Green Chemistry

Cutting-edge research for a greener sustainable future

rsc.li/greenchem

The Royal Society of Chemistry is the world's leading chemistry community. Through our high impact journals and publications we connect the world with the chemical sciences and invest the profits back into the chemistry community.

IN THIS ISSUE

ISSN 1463-9262 CODEN GRCHFJ 25(7) 2469-2882 (2023)



Cover See Haruo Kawamoto *et al.*, pp. 2583–2595.

Image reproduced by permission of Haruo Kawamoto from *Green Chem.*, 2023, **25**, 2583.





Inside cover See Xi Chen *et al.*, pp. 2596–2607.

Image reproduced by permission of Xi Chen from *Green Chem.*, 2023, **25**, 2596.

CRITICAL REVIEWS

2482

Challenges and recent advances in bio-based isocyanate production

Joanna Niesiobędzka and Janusz Datta*



2505

Recent advances in biomass pretreatment using biphasic solvent systems

Ruolin Li, Yayue Zheng, Xiaoxue Zhao, Qiang Yong, Xianzhi Meng,* Arthur Ragauskas* and Caoxing Huang*



Editorial Staff

Executive Editor Michael A. Rowan

Deputy Editor Vikki Pritchard

Development Editors Bee Hockin, Andrea Carolina Ojeda Porras Editorial Production Manager

Gisela Scott Publisher

Jeanne Andres

Senior Publishing Editor Robin Brabham

Publishing Editors

Catherine Au, Isobel Darlington, Konoya Das, Alexandre Dumon, Amy Lucas, Hugh Ryan, Wing So

Editorial Assistant

Publishing Assistant

Robert Griffiths

For queries about submitted articles please contact Gisela Scott, Editorial Production Manager, in the first instance. E-mail green@rsc.org

For pre-submission queries please contact Michael A. Rowan, Executive Editor. E-mail green-rsc@rsc.org

Green Chemistry electronic: ISSN 1463-9270 is published 24 times a year by the Royal Society of Chemistry, Thomas Graham House, Science Park, Milton Road, Cambridge, CB4 0WF, UK.

All orders, with cheques made payable to the Royal Society of Chemistry, should be sent to the Royal Society of Chemistry Order Department, Royal Society of Chemistry, Thomas Graham House, Science Park, Milton Road, Cambridge, CB4 0WF, UK

Tel +44 (0)1223 432398; E-mail orders@rsc.org

2023 Annual electronic subscription price: £2578; US\$4544. Customers in Canada will be subject to a surcharge to cover GST. Customers in the EU subscribing to the electronic version only will be charged VAT.

If you take an institutional subscription to any Royal Society of Chemistry journal you are entitled to free, site-wide web access to that journal. You can arrange access via Internet Protocol (IP) address at www.rsc.org/ip

Customers should make payments by cheque in sterling payable on a UK clearing bank or in US dollars payable on a US clearing bank.

Whilst this material has been produced with all due care, the Royal Society of Chemistry cannot be held responsible or liable for its accuracy and completeness, nor for any consequences arising from any errors or the use of the information contained in this publication. The publication of advertisements does not constitute any endorsement by the Royal Society of Chemistry or Authors of any products advertised. The views and opinions advanced by contributors do not necessarily reflect those of the Royal Society of Chemistry which shall not be liable for any resulting loss or damage arising as a result of reliance upon this material. The Royal Society of Chemistry is a charity, registered in England and Wales, Number 207890, and a company incorporated in England by Royal Charter (Registered No. RC000524), registered office: Burlington House, Piccadilly, London W1J 0BA, UK, Telephone: +44 (0) 207 4378 6556.

Advertisement sales:

Tel +44 (0) 1223 432246; Fax +44 (0) 1223 426017; E-mail **advertising@rsc.org**

For marketing opportunities relating to this journal, contact marketing@rsc.org

Green Chemistry

Cutting-edge research for a greener sustainable future

rsc.li/greenchem

Green Chemistry focuses on cutting-edge research that attempts to reduce the environmental impact of the chemical enterprise by developing a technology base that is inherently non-toxic to living things and the environment.

