

---

## TABLE OF CONTENTS

---

xxiii	<b>Organiser</b>
xxv	<b>International Committee</b>
xxvii	<b>Committees</b>
xxxv	<b>Foreword</b>
xxxix	<b>Preface</b>
xli	<b>Acknowledgements</b>

### PLENARY PRESENTATIONS

- 2 pH profile control in a Bateman pulsed column—application to stripping of uranium**  
Baruch Grinbaum, Eliyahu Buchalter, Marthie Kotze and Renne de Preez
- 3 Sharing five years of pilot plant experience on aromatics extraction with ionic liquids**  
Ferdy Onink, Antje Hansmeier, Wytze Meindersma and André de Haan
- 4 An alternative formulation for SX industrial operations concerned with nitration**  
Héctor Yáñez, Alexis Soto, Osvaldo Castro, Mauricio Morales and Matthew Soderstrom
- 5 Interfacial species in the metal extraction system with LIX 84I and PC-88A**  
Mikiya Tanaka and Hirokazu Narita
- 6 Active water-oil interface—model systems for evaluating the activity of a complexing agent for liquid-liquid extraction**  
Olivier Diat, Amelie Banc, Caroline Bauer, Pierre Bauduin and Thomas Zemb
- 7 Milestones and future directions in the solvent extraction of caesium**  
Bruce A. Moyer
- 8 Metallurgical performance and characteristics of small and medium size copper SX plants in Chile**  
Hans Hein and Philippe Joly

CHAPTER 1

## Industrial practices and new projects

- 10 Integrating series and series-parallel circuit configurations for optimum plant performance  
Sydney J. Archer and Angus Feather
- 11 Recent advances in uranium ore processing  
James D. Navratil
- 12 Influence of solids (crud) on the separation of liquid two-phase systems  
Sebastian Ruckes and Andreas Pfennig
- 13 Hatch customised solvent extraction technology  
Scott Poulter, Eduardo Robles, Chris Panaou and Ken Gottliebsen
- 14 Clay treatment of degraded organic solutions, part I—effect of contact time and organic to clay ratio  
Keith R. Barnard and Michael G. Davies
- 15 Clay treatment of degraded organic solutions, part II—effect of different remediation agents  
Keith R. Barnard and Michael G. Davies
- 16 Factors affecting hydroxyoxime degradation in the LIX 63/Versatic 10 system under strip conditions  
Robert Halford and Keith R. Barnard
- 17 The potentiality of rare earth recovery using Zinced<sup>TM</sup> technology  
Gustavo Díaz N., Daniel Martín S.L., Francisco Sánchez R. and Sergio Sanguilinda S.
- 18 Applying the 'Fail Safe' concept to the design of reliable SX plants  
Jorge Martínez
- 19 Technological advances implemented by Outotec in recent copper solvent extraction projects  
Jarkko Hakkarainen, Alexis Villarroel, Arturo Sotomayor, Claudio Rodriguez and Rafaela Dellarossa
- 20 The Spence copper SX plant—an innovative design configuration  
Rodrigo Hernández, Fernando Pino, Jaime Roco, Pablo Amigo, Paul E. Thomsen and Mario Ferrera
- 21 Gold-thiocyanate solvent extraction with tertiary amine extractants  
Jaeheon Lee, Sevket Acar and Michael Virnig
- 22 The optimisation of the CSIRO's DSX solvent extraction technology for separation of cobalt and zinc from manganese in the Boleo circuit  
David Dreisinger, Thomas Glück, Kyle Marte and Feng Xie

- 23 Comparison of low aromatic and traditional hydrocarbon extraction diluents in copper production**  
Marco A. Calzada, Ralph Kowalik and Pierre Yves Guyomar
- 24 Production of high-concentration nickel from mixed hydroxide products using LIX 84-INS technology**  
Gary A. Kordosky and Angus Feather
- 25 Laboratory and pilot studies to combat process emulsions at Cominak uranium solvent extraction plant**  
Neilesh Syna, Bruno Courtaud, Nicholas Golles and Mamane Ibrahim
- 26 Design optimisation of a Cyanex 272 solvent extraction circuit**  
Cyril Bourget, Matthew Soderstrom, Simon Donegan and James Morrison
- 27 Solvent extraction of Boleo solutions with Cyanex 272 and Ionquest 290**  
David Dreisinger, Thomas Glück, Kyle Marte and Feng Xie
- 28 Contamination management in solvent extraction plants**  
Graeme Miller
- 29 Regeneration of degraded hydroxyoxime reagents**  
Erkki Paatero, Sami Virolainen and Kai Jyrkkä
- 30 Skorpion Zinc—lessons learnt in the operation of the modified Zinced™ solvent extraction process**  
Carlota David, Stefan Engelbrecht, Gustavo Díaz N., Francisco Sánchez R. and Ana Belén Mejías
- 31 Copper solvent extraction diluent choice—optimised properties equals optimised plant performance**  
Peter A. Haig, Andrew M. Duthie and Sergio M. Valladares

## CHAPTER 2

### **Hydrometallurgy and metals extractions**

- 34 Recovery of zinc from hot-dip galvanising effluent using tri-*n*-butyl phosphate**  
Kwan H. Lum, Sandra E. Kentish and Geoff W. Stevens
- 35 Separation of Ti(IV), Fe(III) and Mg(II) by three-liquid-phase extraction in the presence of EDTA**  
Keng Xie, Kun Huang and Huizhou Liu
- 36 Experimental counter-current solvent extraction of uranium and molybdenum from acid leach liquors**  
Ana M.G. La Gamma, Elena T. Becquart, Mauricio Chocrón, Valeria Díaz and Arián Avato

