

# Green Chemistry

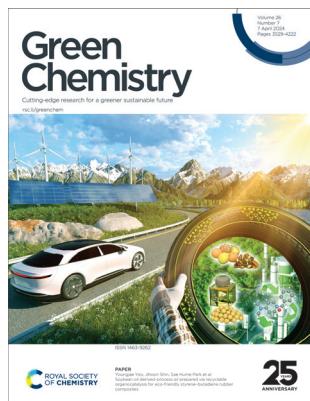
Cutting-edge research for a greener sustainable future

rsc.li/greenchem

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ISSN 1463-9262 CODEN GRCHFJ 26(7) 3529–4222 (2024)



### Cover

See Jihoon Shin,  
Sae Hume Park et al.,  
pp. 3732–3746.

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3732.



### Inside cover

See Andrew J. Hunt et al.,  
pp. 3747–3757.

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*Green Chem.*, 2024, **26**,  
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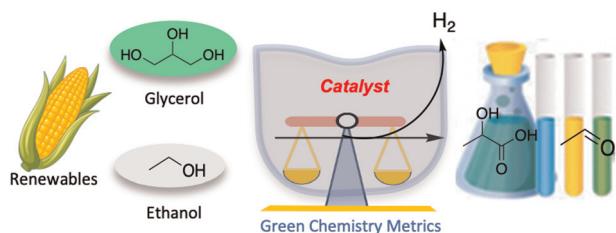
Artist: Pakin Noppawan

## CRITICAL REVIEWS

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### Homogeneous vs. heterogeneous catalysts for acceptorless dehydrogenation of biomass-derived glycerol and ethanol towards circular chemistry

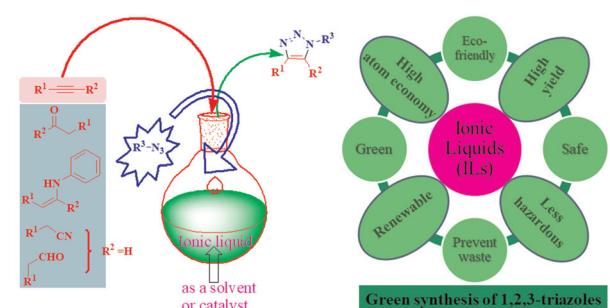
Kai Wang, Jonathan Horlyck, Nan An and  
Adelina Voutchkova-Kostal\*



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### Ionic liquids for the green synthesis of 1,2,3-triazoles: a systematic review

Aman Kumar, Vijay Kumar, Prashant Singh,  
Ram Kumar Tittal\* and Kashmire Lal\*



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with an applied focus

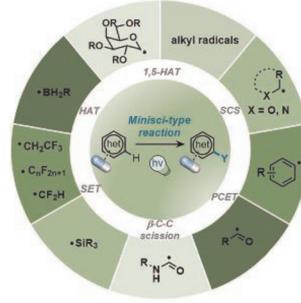
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Fundamental questions  
Elemental answers

## TUTORIAL REVIEWS

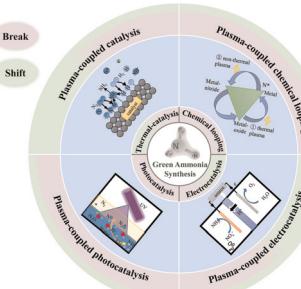
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**Photocatalyzed Minisci-type reactions for late-stage functionalization of pharmaceutically relevant compounds**Xiaotong Zhang, Shuqi Li, Feng Qiu, Hwee Ting Ang,\*  
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**Deep eutectic solvents as an emerging green platform for the synthesis of functional materials**Yunping Ma, Yu Yang, Tie Li, Shahid Hussain and  
Maiyong Zhu\*

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**Strategies for avoiding the scaling relationship in ammonia synthesis with non-thermal plasma methods – the “shift” or “break” approach**Baiqiang Zhang,\* Junhui Li, Hengfei Zuo, Yongqi Liang,  
Jia Wang, Yuhui Chen, Gang Chen, Kenji Kamiya,  
Nobusuke Kobayashi and Bo Wu\*

## PERSPECTIVES

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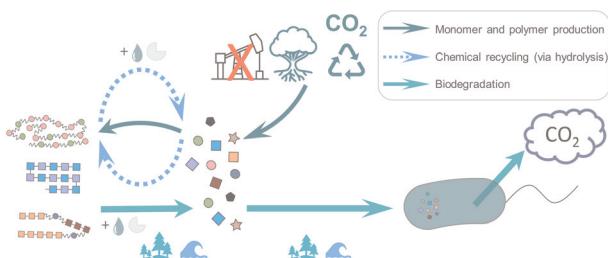
**Advancing sustainable end-of-life strategies for photovoltaic modules with silicon reclamation for lithium-ion battery anodes**