Editorial Board

Chair

Professor Doctor Javier Pérez-Ramírez, ETH Zurich, Switzerland

Associate Editors

Professor Aiwen Lei, College of Chemistry and Molecular Sciences, The Institute for Advanced Studies, Wuhan University, P. R. China Dr Elsje A. Quadrelli, CNRS and CPE Lyon, France

Members Dr François Jérôme, University of Poitiers, France Professor Laurel Shafer, The University of British Columbia, Canada Dr Helen Sneddon, University of York, UK Dr Keiichi Tomishige, Tohoku Univeristy, Japan Dr Tao Zhang, Dalian Institute of Chemical

Dr Tao Zhang, Dalian Institute of Chemic

Advisory Board

Paul Anastas, Yale University, USA Isabel Arends, TU Delft, The Netherlands Asim Bhaumik, Indian Association for the Cultivation of Science, India Fabrizio Cavani, University of Bologna, Italy Yonas Chebude, Addis Ababa University, Ethiopia James Clark, University of York, UK Avelino Corma, Universidad Politecnica de Valencia. Spain Robert H Crabtree, Yale University, USA Pierre Dixneuf, University of Rennes, France James Dumesic, University of Wisconsin-Madison USA Peter Dunn, Pfizer, UK Karen Goldberg, University of Washington,

USA Buxing Han, Chinese Academy of Sciences,

China

Mark Harmer, SAC Technologies, USA Milton Hearn, Monash University, Australia Andrew J. Hunt, Khon Kaen University, Thailand

Information for Authors

Full details on how to submit material for publication in Green Chemistry are given in the Instructions for Authors (available from http://www.rsc.org/authors). Submissions should be made via the journal's homepage: rsc.lig/reenchem

Authors may reproduce/republish portions of their published contribution without seeking permission from the Royal Society of Chemistry, provided that any such republication is accompanied by an acknowledgement in the form: (Original Citation)–Reproduced by permission of the Royal Society of Chemistry.

Graham Hutchings, Cardiff University, UK Philip Jessop, Queen's University, Canada C. Oliver Kappe, University of Graz, Austria Shu Kobayashi, University of Tokyo, Japan Mihkel Koel, Tallinn University of Technology, Estonia

Burkhard Koenig, University of Regensburg, Germany Michael Kopach, Eli Lilly and Company, USA

Dhileep Krishnamurthy, Jubilant Ingrevia Limited, India Walter Leitner, RWTH Aachen University,

Germany Chao-Jun Li, McGill University, Canada Rafael Luque, University of Cordoba, Spain Doug MacFarlane, Monash University,

Australia Regina Palkovits, RWTH Aachen, Germany Alvise Perosa, Universita Ca Foscari, Italy Martina Peters, Bayer AG, Germany Martyn Poliakoff, University of Nottingham, UK Colin Raston, Flinders University, Australia

Physics, Chinese Academy of Sciences, China

Robin D. Rogers, McGill University, Canada Gadi Rothenberg, University of Amsterdam, The Netherlands

Roger Sheldon, Delft University of Technology, The Netherlands

Christian Stevens, Ghent University, Belgium Natalia Tarasova, Mendeleev University of

Chemical Technology, Russia

Rajender Varma, US Environmental Protection Agency, USA

Peter Wasserscheid, Friedrich-Alexander Universität Erlangen-Nürnberg, Germany Tom Welton, Imperial College London, UK Ganapati D. Yadav, Institute of Chemical

Technology, India Suojiang Zhang, Institute of Process Engineering, Chinese Academy of Sciences,

China Julie Zimmerman, Yale University, USA

Vânia Zuin, Federal University of São Carlos, Brazil

This journal is © The Royal Society of Chemistry 2023. Apart from fair dealing for the purposes of research or private study for non-commercial purposes, or criticism or review, as permitted under the Copyright, Designs and Patents Act 1988 and the Copyright and Related Rights Regulation 2003, this publication may only be reproduced, stored or transmitted, in any form or by any means, with the prior permission in writing of the Publishers or in the case of reprographic reproduction in accordance with the terms of licences issued by the Copyright Licensing Agency in the UK. US copyright law is applicable to users in the USA.

Registered charity number: 207890

C ROYAL SOCIETY OF CHEMISTRY

Open Access Article. Published on 03 April 2023. Downloaded on 7/28/2025 4:08:04 AM.

TUTORIAL REVIEWS

2524

Advances in S–N bond formation *via* electrochemistry: a green route utilizing diverse sulfur and nitrogen sources



Zenghui Ye, Xi Zhang, Weiyuan Ma and Fengzhi Zhang*

2541

The dialkylcarbonate route to ionic liquids: purer, safer, greener?

