

# Green Chemistry

Cutting-edge research for a greener sustainable future

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### Cover

See Oliver Y. Gutiérrez *et al.*, pp. 4222–4233.

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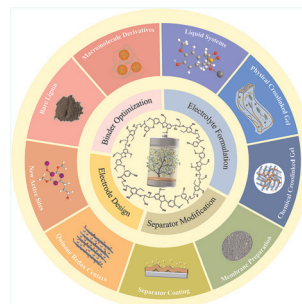
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## CRITICAL REVIEW

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### Renewable lignin and its macromolecule derivatives: an emerging platform toward sustainable electrochemical energy storage

Xueru Yang, Yufei Zhang, Minghui Ye, Yongchao Tang, Zhipeng Wen, Xiaoqing Liu\* and Cheng Chao Li\*

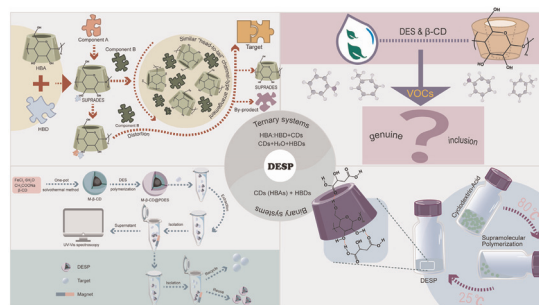


## TUTORIAL REVIEWS

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### Green materials with promising applications: cyclodextrin-based deep eutectic supramolecular polymers

Jingyu Zhang, Liping Yao, Shang Li, Shiqi Li, Yongsong Wu, Zuguang Li\* and Hongdeng Qiu\*



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# Green Chemistry

Cutting-edge research for a greener sustainable future

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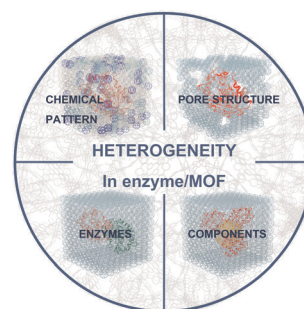


## TUTORIAL REVIEWS

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## Heterogeneity in enzyme/metal–organic framework composites for CO<sub>2</sub> transformation reactions

Ying Shu, Weibin Liang\* and Jun Huang\*

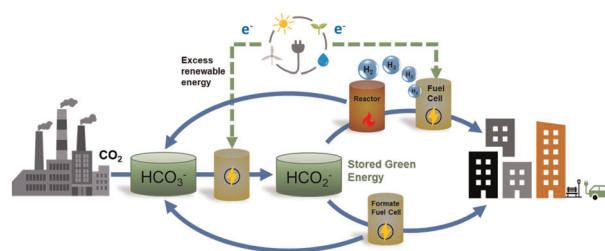


## PERSPECTIVE

4222

## Using earth abundant materials for long duration energy storage: electro-chemical and thermo-chemical cycling of bicarbonate/formate

Oliver Y. Gutiérrez,\* Katarzyna Grubel, Jotheeswari Kothandaraman, Juan A. Lopez-Ruiz, Kriston P. Brooks, Mark E. Bowden and Tom Autrey

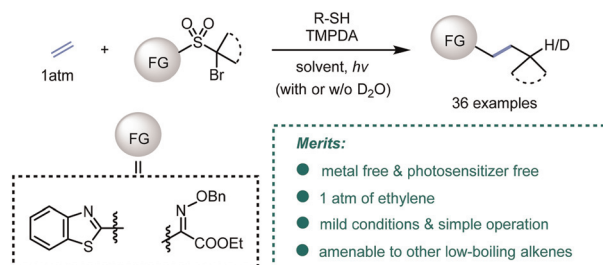


## COMMUNICATIONS

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## Metal-free radical-mediated alkylfunctionalization of ethylene and low-boiling-point alkenes