Owen Wang, Zhuowen Chen and Xiaotu Ma\*



## PERSPECTIVES

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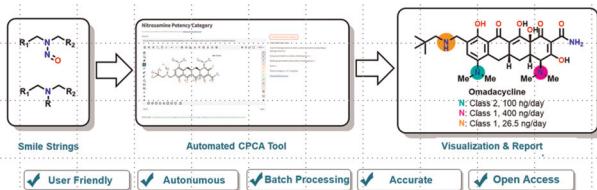


## Polyester biodegradability: importance and potential for optimisation

Yue Wang, Robert-Jan van Putten, Albert Tietema, John R. Parsons and Gert-Jan M. Gruter\*

## COMMUNICATIONS

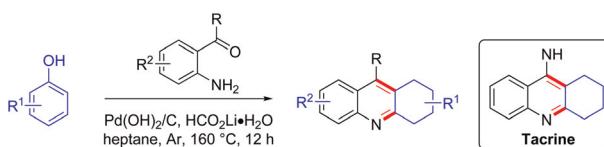
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## An automated carcinogenic potency categorization approach for nitrosamine drug substance-related impurities

Jiazhou Zhu,\* Yang Qu\* and Ning Ye\*

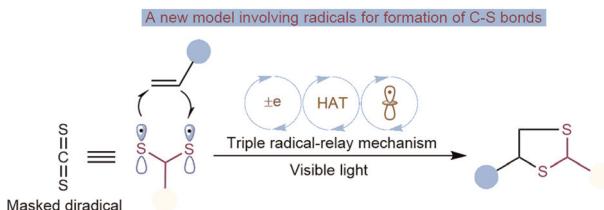
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## Palladium-catalyzed conversion of phenols into tetrahydroacridines

Jianjin Yu, Renqin Zhan, Chao-Jun Li and Huiying Zeng\*

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## [3 + 2] radical sulfuration of alkenes by organic photocatalysis

Na Yang, Gefei Duan and Yunbo Zhu\*

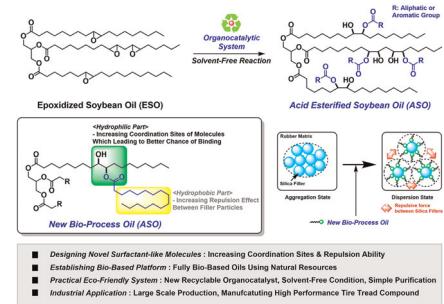


## PAPERS

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**Soybean oil derived-process oil prepared via recyclable organocatalysis for eco-friendly styrene–butadiene rubber composites**

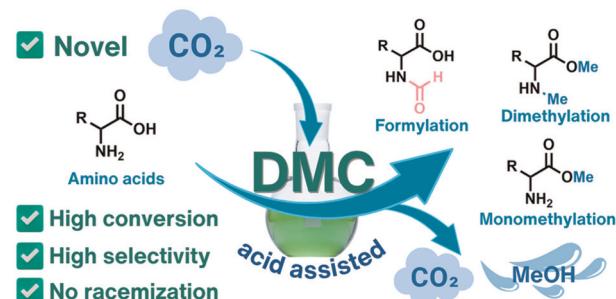
Geunho Kim, Woong Kim, Jeong Suk Yuk, Haemin Jeong, Hee Geom Jeon, Youngjae Yoo,\* Jihoon Shin\* and Sae Hume Park\*



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**A novel approach to amino acid synthesis: acid-assisted reactions with dimethyl carbonate for efficient O-methylated, N,O-methylated and N-formylated derivatives**

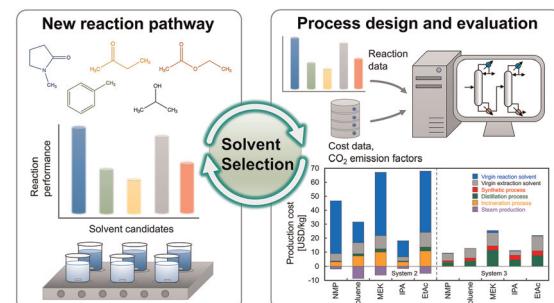
Pattamabhorn Worsawat, Pakin Noppawan, Nontipa Supanchaiyamat, Himmy Wu, Con R. McElroy and Andrew J. Hunt\*



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**Solvent selection based on a conceptual process design by combining cost evaluation and life cycle assessments for developing new reaction pathways**