- 37 Stripping rare earth elements from D2EHPA during zinc solvent extraction**  
Estelle Alberts and Christie Dorfling
- 38 Metal separation after selective dissolution of nickel metal hydride batteries**  
Kristian Larsson, Christian Ekberg and Arvid Ødegaard-Jensen
- 39 Extraction of cobalt(II) and iron(II) from nickel(II) solutions with nickel salts of Cyanex 272**  
Michiel C. Olivier, Christie Dorfling and Jacques J. Eksteen
- 40 Solvent extraction of zinc(II) ions from aqueous chloride solutions by hydrophobic 3-pyridyl ketoximes**  
Karolina Wieszczycka, Marta Krupa, Anna Parus and Andrzej Olszanowski
- 41 Application of extraction for selective removal of Ni(II), Co(II), Zn(II) and Cu(II) from sulphate solutions**  
Magdalena Regel-Rosocka, Katarzyna Staszak and Karolina Wieszczycka
- 42 Copper and zinc extraction from chloride solutions by hydrophobic pyridinecarboxamides**  
Aleksandra Borowiak-Resterna, Marta Krupa and Karolina Wieszczycka
- 43 Solvent extraction of vanadium from sulphate media with TOA/octanol/kerosene systems**  
Nasrin Bighdelou, Eskandar K. Alamdar, Dariush Darvishi and Davoud F. Haghshenas
- 44 Mechanism of rhenium extraction with TBP in presence of sulphuric acid**  
Davoud F. Haghshenas, Dariush Darvishi, Eskandar K. Alamdar, Ali H. Eivazi and Seyed K. Sadraezzaad
- 45 Recovery of molybdenum from copper leach solutions by solvent extraction**  
Violina Cocalia, Troy Bednarski, Douglas J. Harris, Héctor Yáñez, Alexis Soto, Matthew Soderstrom and Eduardo Kamenetzky
- 46 Experimental design applied for the separation of divalent metals using D2EHPA in isoparaffin**  
Clenilson Sousa, Marisa Nascimento and Osvaldo G.C. da Cunha
- 47 Purification of the leach liquor of  $ZnSO_4$  by solvent extraction with D2EHPA**  
João H.P. Brandão, Marcelo B. Mansur, Sônia D.F. Rocha and Carlos A. Morais
- 48 Solvent extraction separation of Au(III) with octanol**  
María Elena Núñez, Eduardo Rodríguez de San Miguel and Josefina de Gyves
- 49 Recovery of sulphuric acid, copper and nickel from copper electrorefining bleed solutions**  
Davoud F. Haghshenas, Dariush Darvishi, Eskandar K. Alamdar, Majid Asnavandi, Naser Yousefi and Hojat Rafieepour

- 50 Zinc extraction from high chloride liquors**  
Takalani Gangazhe, Kathryn C. Sole and Jochen Petersen
- 51 The solvent extraction of vanadium from aqueous solution with di-2-ethylhexyl phosphate**  
Mahboubeh Nabavinia, Mansooreh Soleimani and Ali Kargari
- 52 Zinc extraction from sulphate media with systems based on Cyanex 301**  
Isaac Yu. Fleithikh, Gennady L. Pashkov, Natalia A. Grigorieva, Lidia K. Nikiforova and Olga A. Logutenko
- 53 Recovery of silver and gold from thiourea leaching ore liquors—design of process flowsheet**  
Zeferino Gamiño-Arroyo, Moncef Stambouli, Mario Ávila-Rodríguez and Dominique Pareau
- 54 Separation of ruthenium, iridium and rhodium by solvent extraction using an amide extractant**  
Sarah Belair, Barbara Breeze, Richard Grant, Paul O'Shaughnessy, Emma Schofield and Stephen Woollam
- 55 Recovery of indium from LCD screens**  
Sami Virolainen, Erkki Paatero and Don C. Ibana
- 56 Separation of Co from Ni in an impure sulphate solution, part 1—extraction**  
Tannice McCoy, Keith Mayhew, David Jones, Keith R. Barnard, Wensheng Zhang, Chu Yong Cheng and Dave J. Robinson
- 57 Separation of Co from Ni in an impure sulphate solution, part 2—stripping**  
Tannice McCoy, Keith Mayhew, David Jones, Keith R. Barnard, Chu Yong Cheng, Dave J. Robinson and Wensheng Zhang
- 58 Selective removal of ferric chloride from a pickling liquor by liquid-liquid extraction using Adogen 464**  
José M.G. Evangelista, Jr., Cibele Konzen, Julio C. Balarini, Lino R. Freitas, Tânia L.S. Miranda and Adriane Salum
- 59 Magnified-test in mixer-settler on separating cerium(IV) from bastnasite using Cyanex 923**  
Deqian Li, Jun Lu, Shulan Meng, Shuzhen Liu, Wuping Liao and Yan Bai
- 60 Separation of Co(II) and Li(I) from LIB industry waste by SX and SLM—a comparative study**  
Basudev Swain, Jinki Jeong, Jae-chun Lee and Gae-Ho Lee
- 61 Effect of SX on microbial populations inhabiting in solutions of a heap bioleaching process**  
Cecilia Demergasso, Víctor Iturriaga, Federico Palacios, Ricardo Valdebenito and Sergio Davis