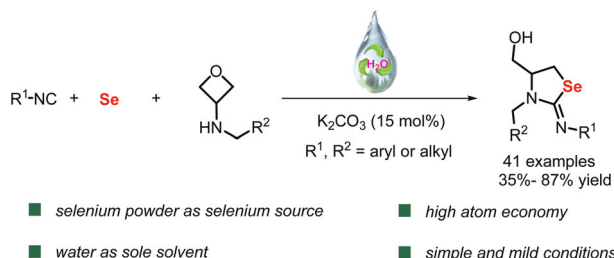
Xu Zhang, Xinxin Wu, Yasu Chen and Chen Zhu\*



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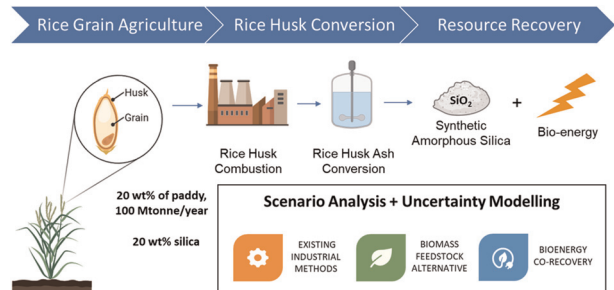
## A multicomponent reaction of isocyanides, selenium powder and 3-aminooxetanes in pure water: green and efficient synthesis of 1,3-selenazolines

Huan Liu, Zi-Lin Ye, Zhong-Jian Cai\* and Shun-Jun Ji\*



## PAPERS

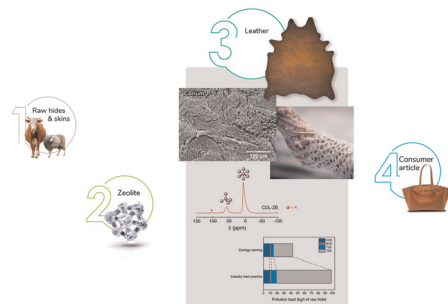
4244



### Synthetic amorphous silica: environmental impacts of current industry and the benefit of biomass-derived silica

Ethan Errington, Miao Guo\* and Jerry Y. Y. Heng\*

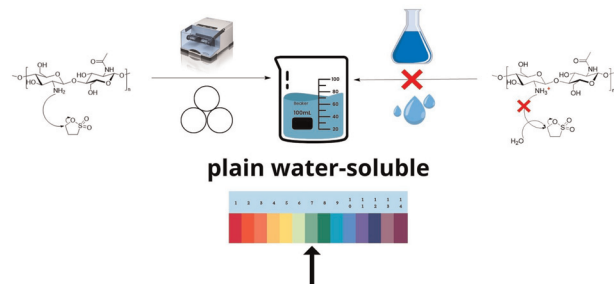
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### Zeolites as sustainable alternatives to traditional tanning chemistries

William R. Wise, Stefan J. Davis,\* Wouter E. Hendriksen, Dirick J. A. von Behr, Sujay Prabakar and Yi Zhang

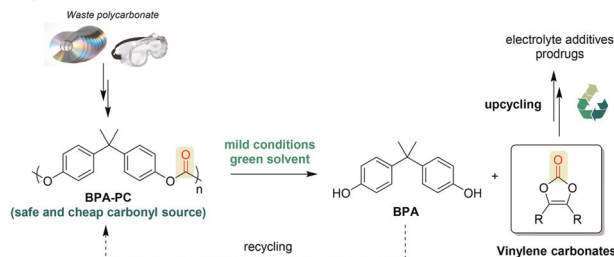
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### Green mechanochemical synthesis of water-soluble *N*-sulfonated chitosan

Casper Van Poucke,\* Aurèle Vandeputte, Sven Mangelinckx and Christian V. Stevens

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### Chemical upcycling of poly(bisphenol A carbonate) to vinylene carbonates through organocatalysis

Killian Onida, Mohamad Fayad, Sébastien Norsic, Olivier Boyron and Nicolas Duguet\*

