction was coupled with pertraction. The alkaloids were transferred from the initial source material into the final receiving solution via the obtained native extracts of the plant and the organic liquid membrane. The applied integrated extraction-pertraction process showed to be very simple, rapid and efficient.

Madlena Lazarova, Zdravka Lazarova,
Hollow fiber membrane extraction: determination of rate controlling step of mass transfer,
University of Food Technologies – Plovdiv, Scientific works, LVIII(2), pp.261-266, 2011.

Abstract: Copper extraction from acid aqueous solutions was studied using a hollow fiber membrane contactor and four different LIX®-reagents. The individual process resistances due to diffusion of the copper ions through the aqueous boundary layer, diffusion of the copper-hydroxyoxime complex through the porous membrane and the organic layer, as well as the chemical reaction resistance were determined and compared.

Madlena Lazarova, Dragomir Yankov, George Kyuchoukov,
Butyric acid recovery applying liquid membrane technique,
University of Food Technologies – Plovdiv, Scientific works, LVIII(2), pp.267-271, 2011.

Abstract: Butyric acid, widely applied in food and beverage industries today, was extracted by means of liquid membrane (pertraction) technique. Pure dodecane was tested as potential membrane liquid. Sodium hydroxide solutions and distilled water were used as recipient phase. Experiments were carried out in a rotating disc pertractor. The process efficiency was strongly dependent on initial acid concentration. Sodium hydroxide permitted more effective recovery of the butyric acid.

Madlena P. Lazarova,
Pervaporation in the context of wastewater treatment,
Journal of International Scientific Publication: Materials, Methods & Technologies, 5(1), pp. 326-333, 2011.

Abstract: Membrane technologies represent one of the most effective and energy-saving alternative separation processes. In this paper the emerging process of pervaporation is introduced together with other membrane processes relevant to environmental applications, in particular to wastewater treatment. The basic process layouts of pervaporation are given; the mass transport is described by a three-step process and the selection criteria for membranes are included. Brief description of commercial pervaporation modules is given and the coupling of pervaporation with other separation techniques for better performance and process optimization is considered.

Z. Lazarova, M. Lazarova,
Hollow-fiber membrane extraction of copper from aqueous nitrate media by LIX® reagents: comparison of extraction efficiency and fractional resistances,
Solvent Extraction and Ion Exchange, 29, pp. 128-145, 2011.

Abstract: Extraction of copper from nitrate/nitric acid aqueous solutions was studied using a HF Membrane Module and four LIX-reagents (LIX® 860N-I, LIX® 984N, LIX® 84-I, and LIX® 65N) containing different active compounds (ketoximes and/or salicylaldoximes). Kinetic experiments varying the flow rates of both phases, aqueous and organic, and the extractant concentration were carried out to compare the extraction rate and efficiency from nitrate aqueous media. A mathematical model based on the "aqueous extraction mechanism" in which the chemical reaction takes place in a aqueous reaction zone was applied to determine the individual resistances of the copper mass transfer process. It was found that the fractional resistance due to chemical reaction in the aqueous reaction zone, which varied from 92.5 % to 95.8 % in the order LIX® 860N-I < LIX® 984N < LIX® 84-I < LIX® 65N, controlled the total rate of the hollow-fiber copper extraction from nitrate aqueous media.

Madlena Lazarova, Zdravka Lazarova,
Hollow fiber membrane extraction of copper by LIX® reagents,
University of Food Technologies – Plovdiv, Scientific works, LVII(1), pp. 513-518, 2010.

Abstract: Non-dispersive copper extraction from acid aqueous solutions was studied using a hollow fiber membrane contactor and representatives of different LIX®-extractant classes: LIX®860N-I, LIX®984N, LIX®84-I and LIX®65N. Kinetic experiments were performed to study and estimate the influence of different process parameters on the extraction efficiency in the four systems.

L. Boyadzhiev, G. Angelov, S. Georgieva, M. Lazarova, T. Popova,
Spent coffee grounds – a neglected source of antioxidants,
University of Food Technologies – Plovdiv, Scientific works, LVII(2), pp. 136-141, 2010.