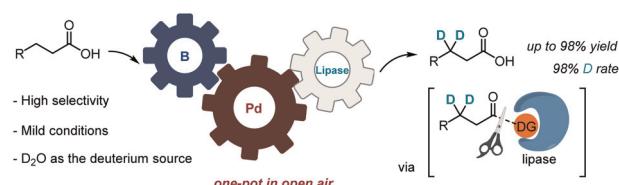
Takehiro Yamaki,\* Thuy T. H. Nguyen, Nobuo Hara, Satoshi Taniguchi and Sho Kataoka\*



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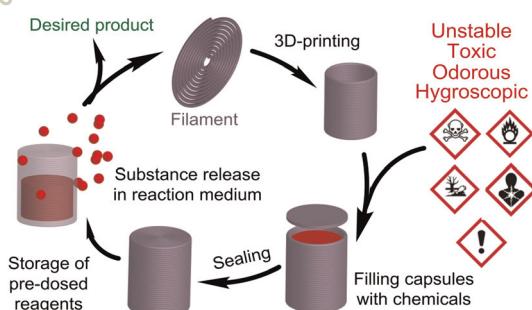
**Chemoenzymatic  $\beta$ -specific methylene C(sp<sup>3</sup>)–H deuteration of carboxylic acids**

Xicheng Wang, Zhaohui Sun, Tao Li, Saima Perveen and Pengfei Li\*



## PAPERS

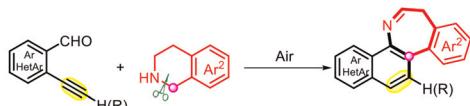
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**A 60-times faster digital-discovery-compatible reaction setup with enhanced safety for chemical applications**

Andrey N. Lebedev, Konstantin S. Rodygin, Svetlana A. Vakhrusheva and Valentine P. Ananikov\*

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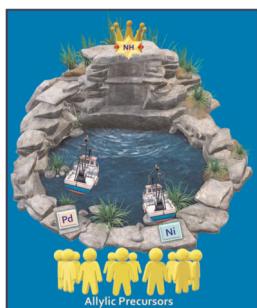


- ◆ Transition metal and additive free
- ◆ Readily accessible starting materials
- ◆ Broad substrate scope with good functionality
- ◆ Air as the oxidant

**Synthesis of the dibenzo[b,d]azepine skeleton via a catalyst-free ring expansion domino reaction**

Tao Guo, Penghua Hu, Jiaxin Li, Yujia Zhou, Panke Zhang,\* Yunhui Zhao\* and Congjun Zhu\*

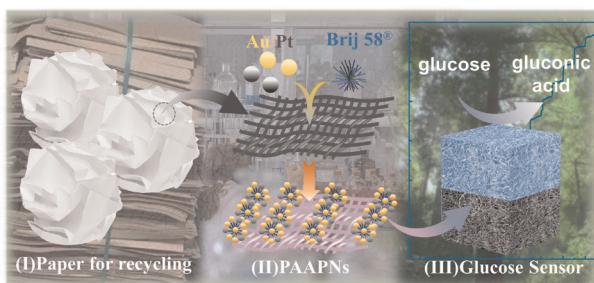
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**An integrative sustainability assessment of the Tsuji–Trost reaction simulating allylic amination under non-conventional (vs. conventional) conditions**

Sangita Dattatray Shinde, Gargi Nikhil Vaidya, Shyam Kumar Lokhande, Anil Shah, Ramesh Hiralal Choudhary and Dinesh Kumar\*

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**Used tissue paper as a 3D substrate for non-enzyme glucose sensors**

Zhiyu Chen, Lei Li, Xuanyu Xiao, Yuxin Zhang, Jieyu Zhang, Qing Jiang,\* Xuefeng Hu\* and Yunbing Wang\*



## PAPERS

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## Solvent-free chemical upcycling of poly(bisphenol A carbonate) and poly(lactic acid) plastic waste using SBA-15-functionalized basic ionic liquids

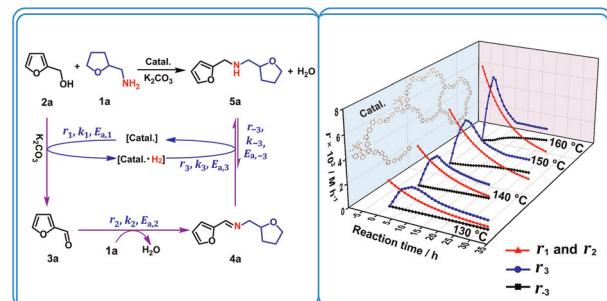
Arjun K. Manal, Garima Saini and Rajendra Srivastava\*