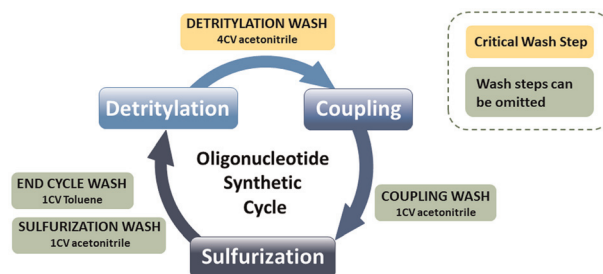


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## Omission of column washing operations in the solid phase synthesis of oligonucleotides

Li Xiao,\* Thomas Pickel, Zifan Li, Dominic Luciano, Jing Yang, David Cho, Sophia Mac, Xianglin Shi, George Bou-Assaf, Firoz Antia and Yannick Fillon



4302

Electrochemical single-step *N*-acylation and *S*-cyclization synthesis of thiazolimide *via* radical process

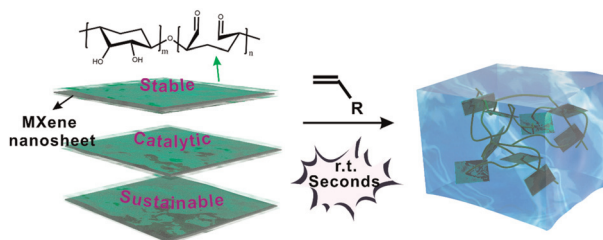
Yao Li, Jun Zhang, Mengyao She, Lang Liu, Zheng Yang, Ping Liu,\* Shengyong Zhang and Jianli Li\*



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## Long-term stable and catalytic 2D MXene nanosheets wrapped with dialdehyde xylan for ultrafast gelation

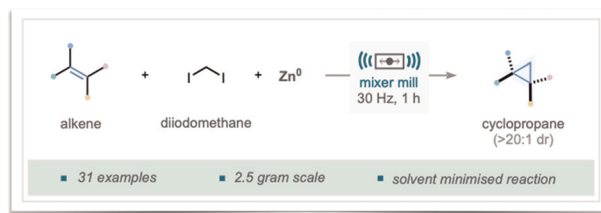
Nan Li, Lupeng Shao, Qiang Xia, Shujun Tan, Shuwen Zhao, XuPeng Li, Zhenhua Su, Xiang Hao\* and Feng Peng\*



4319

Mechanochemical Simmons–Smith cyclopropanation *via* ball-milling-enabled activation of zinc(0)

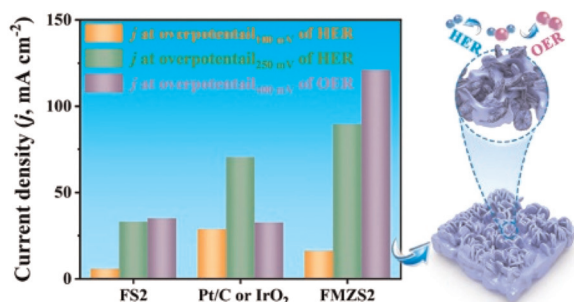
Lorenzo Pontini, Jamie A. Leitch\* and Duncan L. Browne\*





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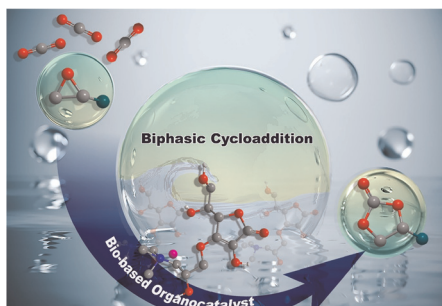
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### Compositionally modulated FeMn bimetallic skeletons for highly efficient overall water splitting

Licheng Huang, Ruiqi Yao, Zili Li, Jiaxin He, Yingqi Li,\* Hongxiang Zong,\* Shuang Han,\* Jianshe Lian, Yang-Guang Li and Xiangdong Ding