- 62 Impact of eukaryotes on industrial heap bioleaching process at Escondida mine**

Felipe A. Galleguillos, Ana M. Sánchez, Enrique Becerra, Gabriel Ocaranza, Horacio Arias, Pedro A. Galleguillos and Cecilia Demergasso

CHAPTER 3

## Nuclear fuel reprocessing

- 64 Development of an extraction process for the removal of technetium-99 from waste streams**

Patricia Paviet-Hartmann, Audrey Roman, Keri Campbell, Jared Horkley, Eric C. Brown, Ana Nuñez Gomez-Aleixandre and Amparo G. Espartero

- 65 Exchange of TBP for a monoamide extraction ligand in a GANEX solvent—advantages and disadvantages**

Emma Aneheim, Christian Ekberg and Nathalie Mabile

- 66 Actinide(III)/lanthanide(III) separation via selective aqueous complexation of actinides(III) in nitric acid**

Andreas Geist, Udo Müllrich, Giuseppe Modolo and Andreas Wilden

- 67 Recent advances in centrifugal contactor designs for nuclear applications**

Jack D. Law, David H. Meikrantz, Troy G. Garn and Lawrence L. Macaluso

- 68 Combining neutral and acidic extractants for recovering transuranic elements from nuclear fuel**

Gregg J. Lumetta, Doinita Neiner, Sergey I. Sinkov, Jennifer C. Carter, Jenifer C. Braley, Stan L. Latesky, Artem V. Gelis, Peter Tkac and George F. Vandegrift

- 69 Physiochemical properties of tributyl phosphate/dodecane/nitric acid systems**

Amber D. Wright, Allen Janezcko and Patricia Paviet-Hartmann

- 70 Solvent effects on the extraction rate in proposed GANEX processes**

Elin Löfström-Engdahl, Emma Aneheim, Christian Ekberg, Nathalie Mabile and Gunnar Skarnemark

- 71 Application of annular centrifugal contactors in the total partitioning process for high-level waste**

Wuhua Duan

- 72 Radiolytic stability of nuclear reprocessing extraction ligands**

Stephen P. Mezyk and Bruce J. Mincher

- 73 Investigating the onset of third-phase formation for acidic phosphoric acid reagents**

Andrew Maycock, George Miller and Mikael Nilsson

- 74 Thermal decomposition studies for alternative PUREX solvent (TiAP) in nitric acid medium**  
Shekhar Kumar, Pranay Kumar Sinha, Biplab Das, Prasenjit Mondal, Uthandi Kamachi Mudali and Rajamani Natarajan
- 75 Contributing to the discussions on the fundamental aspects and complexities of TALSPEAK chemistry**  
Peter R. Zalupska and Leigh R. Martin
- 76 Recycling of used nuclear fuel—bringing well-established solvent extraction processes into the 21<sup>st</sup> century**  
Chris Phillips and Stuart Arm
- 77 Soft-donor extractants vs aqueous complexants in trivalent lanthanide/actinide separations**  
Kenneth L. Nash, Cecile Marie, Mark D. Ogden and Derek Brigham
- 78 Solvent extraction research and development in the US fuel cycle programme**  
Terry A. Todd
- 79 Taylor-Couette flow for liquid-liquid extraction—coupling hydrodynamics and mass transfer**  
Marouan Nemri, Eric Climent, Sophie Charton, Denis Ode and Jean-Yves Lanoë
- 80 Speciation in solvent extraction systems containing malonamide and dialkylphosphoric acid**  
Julie Muller, Laurence Berthon, Nicole Zorz and Jean-Pierre Simonin
- 81 Speciation of americium and europium(III) with aminopolycarboxylic acids in DIAMEX-SANEX process**  
Manuel Miguirditchian, Olivia Pecheur, Laurence Berthon and Laurent Couston
- 82 Separation of europium and yttrium from sulphuric liquor of electronic scrap by solvent extraction**  
Luciene V. Resende and Carlos A. Morais
- 83 Study of separation of terbium from other heavy rare earth elements by solvent extraction**  
Renata D. Abreu and Carlos A. Morais
- 84 Direct actinide(III) separation from PUREX raffinate using a BTBP/TODGA solvent**  
Andreas Wilden, Michal Sypula, Giuseppe Modolo and Andreas Geist
- 85 Complex interactions in solvent extraction—biphasic speciation in the TALSPEAK process**  
Kenneth L. Nash, Mikael Nilsson, Travis Grimes, Jenifer Braley, Kazuyoshi Uruga and Cecile Marie