3832

## Construction of biomass-based amines via Ir-mediated *N*-alkylation: kinetic analysis

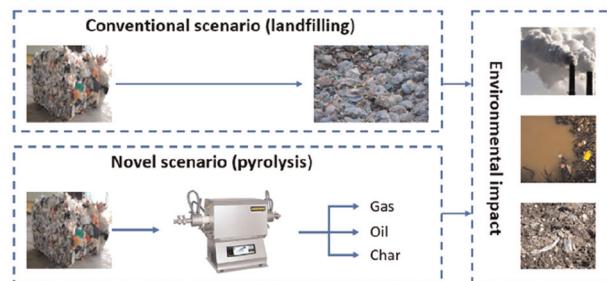
Meixiang Liang, Zhongmou Xu, Tianhao Zhou, Limin Chen\* and Jinzhu Chen\*



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## Environmental impact of different scenarios for the pyrolysis of contaminated mixed plastic waste

Guillermo Garcia-Garcia,\* María Ángeles Martín-Lara,\* Mónica Calero and Gabriel Blázquez



3863

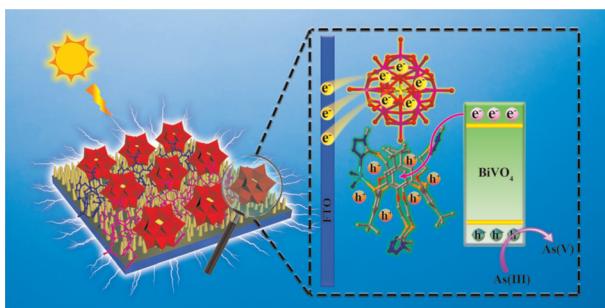
## Closing the loop for poly(butylene-adipate-co-terephthalate) recycling: depolymerization, monomers separation, and upcycling

Mohamed Ismail,\* Adel Abouhmad, Niklas Warlin, Sang-Hyun Pyo, Oliver Englund Örn, Basel Al-Rudainy, Cecilia Tullberg, Baozhong Zhang and Rajni Hatti-Kaul\*



## PAPERS

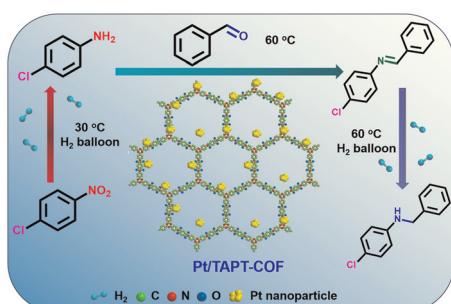
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**Highly efficient photoelectrocatalytic oxidation of arsenic(III) with a polyoxometalate-thiacalix[4]arene-based metal-organic complex-modified bismuth vanadate photoanode**

Yuting Song, Jia-Yi Zhang, Jin Yang,\* Tao Bo\* and Jian-Fang Ma\*

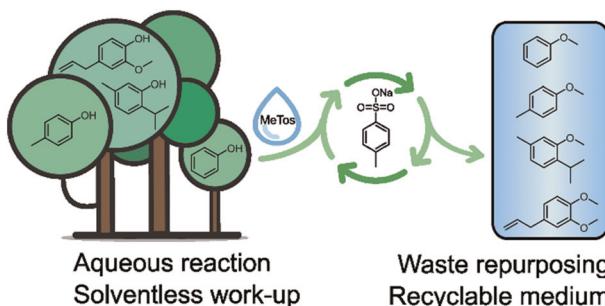
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**Electron-rich Pt anchored on covalent triazine frameworks for the selective hydrogenation of halogenated nitrobenzenes**

Mengmeng Gao, Jinfang Kou, Manhua Xu, Kun Yuan,\* Mengyang Li\* and Zhengping Dong\*

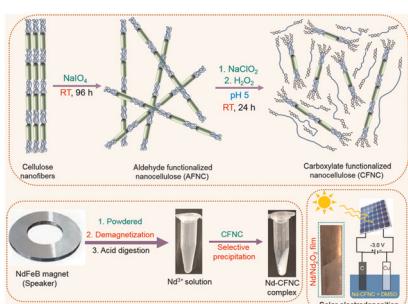
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**Aqueous sodium tosylate: a sustainable medium for alkylations**

Sem Bleus, Jeltzlin Semerel and Wim Dehaen\*

3909



**Neodymium recovery from NdFeB magnets: a sustainable, instantaneous, and cost-effective method**

Sandeep Bose, Benilde Mizero and Parisa A. Ariya\*



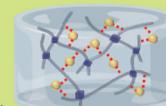
## PAPERS

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**Robust hydrogel sensor with good mechanical properties, conductivity, anti-swelling ability, water tolerance and biocompatibility**

Airong Xu,\* Tiantian Sun, Rukuan Liu,\* Liuzemu Li, Yiming Gong and Zhihong Xiao