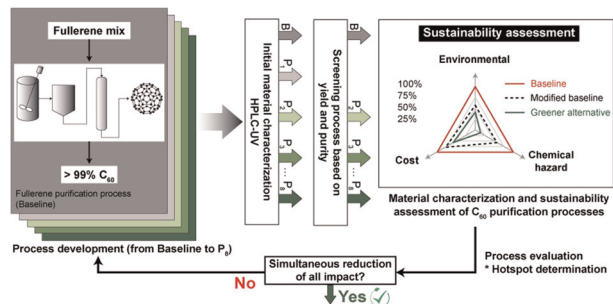
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### Cycloaddition of CO<sub>2</sub> to epoxides “around water”: a strategy to apply and recycle efficient water-soluble bio-based organocatalysts in biphasic media

Tharinee Theerathanagorn, Anna Vidal-López, Aleix Comas-Vives, Albert Poater\* and Valerio D'Elia\*

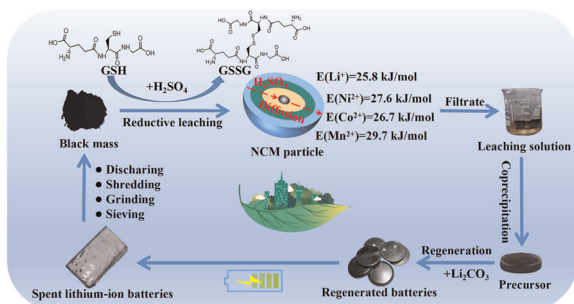
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### Environmental, cost, and chemical hazards of using alternative green solvents for fullerene (C<sub>60</sub>) purification

Seyed M. Heidari, Eunsang Lee, Ben Cecil and Annick Anctil\*

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### A green strategy for recycling cathode materials from spent lithium-ion batteries using glutathione

Kunhong Gu, Xingyuan Gu, Yongwei Wang, Wenqing Qin and Junwei Han\*

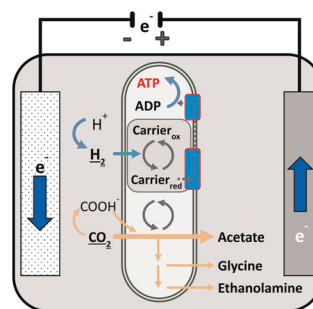


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### Microbial electrosynthesis with *Clostridium ljungdahlii* benefits from hydrogen electron mediation and permits a greater variety of products

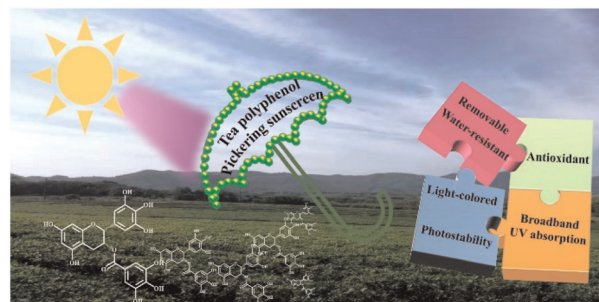
Santiago T. Boto, Bettina Bardl, Falk Harnisch and Miriam A. Rosenbaum\*



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### Polyphenolic condensation assembly enabled biocompatible, antioxidative, and light-colored tea sunscreen formulations with broadband UV protection

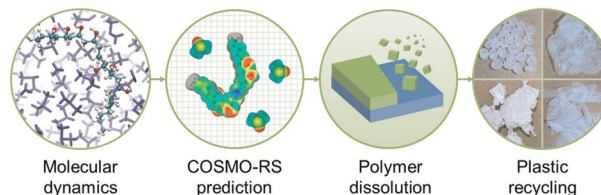
Qiulan Tong, Yue Xiao, Zeng Yi, Xiangyu Chen, Xian Jiang\* and Xudong Li\*