Abstract: This study investigates the possibility for extraction of substances with antioxidant properties, like polyphenols and particularly chlorogenic acid (CGA), from coffee residues obtained after preparation of espresso type coffee. It is shown that an additional water or alcohol-water extraction of this waste produces extracts with high content of polyphenols (40-44%) and CGA (9-13%). This extract is attractive for practical use because high polyphenolic content corresponds to high antioxidant capacity.

Madlena P. Lazarova, Anton Friedl,
Implementation of pervaporation in bioethanol production from lignocellulosic materials,
Journal of International Scientific Publication: Materials, Methods & Technologies, 4(1), pp. 422-429, 2010.

Abstract: Production of ethanol from lignocellulosic biomass has a high potential concerning substrate availability compared to substrates containing starch for the development of non-fossil fuel energy sources. In this case, low concentration

bioethanol is gained by yeast fermentation and it has to be efficiently recovered and concentrated. Cost effective separation technologies are needed to reduce the energy demand for the whole production process. The membrane separation process pervaporation is a very promising option to achieve this goal.

Madlena P. Lazarova,
Pervaporation: New separation technique for bioethanol recovery and dehydration,
Journal of International Scientific Publication: Materials, Methods & Technologies, 4(1), pp. 430-439, 2010.

Abstract: Biofuels are combustible fuels produced from biomass. Among them bioethanol is considered the most promising one due to its high energy value and may be used to replace refined petroleum in the future. Distillation is largely used for the production of ethanol. The main commercial problem is the excessive amount of wastewater discharged from the distillation columns, as well as this process becomes energy-inefficient for azeotrope-breaking or separation/recovery of organic chemicals from relatively dilute aqueous solutions. Pervaporation separation technique shows to be a highly potential alternative for both recovery and dehydration of ethanol.

M. Lazarova, K. Dimitrov,
Selective recovery of alkaloids from Glaucium flavum Crantz using integrated process extraction-pertraction,
Separation Science and Technology, 44, pp. 227–242, 2009.

Abstract: Selective recovery of aporphine alkaloids from Glaucium flavum Crantz was studied. The alkaloids were successfully recovered from aqueous solutions, including native extracts of Glaucium flavum Crantz, applying pertraction in a rotating discs contactor. As a liquid membrane n-heptane and as receiving solution diluted phosphoric acid were used. Pertraction was also coupled to solidliquid extraction in order to simultaneously purify the extract obtained from the plant. This integrated extraction-pertraction process was very simple, rapid, and efficient. The permeation of alkaloids through the liquid membrane was very selective and their purity in the receiving solution was 88.7%.

M. Lazarova, K. Dimitrov, D. Metcheva, L. Boyadzhiev,
Glaucine recovery and concentration applying liquid membrane technique,
Comptes Rendus de l'Académie Bulgare des Sciences, 61(3), pp. 321-326, 2008.

Abstract: Glaucine, an aporphine alkaloid with pronounced analgetic and antitussive effect, was extracted and concentrated, applying liquid membrane (pertraction) technique. Two organic solvents, chloroform and di-*iso*-propyl ether, were tested as potential membrane liquids varying the pH value of aqueous feed phase and the ether was chosen due to its much lower toxicity, lower solubility and better stripping results. The experiments were carried out in a laboratory rotating disk pertractor, studying the effect of disk rotation velocity. It was shown that the alkaloid could be almost completely recovered and due to the difference between the pH-values and the volumes of feed and the stripping aqueous solutions, a considerable concentration of glaucine in the latter can be obtained.

Z. Lazarova, M. Lazarova,
Kinetic aspects of copper-LIX® extraction from nitrate/nitric acid aqueous solutions,
Solvent Extraction and Ion Exchange 25 (5), pp. 619-638, 2007.

