Renewable Chemistry
https://www.sciltp.com/journals/rc

Editorial

Renewable Chemistry: Dedicated to Advancing Chemistry for a Circular and Regenerative Chemical Industry

James H. Clark [1,2]

[1] Department of Chemistry, University of York, York, United Kingdom
[2] Department of Environmental Science and Engineering, Fudan University, Shanghai, China
Correspondence: james.clark@york.ac.uk;

How To Cite: Clark, J.H. Renewable Chemistry: Dedicated to Advancing Chemistry for a Circular and Regenerative Chemical Industry. *Renewable Chemistry* **2025**, *1* (1), 1.

Chemistry is the science that is concerned with the substances of matter and the transformations that they undergo. Chemistry has been at work from the earliest days of the universe, transforming hydrogen into helium thus making the building blocks and the energy needed for life. For that life to exist and flourish, eco-systems like Earth can only rely on one (effectively) infinite resource: the energy from the Sun. We must continuously replenish all other resources. The chemistry that makes and sustains life must be renewable on a reasonable timescale. The life that consumes resources must itself becomes a resource for the next generation. However, in a mere 100 years or so, we have chosen to step away from the fundamental principle of renewability by using non-renewable (fossil) resources to make non-renewable products, or at least products that were not designed to be renewable. This is an unprecedented challenge to Nature—and while we have enjoyed a century of consumption on a hitherto unimaginable scale, we are now beginning to see the negative consequences of our actions. Pollution to the air and water is threatening our climate and our oceans; the creation of billions of tonnes of non-renewable solid wastes are depleting limited resources and poisoning the planet. We must also face the fact that the easily accessed resources we have built our last centuries wealth on are largely finite or are only available at an increasingly unacceptable cost to our planet.

The greatest challenge we face in the 21st century is to move away from linear supply chains based on using traditional non-renewable resources in often dangerous and inefficient processes to make environmentally harmful products to truly sustainable and circular products. Our consumption of primary resources continues to rapidly climb along with the waste and pollution that comes with their exploitation. This cannot continue. We do not want to stop the manufacture of plastics or tyres or textiles that currently end up as enormous waste problems, nor do we want to stop the use of performance enhancing and other valuable chemicals that are currently toxic or environmentally persistent. Rather, we want to find ways to enjoy the benefits of such products without the currently associated drawbacks. Chemistry is at the heart of the problem and of the solution. We have learned an extraordinary amount of chemistry over the last century as we found ways to convert rather dull hydrocarbons into millions of functional chemical products although only a small fraction of the 100+ million chemicals we have made are used in modern society. We must learn from this and continue to seek benefit from that remarkable diversity of chemical functionality that feeds all of our industry, and all of our modern lifestyle. But we have to do this in a controlled and intelligent way with the next generation in mind, and with a more holistic appreciation of what we are doing and a greater respect for the environment—and for nature that has been practising environmentally compatible chemistry for billions of years. Now is the time for change—now is the time for Renewable Chemistry.

Renewable Chemistry embraces all the critical factors necessary to achieve a sustainable but modern society with all its needs and desires. How can we better exploit the chemical potential of biomass, natures ultimate soup of chemical functionality? What chemistry pathways can be used to obtain the small molecule functionality that we need from biomass and other renewable resources? How can we ensure that these and other chemistry pathways are themselves consistent with Renewable Chemistry, such as the use of recyclable and bio-based reagents and catalysts, as well as renewable energy? What are the future, energy efficient green technologies that can drive

these processes? We must also find new, effective but safer and recyclable replacements for many commonly used chemical products such as additives and vital process auxiliaries such as solvents. Most chemicals end up in formulations be they personal care goods, cleaning products, clothes or plastics, and we need a strong eco-design ethos to ensure that the inherent complexity of such articles is not to the detriment of the recovery and reuse of their chemical components. Industrial symbiosis can be very important here as we take a positive approach to getting chemical value from waste useful to other industries—one person's waste can (and should) be another's resource. All of these new technologies, more circular processes and chemical valorisation strategies can be greatly aided by artificial intelligence and machine learning. And all of the new Renewable Chemistry that we seek to exploit can only be justified by applying the appropriate metrics and can only work if economically sound and encouraged by the right policies.

Chemistry has always been there, but we have made it more complex through our desire to have a more healthy, comfortable and interesting lifestyle. We should not give on these ambitions but instead frame them in a truly sustainable way through Renewable Chemistry. I started the journey towards sustainability over 25 years ago as the founding scientific editor of the new journal Green Chemistry which has since helped change the views and practices of many. From that, we have learned a lot and now better recognise the challenges ahead and the opportunities they provide for better chemistry. We now stand at the beginning of the next major step in the journey—Renewable Chemistry—we need to be green and sustainable across the whole product lifecycle. I very much hope that many will join me in taking this forward through our new journal and pioneer the advancement of chemistry driven by renewable resources, processes and innovations that contribute to a circular and regenerative chemical industry that will sustainably support modern society.