

# GREEN PROCESSING AND SYNTHESIS

## EDITOR-IN-CHIEF

*Volker Hessel*

Department of Chemical Engineering and Chemistry  
Eindhoven University of Technology, The Netherlands

## EDITORS

*Galip Akay*

Formerly School of Chemical Engineering and Advanced Materials  
Newcastle University, UK

*Isabel Arends*

Biocatalysis and Organic Chemistry, Department of Biotechnology  
Delft University of Technology, The Netherlands

*Michael C. Cann*

Environmental Science at Chemistry Department  
University of Scranton, USA

*Yi Cheng*

Beijing Key Laboratory of Green Reaction Engineering and Technology  
Tsinghua University Beijing, China

*Giancarlo Cravotto*

Organic Chemistry  
University of Torino, Italy

*Dana Kralisch*

Institute for Technical Chemistry and Environmental Chemistry  
Friedrich Schiller University Jena, Germany

*Krishna D. P. Nigam*

Department of Chemical Engineering  
Institute of Technology Delhi, India

*Basu Saha*

Engineering, Science and The Built Environment, Department of Applied Science  
London South Bank University, UK

*Christophe A. Serra*

Laboratory of Polymer Engineering for High Technologies  
University of Strasbourg, France

*Wei Zhang*

Boston Center for Green Chemistry  
University of Massachusetts Boston, USA

**DE GRUYTER**

**ABSTRACTED/INDEXED IN** Celdes, Chemical Abstracts Service (CAS), CNKI Scholar (China National Knowledge Infrastructure), CNPIEC, EBSCO Discovery Service, EBSCO TOC Premier, GeoArchive, Google Scholar, J-Gate, Naviga (Softweco), Paperbase, Pirabase, Polymer Library, Primo Central (ExLibris), Summon (Serials Solutions/ProQuest), TDOne (TDNet), TEMA Technik und Management, Thomson Reuters: Science Citation Index Expanded, Ulrich's Periodicals Directory/ulrichsweb, WorldCat (OCLC)

The publisher, together with the authors and editors, has taken great pains to ensure that all information presented in this work (programs, applications, amounts, dosages, etc.) reflects the standard of knowledge at the time of publication. Despite careful manuscript preparation and proof correction, errors can nevertheless occur. Authors, editors and publisher disclaim all responsibility for any errors or omissions of liability for the results obtained from use of the information, or parts thereof, contained in this work.

The citation of registered names, trade names, trademarks, etc. in this work does not imply, even in the absence of a specific statement, that such names are exempt from laws and regulations protecting trademarks etc. and therefore free for general use.

ISSN 2191-9542 · e-ISSN 2191-9550

All information regarding notes for contributors, subscriptions, Open access, back volumes and orders is available online at [www.degruyter.com/gps](http://www.degruyter.com/gps)

**RESPONSIBLE EDITOR** Prof. Volker Hessel, Micro Flow Chemistry and Process Technology Group, Department of Chemical Engineering and Chemistry, Eindhoven University of Technology, Den Dolech 2, 5600 MB Eindhoven, The Netherlands, Tel.: +31-40-247 2973, Email: [v.hessel@tue.nl](mailto:v.hessel@tue.nl)

**ASSISTANT MANAGING EDITOR** Jannelies Smit, Department of Chemical Engineering and Chemistry, Eindhoven University of Technology, Den Dolech 2, 5600 MB Eindhoven, The Netherlands, Tel.: +31-40-247 5280, Email: [ST-GPS@tue.nl](mailto:ST-GPS@tue.nl)

**JOURNAL MANAGER** Dr. Gunda Stöber, De Gruyter, Genthiner Straße 13, 10785 Berlin, Germany, Tel.: +49 (0)30 260 05-279, Fax: +49 (0)30 260 05-298, Email: [gps.editorial@degruyter.com](mailto:gps.editorial@degruyter.com)

**RESPONSIBLE FOR ADVERTISEMENTS** Panagiota Herbrand, De Gruyter, Rosenheimer Str. 143, 81671 München, Germany, Tel.: +49 (0)89 76902-394, Fax: +49 (0)89 76902-350, E-Mail: [panagiota.herbrand@degruyter.com](mailto:panagiota.herbrand@degruyter.com)

© 2014 Walter de Gruyter GmbH, Berlin/Boston

**TYPESETTING** Compuscript Ltd., Shannon, Ireland

**PRINTING** Franz X. Stückle Druck und Verlag e.K., Ettenheim  
Printed in Germany



## Contents

### Editorial

Volker Hessel

**Megatrends – megascience? Part 2** — 187

### Feature

Jan Harmsen

**Novel sustainable industrial processes: from idea to commercial scale implementation** — 189

### Original articles

Joana Lima-Ramos, Pär Tufvesson and John M. Woodley  
**Application of environmental and economic metrics to guide the development of biocatalytic processes** — 195

Haibao Zhang, Tengfei Cao and Yi Cheng  
**Synthesis of nanostructured MgO powders with photoluminescence by plasma-intensified pyrohydrolysis process of bischofite from brine** — 215

Suresh Kumar  
**A solvent free approach for Knoevenagel condensation: facile synthesis of 3-cyano and 3-carbethoxycoumarins** — 223

Sayed M. Badawy  
**Green synthesis and characterisations of antibacterial silver-polyvinyl alcohol nanocomposite films for wound dressing** — 229

### Company profiles

Thomas Kläusli

**AVA Biochem: commercialising renewable platform chemical 5-HMF** — 235

Andreas Freitag

**Invenios: micro process technology – chemical process technology of tomorrow** — 237

### Conference announcements

Mónica Martins

**International Conference on Green Chemistry and Sustainable Engineering International (Barcelona, Spain, July 29–31, 2014)** — 239

Sophie West

**7th Annual European Forum for Industrial Biotechnology and the Biobased Economy (Reims, France, September 30–October 2, 2014)** — 241

Luc Cloutier

**19th International Symposium on Homogeneous Catalysis (ISHC-XIX; Ottawa, ON, Canada, July 6–11, 2014)** — 243

Shawn Torres

**248th American Chemical Society National Meeting and Exposition: Chemistry and Global Stewardship (San Francisco, CA, USA, August 10–14, 2014)** — 245

**Conferences 2014–2017** — 247

### Book reviews

Anuradha Mishra and James H. Clark (Eds.)

**Green materials for sustainable water remediation and treatment (Annette Johnston)** — 253

Dmitry Yu. Murzin

**Engineering catalysis (Bhaskar Patil)** — 255