- 86 Promising method for selective separation of a lanthanide(III) using synergistic extraction**  
Yuko Hasegawa, Sayaka Tamaki, Hirofumi Yajima, Tohru Kobayashi and Tsuyoshi Yaita
- 87 Transient extraction behaviour of plutonium and uranium in reprocessing plants**  
Gunzo Uchiyama, Hitoshi Abe and Kazuhiro Asakawa
- 88 Extraction of actinides, fission products and corrosion products from synthetic high-level liquid waste with DMDOHEMA**  
Gunnar Skarnemark, Sofie Englund, Christian Ekberg, Mikael Nilsson and Arvid Ødegaard-Jensen
- 89 Kinetics of extraction of europium(III) ion by various extractants for nuclear applications**  
Jean-Pierre Simonin and Trong-Hung Vu
- 90 Modification of extraction kinetics of C2-BTBP and CyMe4-BTBP by addition of *tert*-butyl to the core molecule**  
Teodora V. Retegan, Christian Ekberg and Anna Fermvik
- 91 Radiolytic stability of TODGA—characterisation and quantification of degradation compounds**  
Ana Núñez, Hitos Galán, Aritz Durana, Rosa Sedano, Javier de Mendoza and Amparo G. Espartero
- 92 Next-generation caustic-side solvent extraction (NG-CSSX) process**  
Lætitia H. Delmau, Joseph F. Birdwell, Jr., Peter V. Bonnesen, Nathan B. Ladd, Bruce A. Moyer, Erica L. Stoner, Denise L. Lee and Frederick V. Sloop, Jr.
- 93 Innovative SANEX process for actinide(III) separation from PUREX raffinate using TODGA-based solvents**  
Michał Syputa, Andreas Wilden, Giuseppe Modolo and Andreas Geist
- 94 Kinetics and stability of separation systems for spent nuclear fuels by supported liquid membrane extraction**  
Ko Nee and Mikael Nilsson
- 95 Monitoring nitric acid extraction by near-IR spectroscopy in treatment of nuclear material**  
Omed S. Muzaffery, Amanda J. Casella, Samuel A. Bryan, Tatiana G. Levitskaia and Mikael Nilsson
- 96 TALSPEAK extraction system under variable loading conditions, part 1—distribution studies**  
Tatiana G. Levitskaia, Troy Robinson, Samuel A. Bryan and Amanda J. Casella
- 97 TALSPEAK extraction system under variable loading conditions, part 2—speciation studies**  
Troy Robinson, Samuel A. Bryan and Tatiana G. Levitskaia

- 98 Monitoring and modelling of radiolytic degradation products of TBP/*n*-dodecane**  
James M. Peterson, Tatiana G. Levitskaia and Samuel A. Bryan
- 99 Raman spectroscopy for on-line acid concentration/pH monitoring in used nuclear fuel reprocessing**  
Amanda J. Casella, Tatiana G. Levitskaia, James M. Peterson, Omed S. Muzaffery, Mikael Nilsson and Samuel A. Bryan
- 100 Spectroscopic on-line monitoring for process control and safeguarding of radiochemical streams**  
Samuel A. Bryan, Tatiana G. Levitskaia, Amanda J. Casella, James M. Peterson, Amanda M. Lines, Dawn E. Verdugo and Elizabeth A. Jordan
- 101 Aqueous complexation and interactions of trivalent neodymium with citric acid at varying ionic strengths**  
M. Alex Brown, Alena Paulenova and Artem V. Gelis
- 102 Impact of sulphate media on the extraction of rare earths with organophosphorous reagents**  
Marina Fainerman-Melnikova, Elizabeth Ho and Karin Soldenhoff
- 103 A powerful tool to model and simulate solvent extraction operations**  
Christian Sorel, Marc Montuir, Coralie Balaguer, Pascal Baron, Binh Dinh, Xavier Hérès, Vincent Pacary and Hervé Roussel
- 104 C5-BPP—a new highly selective extractant for the separation of trivalent actinides from lanthanides**  
Andreas Geist, Udo Müllrich, Andreas Wilden, Steve Gülland and Giuseppe Modolo
- 105 Progress of extraction process in future nuclear fuel cycles**  
Dominique M. Warin, Christophe Poinssot, Pascal Baron and Marie-Christine Charbonnel

CHAPTER 4

**Process chemistry and engineering**

- 108 Performance comparison between KARR column and pulsed column**  
Donald Glatz and Wendy Parker
- 109 Optimal spacing in BPC disk and doughnut pulsed columns**  
Baruch Grinbaum, Israel Kenner (†), Nadav Dobrin, Alon Efraim and Geoff W. Stevens
- 110 Hydraulic characteristics, holdup and flooding of pulsed disk and doughnut column**  
Oded Lerner, Nadav Dobrin and Einat Shooster

- 111 Decreasing entrainment in settlers using turbulent mixing**  
Leonid Braginsky, Yuri Kokotov, Roman Sheinman, Edwin Slonim and Baruch Grinbaum
- 112 Extraction of Co(II) by di (2-ethylhexyl) phosphoric acid in a microfluidic device**  
Davide Ciceri, Jilska M. Perera and Geoff W. Stevens
- 113 A new design method for stirred liquid-liquid extraction columns based on single-drop experiments**  
Florian Buchbender and Andreas Pfennig
- 114 Entrainment quantification in static-mixer settler setup**  
Esayas Barega, Edwin Zondervan and André de Haan
- 115 Simulation of a miniplant Kühni extraction column coupled with PBM**  
Mark W. Hlawitschka and Hans-Jörg Bart
- 116 Determination of drop sizes in extraction columns by automated optical image analysis**  
Matthias Mickler, Hans-Jörg Bart and Stephan Didas
- 117 Proper agitator design for pumper and auxiliary tanks in copper solvent extraction plants**  
Richard O. Kehn and Joseph Kontur
- 118 Development of static-mixer based novel mixer settler for nuclear solvent extraction**  
Shekhar Kumar, Manavalan Balamurugan, Uthandi Kamachi Mudali and Rajamani Natarajan
- 119 Development of static-mixer internals based novel miniature pulsed column for solvent extraction**  
Shekhar Kumar, Manavalan Balamurugan, Uthandi Kamachi Mudali and Rajamani Natarajan
- 120 Characterisation of two-phase flow instability in the mixing zone of annular centrifugal contactor**  
Jaysree Patra, Pandey N.K., Uthandi Kamachi Mudali and Rajamani Natarajan
- 121 Enhancement of mass transfer performance by drops flowing in microchannels**  
Jianhong Xu, Jing Tan and Guangsheng Luo
- 122 CFD aided design and scale-up of agitated extraction columns**  
Enes Aksamija, Rainer Pfeffer, Marlene Fritz and Matthias Siebenhofer
- 123 Characterisation of flows in copper SX settlers**  
William Yang, Kosta Simic, Rueben Rajasingam, Mauricio Chovar and M. Philip Schwarz