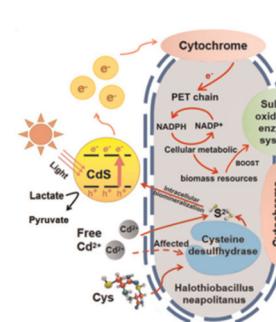
- Conductivity
- Biocompatibility
- Anti-swelling ability
- Water tolerance
- Stable signal output
- Satisfactory practicality
- Robust mechanical properties (stress, strain, elastic modulus, toughness, fatigue resistance, notch insensitivity, endure needle puncture)



3940

**Semiconductor biohybrids for enhanced bifunctional wastewater sulfur and heavy metal removal**

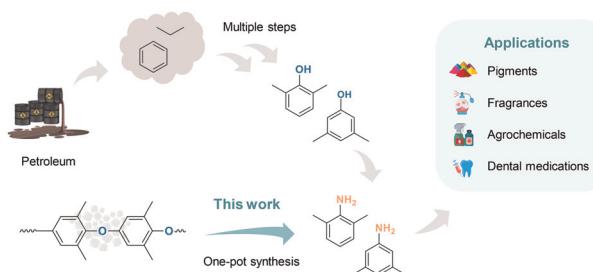
Yanju Zhang, Furui Fang, Xiaoxiao Qian, Liangchen Li, Zongli Huo, Jingjing Zhang, Dandan Dong, Chaofeng Huang,\* JiaYuan Li, Yonghong Hu\* and Li Mi\*



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**Direct amination of poly(*p*-phenylene oxide) to substituted anilines over bimetallic Pd–Ru catalysts**

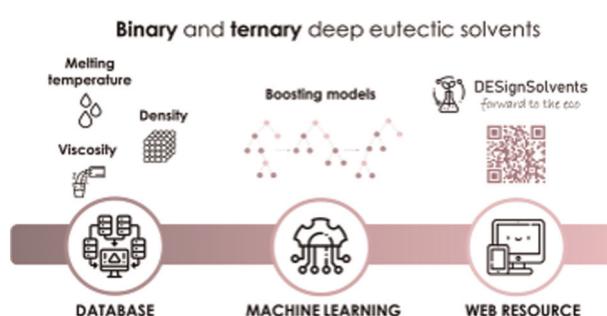
Phuc T. T. Nguyen, Gökulp Gözaydin, Jieran Ma, Bingqing Yao, Qian He and Ning Yan\*



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**DESignSolvents: an open platform for the search and prediction of the physicochemical properties of deep eutectic solvents**

Valeria Odegova, Anastasia Lavrinenko, Timur Rakhmanov, George Sysuev, Andrei Dmitrenko\* and Vladimir Vinogradov\*



## PAPERS

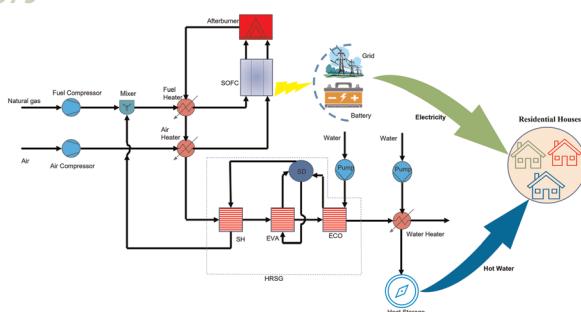
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## Food-safe glycidyl-free chain extenders for polylactides

Hazem M. Elkholy, Mohamed A. Abdelwahab, Muhammad Naveed, Khaled Abdelaziz and Muhammad Rabnawaz\*

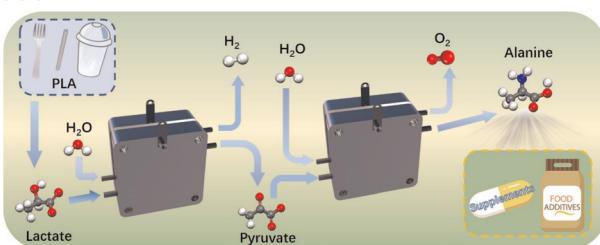
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## Techno-economic analysis of solid oxide fuel cell-based energy systems for decarbonising residential power and heat in the United Kingdom

Dibyendu Roy, Samiran Samanta, Sumit Roy,\* Andrew Smallbone and Anthony Paul Roskilly

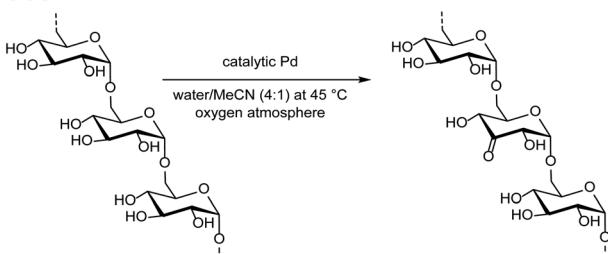
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## Beyond biodegradation: upcycling of polylactic acid plastic waste into amino acids via cascade catalysis under mild conditions