Martin Tiano,* Ryan Clark, Laetitia Bourgeois and Margarida Costa Gomes*



COMMUNICATIONS

2559

Solvent-free mechanochemical chlorination of pyrazoles with trichloroisocyanuric acid

Chi-Min Chen, Jia-Xin Chen and Ching Tat To*





solvent-free high atom economy no column chromatography

2563

Speeding up sustainable solution-phase peptide synthesis using T3P® as a green coupling reagent: methods and challenges

Alexia Mattellone, Dario Corbisiero, Lucia Ferrazzano, Paolo Cantelmi, Giulia Martelli, Chiara Palladino, Alessandra Tolomelli* and Walter Cabri*



COMMUNICATIONS





Acid hydrolysis of chitin in calcium chloride solutions

Yudi Wang, Jia Kou, Xuewei Wang and Xi Chen*

2608

One-pot cellulose etherification and self-crosslinking via a mild hydroxyl-yne click reaction in a homogeneous system

Bowen Li, Chaoqun Xu, Juan Yu,* Liang Liu, Xiaofang Zhang* and Yimin Fan*



2620

Deep eutectic solvothermal NiS₂/CdS synthesis for the visible-light-driven valorization of the biomass intermediate 5-hydroxymethylfurfural (HMF) integrated with H_2 production

Shuzi Liu, Baolong Zhang, Zhaohui Yang, Zhimin Xue* and Tiancheng Mu*



2629

Accessing secondary amine containing fine chemicals and polymers with an earth-abundant hydroaminoalkylation catalyst

Manfred Manßen, Sabrina S. Scott, Danfeng Deng, Cameron H. M. Zheng and Laurel L. Schafer*



2640

Influence of stabilisers on the catalytic activity of supported Au colloidal nanoparticles for the liquid phase oxidation of glucose to glucaric acid: understanding the catalyst performance from NMR relaxation and computational studies

- E. Monti, A. Ventimiglia, L. Forster, E. Rodríguez-Aguado,
- J. A. Cecilia, F. Ospitali, T. Tabanelli, S. Albonetti,
- F. Cavani, I. Rivalta,* C. D'Agostino* and N. Dimitratos*





Atomically dispersed Co²⁺ on MgAlO_x boosting C₄₋₁₀ alcohols selectivity of ethanol valorization

Wen-Lu Lv, Lei He, Wen-Cui Li, Bai-Chuan Zhou, Shao-Pei Lv and An-Hui Lu*



Facile, green, and functional group-tolerant reductions of carboxylic acids...in, or with, water

Karthik S. Iyer, Chandler Nelson and Bruce H. Lipshutz*



A bio-based click reaction leading to the dihydropyridazinone platform for nitrogen-containing scaffolds

Jia-Yue Chen, Yao-Bing Huang,* Bin Hu, Ke-Ming Li, Ji-Long Zhang, Xuan Zhang, Xia-Yun Yan and Qiang Lu*

2681

Electrochemical dual α,β -C(sp³)–H functionalization of cyclic amines



Electrochemical dual α,β -C(sp³)–H functionalization of cyclic N-aryl amines

Tian Feng, Zile Zhu, Dongmei Zhang, Siyi Wang, Ruopu Li, Zhaolin Zhu, Xinxing Zhang* and Youai Qiu*

2690

Cellulose nanocrystals for crop protection: leaf adhesion and controlled delivery of bioactive molecules

Like Ning, Chaoqun You,* Yuxin Jia, Jingqian Chen, Yu Zhang, Xun Li, Orlando J. Rojas* and Fei Wang*



2699

Visible-light-driven 3-hydroxybutyrate production from acetone and low concentrations of CO₂ with a system of hybridized photocatalytic NADH regeneration and multi-biocatalysts

Yu Kita and Yutaka Amao*

2711

Process optimization by NMR-assisted investigation of chemical pathways during depolymerization of PET in subcritical water

Antonio Jaime-Azuara, Thomas Helmer Pedersen* and Reinhard Wimmer*





2723

S-Trifluoromethyl thioesters as bifunctional reagents for acyl-trifluoromethylthiolation of alkenes and 1,3-enynes *via* photoredox/copper dual catalysis