- 124 Development of a continuous electrostatic demulsifier for splitting high stability W/O emulsions**  
Cibele Konzen, Julio C. Balarini, Luiz C. Meira-Belo, Tânia L.S. Miranda and Adriane Salum
- 125 Design and characterisation of an electrostatic demulsifier prototype for breaking-up W/O emulsions**  
Cibele Konzen, Luiz C. Meira-Belo, Alexandre Konzen (†), Dirlane M. Albino, Julio C. Balarini, Adriane Salum and Tânia L.S. Miranda
- 126 Comparison of two treatment routes for primary cobalt metal production—direct solvent extraction vs intermediate precipitation**  
Sean Scott and Peter Cole

#### CHAPTER 5

### **Analytical and preparative applications**

- 128 Powder X-ray diffraction as a tool for structure determination of the extracting ligand dithizone**  
Mariano Montiel, Salvador Palomares and Guadalupe Sánchez
- 129 Diffusion-NMR elucidation of modifier-oxime interactions**  
Douglas J. Harris, Benjamin D. Roach and Peter A. Tasker
- 130 Calculation of the organic phase composition in system H<sub>2</sub>O-HNO<sub>3</sub>-TBP**  
Alexander Ochkin, Dmitry Gladilov and Sergey Nekhaevskiy
- 131 Calculation of organic phase composition of H<sub>2</sub>O-UO<sub>2</sub>(NO<sub>3</sub>)<sub>2</sub>-TBP system**  
Alexander Ochkin, Dmitry Gladilov and Sergey Nekhaevskiy
- 132 Development of the method of equilibrium calculation in extraction systems with TBP**  
Alexander Ochkin, Dmitry Gladilov and Sergey Nekhaevskiy
- 133 NMR investigation of the lanthanide and actinide complexes of bis-triazine extracting agents**  
Jean F. Desreux, Geoffrey Vidick and Nouri Bouslimani
- 134 Extraction phase separation issues caused by diluent loss due to preferential evaporation**  
Glenn L. Pfennigwerth, Roger D. Spence, Debra L. Veach, John J. Langford and Elijah L. Shekinah
- 135 Quantification of isotridecanol in commercial extractants by gas chromatography-mass spectrometry**  
Argune Ocio, Begoña Menoyo and María P. Elizalde
- 136 The extraction photometric determination of Ni(II) by using in situ extractant formation method**  
Kaoru Fujinaga, Hiroko Sugiyama, Shigeru Matsuo, Syunichi Oshima, Yujiro Watanabe, Shigekazu Tsurubou and Yu Komatsu

- 137 Determination of the stability constants of neodymium:diamide complexes in alcoholic media**

Joseph L. Lapka, Alena Paulenova and Jack D. Law

- 138 Reactivity of tributyl phosphate with various organic extractants**

Keith R. Barnard and Denis W. Shiers

## CHAPTER 6

### **Biotechnology, pharmaceuticals, life science products and organic products**

- 140 Affinity extractants for the selective recovery of IgG from proteins**

André de Haan, Meritxel Martinez, Ronald Korporaal, Jelle de Vries and Ton Visser

- 141 Plant-material extraction in a standardised laboratory apparatus using optimal experimental design**

Dirk Delinski, Jan Bernd Bol and Andreas Pfennig

- 142 Renewable glycolaldehyde isolation from pyrolysis oil by reactive extraction with primary amines**

Caecilia R. Vitasari, Geert W. Meindersma and André de Haan

- 143 Extraction of butanol from aqueous solutions and fermentation broth using ionic liquids**

Francesca Santangelo, Martin Stoffers, Andrzej Górkak, William Pitner and Michael Schulte

- 144 The application of highly integrated centrifugal contactor-separator devices for reactive extractions**

Boelo Schuur, Carolus B. Rasrendra, Gerard N. Kraai, Jos G.M. Winkelmann, Johannes G. de Vries and Hero J. Heeres

- 145 Extraction of hydroxylamine from aqueous solution containing hydroxylammonium salts using D2EHPA**

Yang Zou, Yundong Wang and Weiyang Fei

- 146 Magnetic composite particles for the separation of naphthenic acid from organic solvents**

Zatoun Akhtar, E. Susana Pérez de Ortiz, Julian Waters and David Chadwick

- 147 Thermodynamic study of chloroquine extraction with organo-phosphorus and thiophosphorus acids**