Yingxin Ma, Xuyun Guo, Mengmeng Du, Sailei Kang, Weiliang Dong, Valeria Nicolosi, Zhongli Cui, Yu Zhang\* and Bocheng Qiu\*

4005



## Regioselective palladium-catalysed aerobic oxidation of dextran and its use as a bio-based binder in paperboard coatings

Sarina C. Maßmann, Gerald A. Metselaar, Derk Jan van Dijken, Keimpe J. van den Berg, Martin D. Witte\* and Adriaan J. Minnaard\*



## PAPERS

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**Biocompatible diimidazolium based ionic liquid systems for enhancing the solubility of paclitaxel**

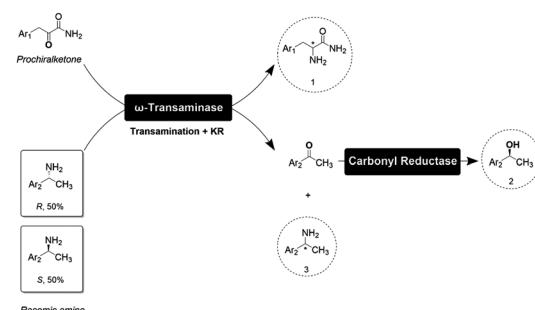
Yanhui Hu, Hua Yue, Shiqi Huang, Bingxi Song, Yuyuan Xing, Minmin Liu, Gongying Wang,\* Yanyan Diao\* and Suojiang Zhang\*



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**Biotransamination with racemic amines as amine donors: kill three birds with one stone through a dual-enzyme cascade**

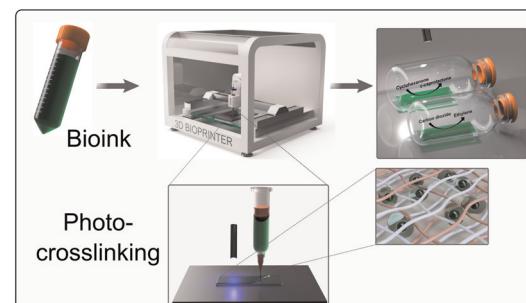
Kai Li, Mengjie Sun, Haoyu Jing, Jing Liu, Jun Gao and Bo Wang\*



4032

**Employing photocurable biopolymers to engineer photosynthetic 3D-printed living materials for production of chemicals**

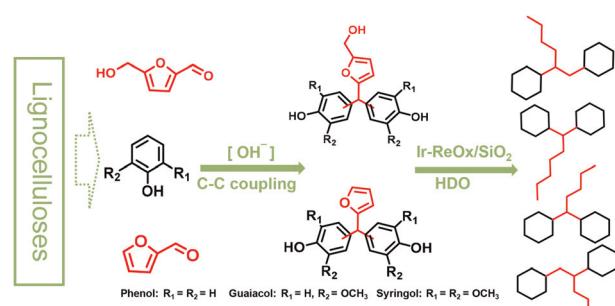
Gábor Szilveszter Tóth, Oskar Backman, Tiia Siivola, Wenyang Xu, Sergey Kosourov, Vilja Siitonен, Chunlin Xu and Yagut Allahverdiyeva\*



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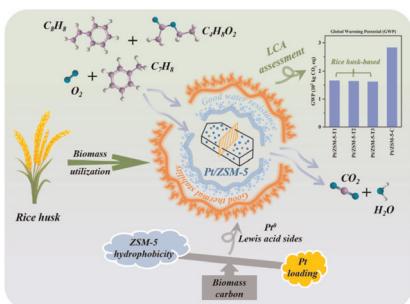
**Selective production of bicyclic alkanes as high-density fuel additives by coupling lignocellulose-derived furanics and phenolics**

Shumin Huang, Xiaolin Luo, Ji Li, Sibao Liu and Li Shuai\*



## PAPERS

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**Pt anchored in the skeleton of rice husk-based ZSM-5 for excellent catalytic VOC oxidation: structure–activity relationship and environmental impact assessment**

Wenxin Lan, Muping Shen, Yinye Chen, Kui Niu, Weiming Zhou,\* Jing Xu, Baoquan Huang,\* Hongjie Cai, Jiachang Zuo, Daifeng Lin, Yongjin Luo,\* Qingrong Qian and Qinghua Chen