4402

### Large-scale computational polymer solubility predictions and applications to dissolution-based plastic recycling

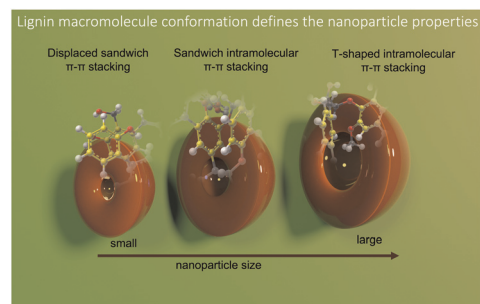
Panzheng Zhou, Jiuling Yu, Kevin L. Sánchez-Rivera, George W. Huber and Reid C. Van Lehn\*



4415

### Molecular understanding of the morphology and properties of lignin nanoparticles: unravelling the potential for tailored applications

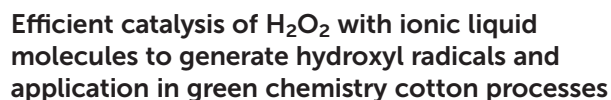
Ievgen V. Pylypchuk, Maria Karlsson, Pär A. Lindén, Mikael E. Lindström, Thomas Elder, Olena Sevastyanova\* and Martin Lawoko\*





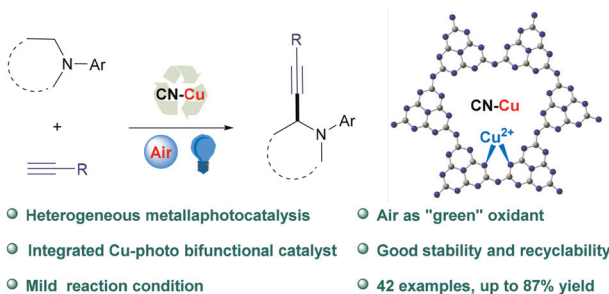
Zhuo Chen, Haiyu Sun, Weiqing Kong, Long Chen\* and  
Weiwei Zuo\*

## 4438



Kongliang Xie, Xiang Zhuang, Xiang Luo, Zeye Jing,  
Xiyu Song,\* Aiqin Hou and Aiqin Gao\*

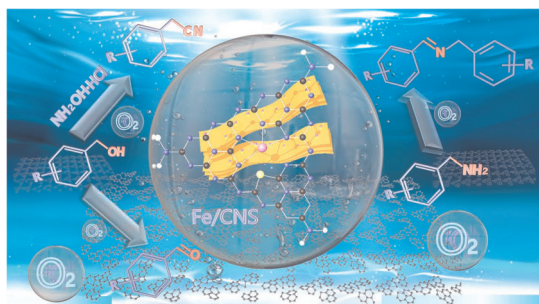
## 4446



# Copper-doped carbon nitride as a practical heterogeneous metallaphotocatalyst for aerobic oxidative cross-coupling of tertiary amines with terminal alkynes

Yilian Bai, Qian Yang, Yurong Tang,\* Xiao Dan,  
Wentao Wang\* and Yunfei Cai\*

## 4453



## Enzyme-mimicking single atoms enable selectivity control in visible-light-driven oxidation/ammoxidation to afford bio-based nitriles

Ye Meng, Jinshu Huang, Jie Li, Yumei Jian, Song Yang\*  
and Hu Li\*

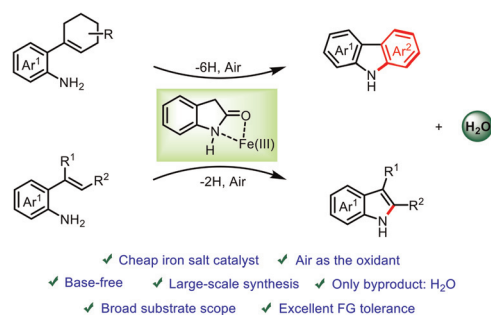


## PAPERS

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### Iron-catalyzed intramolecular C–H amination for the synthesis of N–H carbazoles and indoles