Michèle Grosber-Manon, Moncef Stambouli, Jean-Michel Gillet, Jean-Louis Grossiord and Dominique Pareau

- 148 Hydrolysis and fractionation of lignocellulosic biomass using sub-critical water**

Ricardo M.N. Roque, Muhammad N. Baig, Steve Bowra, Regina C.D. Santos and Gary A. Leeke

- 149 Challenges and opportunities for enantioselective liquid-liquid extraction**  
Boelo Schuur and André de Haan
- 150 Phenylalanine extraction using Adogen 464 by liquid surfactant membranes**  
Lorena C. Nascimento, Leandro D.S. Andrade, Cibele Konzen, Julio C. Balarini, Tânia L.S. Miranda and Adriane Salum
- 151 Solvent impregnated resins (SIRS) for the trace removal of aromatic nitrogen containing compounds from wastewater streams**  
Jeroen Bokhove, Boelo Schuur and André de Haan
- 152 Extractant screening for bio-based recovery of carboxylic acids**  
Agnieszka Krzyzaniak, Boelo Schuur and André de Haan
- 153 The influence of polymer addition in a microemulsion system and its application in enhanced oil recovery**  
Tereza N.C. Dantas, Afonso A.D. Neto, Ewerton R.F. Teixeira, Cátila G.F. Teixeira and Ragel R.R. Teixeira
- 154 Separation and purification of organic acids using membrane contactors**  
Luciana de S. Moraes, Helen C. Ferraz and Alberto C. Habert

## CHAPTER 7

### Fundamentals

- 156 Effect of modifiers on the interfacial tension of P50 at the heptane-water interface**  
Wendy Tao, Sarah Glasson, Geoff W. Stevens and Jilska M. Perera
- 157 Theoretical and experimental investigation of droplet-droplet coalescence phenomena**  
Arijit A. Ganguli, Eugeny Y. Kenig, René T. Eiswirth and Hans-Jörg Bart
- 158 A study of copper extraction kinetics with LIX 984N using a Lewis cell**  
Wensheng Zhang, Fuping Hao, Yoko Pranolo, Chu Yong Cheng and Dave J. Robinson
- 159 Effect of histidine in aqueous phase on extraction of metal ions with D2EHPA**  
Tatsuya Oshima, Sho Ishizaka and Yoshinari Baba
- 160 Optical chiral reactions observed at liquid-liquid interfaces**  
Hitoshi Watarai, Shiori Watanabe and Kimika Matsuura
- 161 X-ray crystal structures of nickel and cobalt alpha-hydroxyoxime-carboxylic acid synergist complexes**  
Keith R. Barnard, Matthew McIlldowie, Gareth L. Nealon, Mark I. Ogden and Brian W. Skelton

- 162 Current understanding of LIX 63/Versatic 10 synergistic solvent extraction system chemistry**  
Keith R. Barnard
- 163 Process intensification in liquid-liquid extraction—changing the solvent and hybrid process**  
Jörg Koch, Juan Herguijuela and Eva Maus
- 164 Effect of pulsed electrostatic fields on mass transfer in a modified Lewis cell**  
Simon Assmann, Don C. Ibana and Christopher McRae
- 165 Synthesis of semiconductor ZnO and ZnS nanoparticles in a two-phase liquid-liquid system using Cyanex 272 and D2EHPA as extractants**  
Jocabeth Aguilera, Rosa L. Tovar, Adriana Gaona, Octavio Domínguez and Guadalupe Sánchez
- 166 Synergism in the competitive extraction of lanthanides with Cyanex 272, phosphonic and sulphonnic acids**  
Basudev Swain and Emmanuel O. Otu
- 167 A study of nickel extraction kinetics with synergistic organic system consisting of LIX 63, Versatic 10 and TBP using a Lewis cell**  
Wensheng Zhang, Yoko Pranolo, Zhaowu Zhu, Chu Yong Cheng and Dave J. Robinson
- 168 Nitric acid extraction with TBP solutions in *n*-dodecane**  
Alexander Ochkin, Maria Afonina, Alexey Merkushkin and Sergey Nekhaevskiy
- 169 Novel synergistic solvent extraction systems to recover copper, nickel, cobalt and zinc from chloride solutions**  
Zhaowu Zhu, Chu Yong Cheng and Wensheng Zhang
- 170 Dimerisation, oligomerisation and chemical activities in the organic phase for acidic phosphoric acid reagents in aliphatic diluents**  
Michael F. Gray, Peter R. Zalupski and Mikael Nilsson
- 171 Complexation of Ln(III) with the hydrophobic agent TEDGA—structural and thermodynamic studies**  
Marie-Christine Charbonnel, Claude Berthon, Laurence Berthon, Nathalie Boubals, Fabien Burdet, Philippe Guilbaud, Nicole Zorz, Nathalie Mabille and Sébastien Petit
- 172 Liquid-liquid extraction of group 13 metals by using 3-Isopropoxy-*N*-isopropylpropaneamide as an extracting solvent**  
Kaoru Fujinaga, Ryosuke Tanaka, Shigeru Matsuo, Syunichi Oshima, Yujiro Watanabe, Shigekazu Tsurubou, Junji Noro and Yu Komatsu
- 173 Outer-sphere ligands as chlorozincate extractants**  
Jennifer R. Turkington, Philip J. Bailey, Jy Chartres, Ross J. Ellis, David K. Henderson, Peter A. Tasker, Eduardo Kamenetzky, Thomas Sassi and Kathryn C. Sole