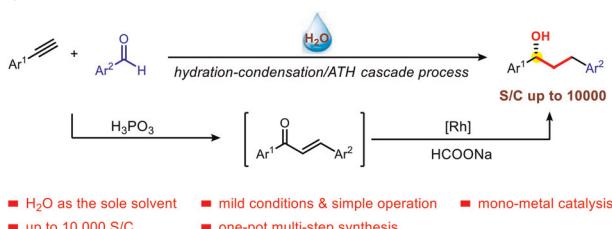
4065



**Kinetic model of asymmetric dehydration of aldoxime catalyzed by immobilized OxdPsp in an organic solvent**

Jiarui Chen, Yunlong Zhang, Xiaoying Zhang, Shiyang Wen, Min Qiao, Junhong Liu and Yuanyuan Zhang\*

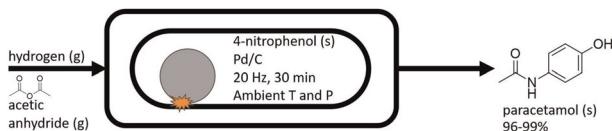
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**Water-mediated one-pot multi-step synthesis of chiral 1,3-diarylpropan-1-ols by the asymmetric hydrofunctionalisation of simple alkynes**

Pinke Yu, Qixing Liu, Linhong Zuo, Xumu Zhang,\* Congcong Yin\* and Haifeng Zhou\*

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**One-pot mechanochemical hydrogenation and acetylation of 4-nitrophenol to 4-aminophenol and paracetamol**

Jimin Park, Jacob S. Maier, Caria Evans, Marta Hatzell, Stefan France, Carsten Sievers\* and Andreas S. Bommarius\*

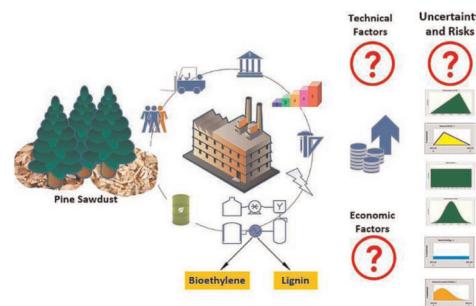


## PAPERS

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**Design of an integrated biorefinery for bioethylene production from industrial forest byproducts**

Rocio Elizabeth Cardozo,\* Nicolás Martín Clauser, Fernando Esteban Felissia, María Cristina Area and María Evangelina Vallejos



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**Valorization of cheese whey: closing the loop from protein extraction to whey protein film composting**

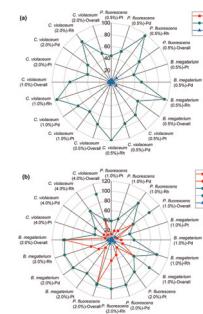
Maialen Uribarrena, Eric Rovira-Cal, Leire Urbina, Maria Jose Suárez, Enrique Aymerich, Pedro Guerrero, Koro de la Caba\* and Alaitz Etxabide\*



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**Evaluation of green chemistry metrics for sustainable recycling of platinum group metals from spent automotive catalysts via bioleaching**

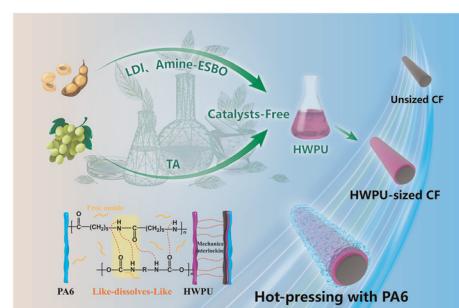
Salman Karim, Han Mei Saw and Yen-Peng Ting\*



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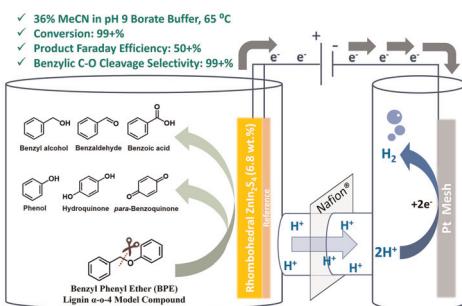
**Synthesis of a fully bio-based self-catalyzed hyperbranched waterborne polyurethane as a sizing agent for enhancing the interfacial properties of CF/PA6 composites**

Shengtao Dai, Fei Yan, Siyu Zhang, Jiaming Guo, Lin Zhang, Yu Liu, Liu Liu\* and Yuhui Ao\*



## PAPERS

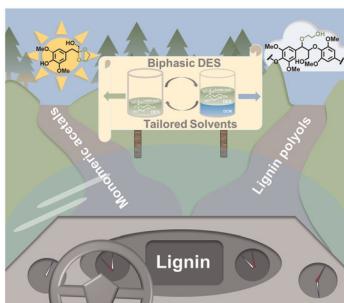
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### Rhombohedral $\text{ZnIn}_2\text{S}_4$ -catalysed anodic direct electrochemical oxidative cleavage of C–O bond in $\alpha$ -O-4 linkages in ambient conditions