Abstract: A comparative kinetic study of the extraction of copper from nitrate/nitric acid aqueous solutions by different classes of LIXw reagents (LIX 984N, LIX 860N-I, LIX 84-I, LIX 65N) was performed. Using a Rotating Diffusion Cell, the rate constants of the chemical reactions (forward and reverse) were estimated and compared. In the case of the mixed extractant LIX 984N, a synergistic effect was observed. The values of the forward reaction constants of all the extractants were found to be an order of magnitude higher than those of the reverse reaction. The relatively low Ea-values prove the substantial influence of the diffusion on the extraction kinetics under the experimental conditions studied.

T. Leiknes, M. Lazarova, H. Ødegaard,
Development of a hybrid ozonation biofilm-membrane filtration process for the production of drinking water,
Water Science and Technology 51 (6-7), pp. 241-248, 2005.

Abstract: Drinking water sources in Norway are characterized by high concentrations of natural organic matter (NOM), low alkalinity and low turbidity. The removal of NOM is therefore a general requirement in producing potable water. Drinking water treatment plants are commonly designed with coagulation direct filtration or NF spiral wound membrane processes. This study has investigated the feasibility and potential of a hybrid process combining ozonation and biofiltration with a rotating disk membrane for treating drinking water with high NOM concentrations. Ozonation will oxidize the NOM content removing colour and form biodegradable organic compounds, which can be removed in biological filters. A constructed water was used in this study which is representative of ozonated NOM-containing water. A rotating membrane disk bioreactor downstream the ozonation process was used to carry out both the biodegradation as well as biomass separation in the same reactor. Maintenance of biodegradation of the organic matter while controlling biofouling of the membrane and acceptable water production rates was the focus in the study. Three operating modes were investigated. Removal of the biodegradable organics was consistent throughout the study indicating that sufficient biomass was maintained in the reactor for all operating conditions tested. Biofouling control was not achieved through shear-induced cleaning by periodically rotating the membrane disks at high speed. By adding a small amount of sponges in the membrane chamber the biofouling could be controlled by mechanical cleaning of the membrane surface during disk rotation. The overall results indicate that the system can favorably be used in an ozonation/biofiltration process by carrying out both biodegradation as well as biomass separation in the same reactor.

Z. Lazarova, M. Lazarova,
Solvent Extraction of Copper from Nitrate Media with Chelating LIX-Reagents: Comparative Equilibrium Study,

Solvent Extraction and Ion Exchange, 23(5), pp. 695 - 711, 2005.

Abstract: Comparative experimental studies were carried out on extraction of copper (II) cations from aqueous acid nitrate media using four LIX-reagents, representatives of different extractant classes: LIX 984N-I, LIX 860N, LIX 84-I and LIX 65N. As a diluent, the liquid hydrocarbon undecane was used.
The extraction behaviour of the LIX-reagents was compared based on analysis of the influence of main factors on the two-phase mass transfer process: aqueous pH-value, initial copper and extractant concentrations and temperature. The experimental data received were used in calculation of important parameters characterising the efficiency of copper extraction from nitrate media with different LIX reagents: distribution ratios *D*, concentration extraction constants $K_{ex,}$ $pH_{0,5}$-values and thermodynamic parameters such as enthalpy, entropy and free energy changes (ΔH^o, ΔS^o, ΔG^o -values).

Z. A. Lazarova, M. P. Lazarova,
Comparative kinetic study of copper extraction by liquid ion exchange reagents with a rotating diffusion cell,
Bulgarian Chemical Communications, 37(3), pp. 140-147, 2005.

Abstract: A rotating diffusion cell with a porous hydrophobic membrane was used to study the kinetics of liquid/liquid extraction of copper ions from aqueous acidic solutions by commercially important liquid ion exchange reagents (LIX), representatives of three extractant classes: aldoxime (LIX 860N-I), ketoxime (LIX 84-I and LIX 65N) and mixture of them (LIX 984N). The reaction order in respect to copper, LIX and hydrogen cation concentrations was determined and compared in the following concentration ranges: pH = 1-4, copper concentration – from 7.86 mol m^{-3} and LIX-concentration from 5% to 20% (w/v). The relative low values of the activation energies obtained revealed that diffusion processes have a considerable effect on the copper extraction kinetics with LIX-reagents.