- 174 Effect of chloride ions on the solvent extraction of uranium with Alamine 336**  
Carlos L.G. Alvarenga, Carlos A. Morais, Marcelo B. Mansur and Luiz A. Gomiero
- 175 Effect of mass transfer on flow patterns and droplet size of liquid-liquid system in a co-axial capillary microfluidic device**  
Huawei Shao, Yangcheng Lu, Kai Wang and Guangsheng Luo
- 176 Fundamental research on the preparation of  $\text{KH}_2\text{PO}_4$  using extraction technology**  
Fang Zhao, Yangcheng Lu, Jianhong Xu and Guangsheng Luo
- 177 A new vibrational Lewis cell devoted to interfacial chemical kinetics studies**  
Moncef Stambouli, Dominique Pareau, Hervé Duval, Alevtina Ivanova and Viktor Kozlov
- 178 Study on the degradation of 3,3,5-trimethylcyclohexanone under oxidising conditions**  
Barbara Breeze, Sarah Belair, Neil Davidson, Richard Grant, Brian Moore, Emma Schofield and Christopher Smith
- 179 Modelling of extraction equilibria—uranyl nitrate extracted by tributyl-phosphate**  
Stepan Hlushak, Jean-Pierre Simonin, Philippe Moisy and Christian Sorel
- 180 Copper extraction from 0.1 M hydrochloric acid by oxime extractants—effect of the composition of the extractants**  
Begoña Menoyo, María P. Elizalde, María del Sol Rúa and Argune Ocio
- 181 Combination of solvent extraction with ion exchange resin**  
Eitan Shalom and Gideon Harel
- 182 Solvent extraction of Pt/Pd from chloride media by Alamine 300—analysis of equilibrium and mechanism**  
Basudev Swain, Jinki Jeong, Min-seuk Kim and Jae-chun Lee
- 183 Brief review on the recovery of silver(I) from chloride media—further insight on the structure of the extracted species**  
Ana P. Paiva
- 184 Mass transfer kinetics of Mo(VI) extraction with trialkyl amine from hydrochloride acid medium**  
Ying Xiong, Weijun Shan, Zhenning Lou and Deqian Li
- 185 Outer sphere interactions in copper complexes of salicylaldehyde hydrazone extractants**  
Benjamin D. Roach, Tai Lin, Ross S. Forgan, Heiko Bauer, Patricia Richardson, Fraser J. White, Peter A. Tasker and John Campbell
- 186 Extraction and competitive transport of some metal ions by *N*-benzyl substituted cyclen derivatives**  
Robert C. Luckay, Xia Sheng, Christoph E. Strasser and Helgard G. Raubenheimer

- 187 A kinetic study of gold stripping by oxalic acid in a modified Lewis cell**  
Sepideh Javanshir, M. Rosinda C. Ismael, M. Teresa A. Reis, Mahmoud Abdollahi and Jorge M.R. Carvalho
- 188 Palladium extraction from acidic chloride streams using simple oxime ligands**  
A. Matthew Wilson, David K. Henderson, Jason B. Love, Peter A. Tasker, Sarah Belair and Richard Grant
- 189 Prediction of sedimentation and coalescence profiles for copper extractants**  
Jonathan Castillo, Felipe Biela and Patricio Navarro
- 190 Micellization-induced microphase mass transfer—aqueous two-phase extraction of platinum metals**  
Kun Huang, Pinhua Yu, Chao Zhang, Keng Xie, Xiuqiong He and Huizhou Liu

#### CHAPTER 8

### **Novel reagents, materials and techniques**

- 192 N,N-disubstituted monoamides in the recovery of iron(III) from chloride media**  
Lília C. Ribeiro and Ana P. Paiva
- 193 Synergistic solvent impregnated resin for selective recovery of lithium ion**  
Kazuharu Yoshizuka, Kenta Onishi, Takahide Nakamura and Syouhei Nishihama
- 194 Glycols recovery using reactive extraction with boronic acid derivatives**  
Lesly Y. Garcia-Chavez, Estefania Alonso, Boelo Schuur and André de Haan
- 195 Solvent impregnated kapok fibre for separation of rare earth metals**  
Syouhei Nishihama, Natsuki Higa and Kazuharu Yoshizuka
- 196 Composite membranes in liquid membrane permeation with support layers**  
Marlene Fritz, Hannes Noll and Matthäus Siebenhofer
- 197 Liquid membrane permeation with support layers**  
Marlene Fritz, Hannes Noll and Matthäus Siebenhofer
- 198 Recycling of heavy metal ions in a continuously operated supported liquid membrane reactor**  
Hannes Noll, Marlene Fritz and Matthäus Siebenhofer
- 199 Molecular modelling for designing new extractants in hydrometallurgy**  
Alexandre Chagnes, Bruno Courtaud, Jacques Thiry and Gérard Cote
- 200 Multifunctional Schiff base ligands for  $\text{UO}_2^{2+}$  binding and extraction**  
Harold B. Tanh Jeazet, Kerstin Gloe, Thomas Doert, Jens Mizera, Axel Heine, Olga N. Kataeva, Margaret Acker, Satoru Tsushima, Gert Bernhard and Karsten Gloe
- 201 Exotic reagents for separation of metals from nickel metal hydride batteries**  
Kristian Larsson, Emma Aneheim, Christian Ekberg and Arvid Ødegaard-Jensen