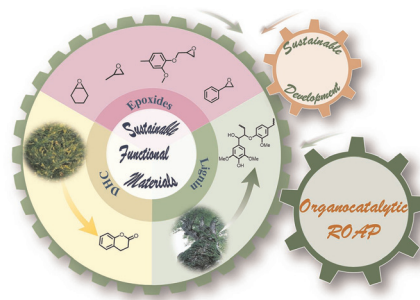
Zheng-Lin Wang, Yun-Hao Zhang, Jun-Yu Huang, Jian Zhou, Ya-Qin Yu, Dexin Feng\* and Da-Zhen Xu\*



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### Lignin-grafting alternative copolymer of 3,4-dihydrocoumarin and epoxides as an active and flexible ingredient in sunscreen

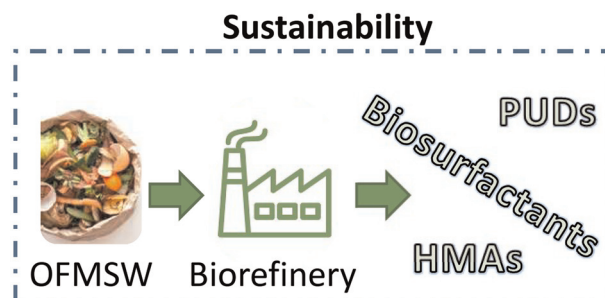
Pengcheng Liu, Yuanlong Guo, Gu Guo, Lei Dai, Gang Hu and Haibo Xie\*



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### Techno-economic evaluation and life cycle assessment for sustainable alternative biorefinery concepts using the organic fraction of municipal solid waste

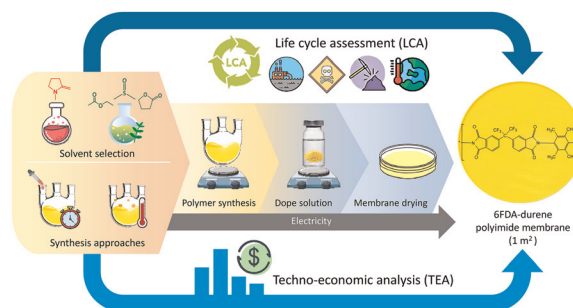
Sofia-Maria Ioannidou, José Pablo López-Gómez, Joachim Venus, Miguel Angel Valera, Vera Eßmann, Irantzu Alegria-Dallo, Ioannis K. Kookos, Apostolis Koutinas\* and Dimitrios Ladakis\*



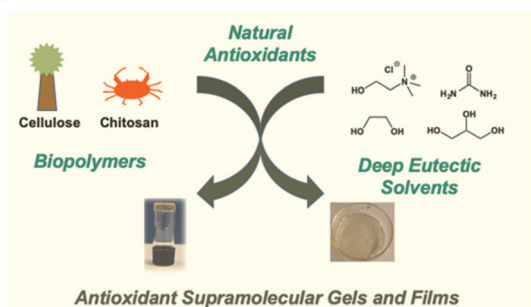
4501

### Are green solvents truly green? Integrating life cycle assessment and techno-economic analysis for sustainable membrane fabrication

Seang Uyin Hong, Yida Wang, Leong Sing Soh and Wai Fen Yong\*



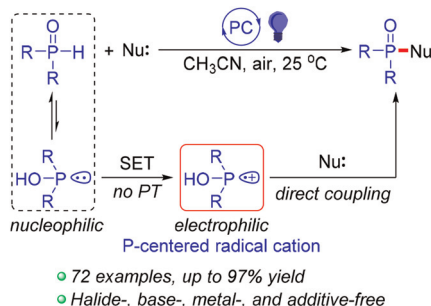
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### Polysaccharide-based supramolecular bicomponent eutectogels as sustainable antioxidant materials