Доклади, публикувани в пълен текст

Madlena Lazarova, Dragomir Yankov, George Kyuchoukov,
Butyric acid recovery applying liquid membrane technique,
Proceedings, School Bourgas, 10-12 November 2011.

Abstract: Butyric acid, widely applied in food and beverage industries today, was extracted by means of liquid membrane (pertraction) technique. Pure dodecane was tested as potential membrane liquid. Sodium hydroxide solutions and distilled water were used as recipient phase. Experiments were carried out in a rotating disc pertractor. The process efficiency was strongly dependent on initial acid concentration. Sodium hydroxide permitted more effective recovery of the butyric acid.

Madlena Lazarova, Anton Friedl,
Pervaporation process for bioethanol production,
Proceedings, Summer School Bourgas, 06-08 July 2010.

Abstract: Ethanol production from lignocellulosic biomass has a high potential concerning substrate availability compared to substrates containing starch for the development of non-fossil fuel energy sources. In this case, low concentration bioethanol is gained by yeast fermentation and it has to be efficiently recovered and concentrated. Cost effective separation technologies are needed to reduce the energy demand for the whole production process. The membrane separation process pervaporation is a very promising option to achieve this goal.

T. Leiknes, M. Lazarova, H. Ødegaard,
Development of a hybrid ozonation biofilm-membrane filtration process for the production of drinking water,
Proceedings, Water Environment- Membrane Technology (WEMT) 2004 Conference, Seoul, Korea, June 7-10, 2004.

Abstract: Drinking water sources in Norway are characterized by high concentrations of natural organic matter (NOM), low alkalinity and low turbidity. The removal of NOM is therefore a general requirement in producing potable water. Drinking water treatment plants are commonly designed with coagulation direct filtration or NF spiral wound membrane processes. This study has investigated the feasibility and potential of a hybrid process combining ozonation and biofiltration with a rotating disk membrane for treating drinking water with high NOM concentrations. Ozonation will oxidize the NOM content removing colour and form biodegradable organic compounds, which can be removed in biological filters. A constructed water was used in this study which is representative of ozonated NOM-containing water. A rotating membrane disk bioreactor downstream the ozonation process was used to carry out both the biodegradation as well as biomass separation in the same reactor. Maintenance of biodegradation of the organic matter while controlling biofouling of the membrane and acceptable water production rates was the focus in the study. Three operating modes were investigated. Removal of the biodegradable organics was consistent throughout the study indicating that sufficient biomass was maintained in the reactor for all operating conditions tested. Biofouling control was not achieved through shear-induced cleaning by periodically rotating the membrane disks at high speed. By adding a small amount of sponges in the membrane chamber the biofouling could be controlled by mechanical cleaning of the membrane surface during disk rotation. The overall results indicate that the system can favorably be used in an ozonation/biofiltration process by carrying out both biodegradation as well as biomass separation in the same reactor.

T. Leiknes, H. Odegaard, H. Ohme, M. Lazarova,
Ozonation/biofiltration for NOM-removal using rotating disc membranes,
Proceedings, IMSTEC'03 – 5th International Membrane Science and technology Conference, Sydney, Australia, 10-14 November 10-14, 2003.

Abstract: Drinking water sources in Norway are characterized by high concentrations of natural organic matter (NOM), acidic, low alkalinity and turbidity. The removal of NOM is therefore a general requirement in producing potable water. Drinking water treatment plants are commonly designed with coagulation direct filtration or NF spiral wound membrane processes. This study has investigated the feasibility and potential of a hybrid process combining ozonation and biofiltration with a rotating disk membrane for treating drinking water with high NOM concentrations. Raw water with a colour of 50 mg Pt/l was treated for 80% removal of colour by ozonation and removal of the biodegradable fraction of the ozonated water in a biofilm filter. A rotating membrane disk bioreactor downstream the ozonation process was used to carry out both the biodegradation as well as biomass separation in the same reactor.