- 202 Separation of copper(II) and nickel(II) by micellar extraction**  
Laurence Dupont-Leclercq, Sébastien Giroux, Bernard Henry and Patrice Rubini
- 203 Separation of rare earth metals by a highly stable liquid membrane composed of ionic liquids**  
Masahiro Goto and Fukiko Kubota
- 204 Solvent extraction of systems with high viscosity**  
Andreas Pfennig, Donni Adinata and Jan Kröckel
- 205 Efficient regeneration of Cr(III) passivation baths using liquid membranes**  
Eugenio Bringas, Rosa Mediavilla, Ana M. Urtiaga and Inmaculada Ortiz
- 206 Properties of microcapsules containing PC-88A with connected spherical pores for Zn(II) extraction**  
Koichiro Shiomori, Asuka Matsushita, Takashi Sana, Shiro Kiyoyama and Masahiro Yoshida
- 207 Olefin/paraffin separation using room temperature ionic liquids containing a copper salt**  
Daniel Gorri, Juan Canales, Alfredo Ortiz and Inmaculada Ortiz
- 208 Mechanisms of metal ion transfer into RTILs—implications for their use as extraction solvents**  
Mark L. Dietz, Sarah L. Garvey and Cory A. Hawkins
- 209 Indium transport modelling through an SLM system with ADOGEN 364 from concentrated hydrochloric acid**  
Eduardo Rodríguez de San Miguel and Josefina de Gyves
- 210 Solvent extraction of zinc in HCl media using tributylphosphate (TBP) and liquid membranes**  
María Fresnedo San Román, Eugenio Bringas, Marta Vallejo, Angel Irabien and Inmaculada Ortiz
- 211 In(III)/Fe(III) separation from nitrate, chloride and sulphate media using SX and SLMs with D2EHPA**  
Eduardo Rodríguez de San Miguel, María Ballinas and Josefina de Gyves
- 212 Recovery of Bi(III) by liquid-liquid extraction and supported liquid membranes using Cyphos IL 101**  
Luisa Zempoalteca, Diana Cholico, Pilar González, Luis Santiago, Imelda Saucedo, Ricardo Navarro and Mario Ávila-Rodríguez
- 213 Electrochemical aspects of extraction of metal ions in ionic liquid-water two-phase systems**  
Ryota Teraoka and Takashi Kakiuchi
- 214 Process intensification of solvent extraction using microfluidics**  
John Ralston, Craig Priest, Rossen Sedev, Jingfang Zhou, Luke Parkinson, Takehiko Kitamori and Kazuma Mawatari

- 215 Competitive extraction of Fe(III) and Zn(II) using Amberlite XAD-7 impregnated with an ionic liquid**  
Ricardo Navarro, Imelda Saucedo, Violeta Gallardo, Mario Ávila-Rodríguez, Pilar González and Eric Guibal
- 216 Zinc recovery from kaolin effluent treatment plant by liquid surfactant membrane technique**  
Samuel R. Castro, Estevão M.R. Araújo, Cibele Konzen, Julio C. Balarini, Tânia L.S. Miranda and Adriane Salum
- 217 Non-dispersive solvent extraction of copper from ammoniacal medium with LIX 54**  
M. Lurdes F. Gameiro, M. Rosinda C. Ismael, M. Teresa A. Reis and Jorge M.R. Carvalho
- 218 Extraction of rare earths by HEHEHP with room temperature ionic liquid as diluents**  
Xiang L. Wang, Ji Chen and Deqian Li
- 219 2-(imino)bis(*N,N*-dialkylacetamide) (IDAA)—a novel complexing agent for Pd(II), Tc(VII), and Re(VII)**  
Yuji Sasaki, Morihisa Saeki, Yumi Sugo, Yasuji Morita, Akira Ohhashi, Takeshi Oriyama, Yasuhisa Ikeda and Mohammad C. Ali
- 220 Liquid-liquid extraction systems for cadmium(II) and their application to advanced supported liquid membrane technologies**  
Maria Teresa Coll, Irene Garcia-Diaz, Agustí Fortuny, Félix A. Lopez, Ana Maria Sastre and Francisco J. Alguacil
- 221 Polymer induced aqueous two phase systems for extractive concentration of aqueous salt solutions**  
Miran Milošević, Boelo Schuur and André de Haan
- 222 Supercritical fluid extraction of Cu(II) from aqueous solutions using a hollow fibre contactor**  
Rossana Sepúlveda, Hugo Valdés and Julio Romero
- 223 Optimisation of iron extraction by using EDTA-based microemulsion systems**  
Afonso A.D. Neto, Tereza N.C. Dantas, Josilma F. Fontana, Keila R.O. Melo and Janaina C. Xavier
- 224 Uptake of Cu(II) from aqueous solutions using a column with microcapsules containing LIX-860 N-IC**  
Claudio Araneda, Carlos Basualto, Jaime Sapag, Cristián Tapia and Fernando Valenzuela L.
- 225 Microencapsulation of TOA in polymeric matrices for removing Zn(II) and Cu(II) from chloride solutions**  
Carla Fonseca, Claudio Araneda, Thomas Borrmann, Carlos Basualto, Jaime Sapag and Fernando Valenzuela L.
- 227 AUTHOR INDEX**