Qi Zhu, Bo Gong, Shuquan Huang, Yangxin Jin, Shengqin Liu, Shan Shao, Yuwei Yang, Taren Cataldo, Nicholas M. Bedford and Jason Chun-Ho Lam\*

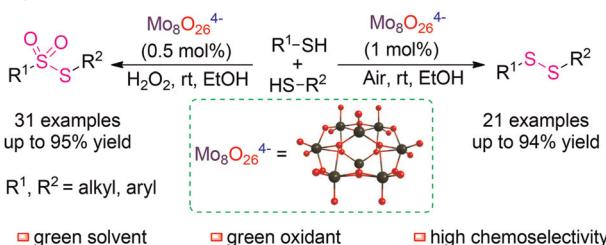
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### Solvent-triggered directional lignin valorization towards monomeric acetals or lignin polyols

Xinyue Sun, Junjie Ni, Yuhua Lou, Peng Zhao, Yanyan Yu, Yilin Li, Qi Tang, Haipeng Yu\* and Yongzhuang Liu\*

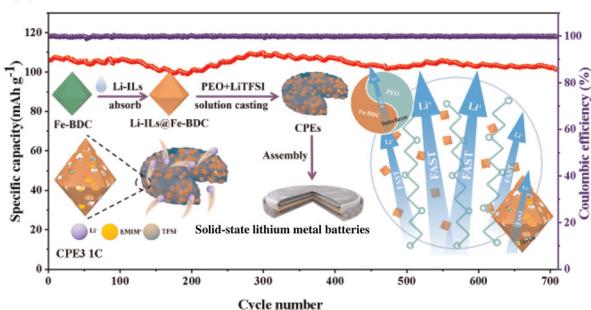
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### Sustainable synthesis of thiosulfonates and disulfides by molybdenum-catalyzed selective oxidation of thiols

Zhibin Zhou, Hao Xu, Jiamin Ma, Xianghua Zeng\* and Yongge Wei\*

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### Enhanced lithium-ion conductivity and interfacial stability of Li-IL@Fe-BDC composite polymer electrolytes for solid-state lithium metal batteries

Liequan Liu, Zikang Gong, Chen Liu, Aiping Peng, Ze Zhang,\* Ji Yu, Jianxin Cai and Zhenyu Yang\*

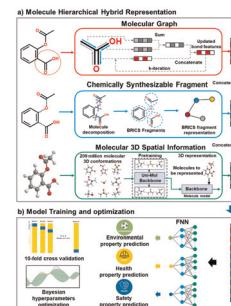


## PAPERS

4181

**An interpretable 3D multi-hierarchical representation-based deep neural network for environmental, health and safety properties prediction of organic solvents**

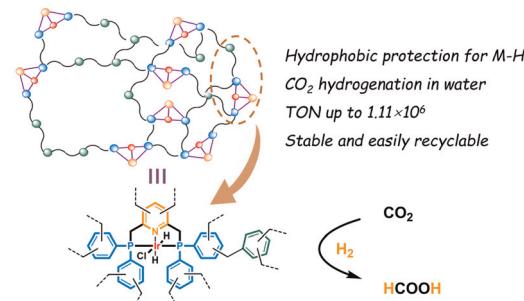
Jun Zhang, Qin Wang,\* Yang Lei and Weifeng Shen\*



4192

**Highly efficient catalysts for  $\text{CO}_2$  hydrogenation to formic acid in water catalyzed by hydrophobic porous polymers containing stable metal–hydride**

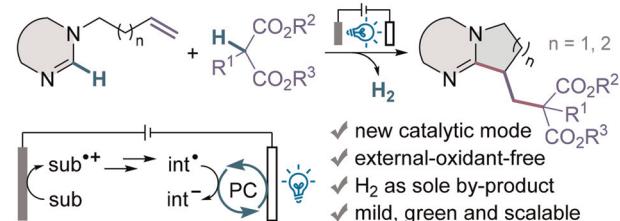
Wentao Ma, Wenjie Xiong,\* Jinling Hu, Jiao Geng\* and Xingbang Hu\*



4199

**Photoredox streamlines electrocatalysis: photoelectrosynthesis of polycyclic pyrimidin-4-ones through carbocyclization of unactivated alkenes with malonates**

Minglin Tao, Qin Feng, Kaixing Gong, Xuege Yang, Lou Shi,\* Qiaowen Chang\* and Deqiang Liang\*



4209

***In situ* electronic redistribution of NiCoZnP/NF heterostructure via Fe-doping for boosting hydrazine oxidation and hydrogen evolution**

Tongtong Shi, Bo Gao, Haoyu Meng, Yumo Fu, Delong Kong, Penghui Ren, Haiyang Fu and Zhongbao Feng\*