Salvatore Marullo, Floriana Petta, Giulia Infurna, Nadka T. Dintcheva and Francesca D'Anna\*

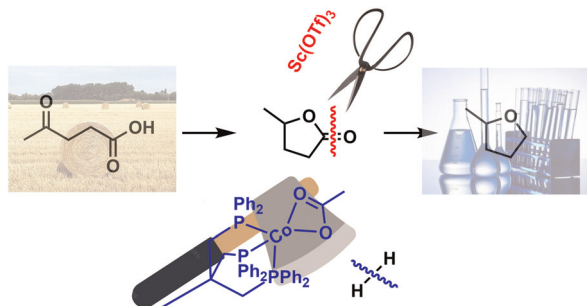
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### Visible light photocatalytic phosphorylation of heteroatom nucleophiles triggered by phosphorus-centered radical cations

Yuanting Huang, Jinyu Tang, Xi Zhao, Yanping Huo, Yang Gao, Xianwei Li and Qian Chen\*

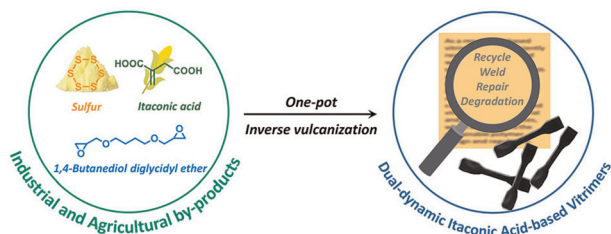
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### Catalytic hydrodeoxygenation of neat levulinic acid into 2-methyltetrahydrofuran using a cobalt phosphine complex and Sc(OTf)<sub>3</sub> co-catalytic system

Lijin Gan and Jin Deng\*

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### Comprehensive itaconic acid-based vitrimers via one-pot inverse vulcanization

Zhongkai Guo, Xuewei Jiao, Kailun Wei, Jianqiao Wu\* and Jun Hu\*

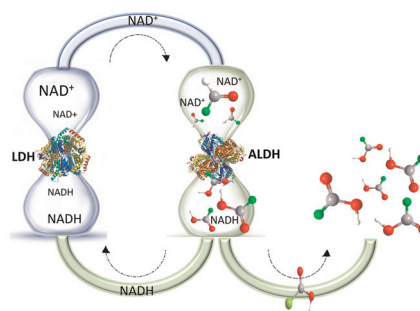


## PAPERS

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### Coupled immobilized bi-enzymatic flow reactor employing cofactor regeneration of $\text{NAD}^+$ using a thermophilic aldehyde dehydrogenase and lactate dehydrogenase

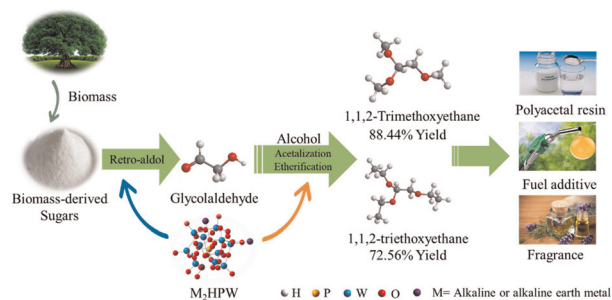
Kim Shortall, Simin Arshi, Simon Bendl, Xinxin Xiao, Serguei Belochapkin, Denise Demurtas, Tewfik Soulimane and Edmond Magner\*



4565

### Conversion of biomass-derived sugars to 1,1,2-trialkoxymethane via a [2 + 4] retro-aldol reaction over alkaline and alkaline earth metal salts of phosphotungstic acid

Tihang Liu, Jiangang Wang, Hongyou Cui\* and Jinghua Wang\*



## CORRECTION

4577

### Correction: Continuous flow solvent free organic synthesis involving solids (reactants/products) using a screw reactor

Brijesh M. Sharma, Ranjit S. Atapalkar and Amol A. Kulkarni\*