Zhong Zhang, Yang Tian, Xiaowei Li, Zemin Wang, Ruihua Liu, Ping Chen, Xiangqian Li, Jiajia Dai and Dayong Shi*





Novel multifunctional unimolecular initiators built on natural indole featuring fast photobleaching and visible light/thermal double polymerization

Shang Gong, Xiang Wu, Qiuyan Liao, Shuang Deng, Jing Hou, Kuangyu Tang, Ying Xiong, Zhen Li and Hongding Tang*



Visible-light-driven anaerobic oxidative upgrading of biomass-derived HMF for co-production of DFF and H_2 over a 1D $Cd_{0.7}Zn_{0.3}S/NiSe_2$ Schottky junction

Tao Shan, Luteng Luo, Taoran Chen, Lixun Deng, Mengqing Li, Xuhui Yang, Lijuan Shen and Min-Quan Yang*



Enhanced driving force and charge separation efficiency of protonated anthraquinone for C–H photooxygenation of alkanes by proton-coupled electron transfer

Hui Yin, Yingying Yuan, Yangbin Li, Jing Tang, Wenzhou Zhong* and Liqiu Mao*

2771



Non-quantum nanostructure-enabled hot carrier generation for enhancive photoelectrocatalytic oxidation of bio-alcohol in water coupled with hydrogen evolution

Pei-dong Wu, Lanyun Li, Keping Wang, Hu Li* and Zhen Fang*

2782

Cu-catalysed Chan–Lam synthesis of unsymmetrical aryl chalcogenides under aqueous micellar conditions

Nan Sun,* Kai Zheng, Mingqiang Zhang, Guowen Zheng, Liqun Jin, Baoxiang Hu, Zhenlu Shen and Xinquan Hu*



2790

1,3-Dioxolane compounds (DOXs) as biobased reaction media

Massimo Melchiorre, Peter H. M. Budzelaar, Maria E. Cucciolito, Roberto Esposito, Emanuela Santagata and Francesco Ruffo*



Coupling of solvent-free synthesis and reactive extrusion of alumina: an ecologically efficient integration for heterogenous catalyst synthesis

Pierre-Igor Dassie, Ryma Haddad, Maud Lenez, Alexandra Chaumonnot, Malika Boualleg, Patrick Legriel, Ales Styskalik, Bernard Haye, Mohamed Selmane, Damien P. Debecker, Clement Sanchez, Corinne Chaneac and Cedric Boissiere*

2815

A recoverable polyoxometalate-ionic liquid catalyst for selective cleavage of lignin β -O-4 models under mild conditions

Xing Xin, Zheng Li, Manzhou Chi, Mo Zhang, Yuanyuan Dong, Hongjin Lv* and Guo-Yu Yang*









Activation of biomass with volatilized KOH

Chao Li, Yuannian Li, Yuewen Shao, Lijun Zhang, Shu Zhang, Shuang Wang, Bin Li, Zhenhua Cui, Yonggui Tang and Xun Hu*

2840



Unlocking the photo-dehydrogenation ability of naphthalene monoimide towards the synthesis of quinazolinones

Supriya Halder, Sourav Mandal, Ayanangshu Biswas and Debashis Adhikari*



Ionic liquid-based electrolysis-deposition for modulating Pb crystal facets to boost CO₂ electroreduction

Chongyang Jiang, Shaojuan Zeng,* Jiaqi Feng, Guilin Li, Zongxu Wang, Kuilin Peng, Lu Bai and Xiangping Zhang*

2853



α -C-H functionalization of glycine derivatives under mechanochemical accelerated aging en route the synthesis of 1,4-dihydropyridines and α -substituted glycine esters

Keyu Xiang, Ping Ying, Tao Ying, Weike Su and Jingbo Yu*

2863

Natural eumelanin-based porous *N*-doped carbon as an active bio-catalyst for base- and initiator-free aerobic oxidation of olefins and alkyl aromatic hydrocarbons

Vishal A. Ghadge, Krishnan Ravi, Dhanaji R. Naikwadi, Pramod B. Shinde* and Ankush V. Biradar*



2872

Recycling of a thermoresponsive "catalyst pill": separation of a molecular catalyst in solid ethylene carbonate in various reactions

Jeroen T. Vossen, Noah Hülsken, Andreas J. Vorholt* and Walter Leitner

