EDITORIAL

Sustainable chemistry in practice

Addressing current and future global problems requires sustainable practices in chemistry. We discuss ways to incorporate sustainability in laboratory practice, processes and beyond.

> At *Nature Reviews Methods Primers*, we believe that values like sustainability can and should be integrated into experimental design

As we face increasingly complex problems caused by climate change, many of our solutions rely on chemistry, and on advances in sustainable chemistry — from better medicines and safer agrochemicals to new materials and cleaner energy supplies. Sustainable chemistry seeks to improve industrial chemistry by producing better profitable products with fewer pollutants and hazardous by-products. There are three main avenues we look at for improving in chemical research: sustainability in laboratory practice, in the chemistry itself and in research that promotes equity and justice.

Evaluating sustainability in chemistry requires measurement of the intrinsic properties of a molecule, material, reaction or process to ensure that resources are not used at a rate faster than they can be replenished. The use of renewable bio-derived feedstocks in energy production[1] or material development[2] is ideal for reducing the environmental impact of chemical research. Improper management of waste and by-products can have dramatic environmental consequences; it is crucial for all researchers working with chemicals to conscientiously and carefully manage materials and by-products through their full life cycles. Ensuring there is no accumulation of hazardous materials, as well as energy and other resource consumption, is a key consideration in sustainable chemistry.

At *Nature Reviews Methods Primers*, we believe that values like sustainability can and should be integrated into experimental design. This year, we have published Comments examining how to make laboratory practice more sustainable[3] and how to safely scale up chemical reactions to reduce environmental impact[4]. In a chemistry laboratory, this includes monitoring waste, reducing water usage, identifying areas to reduce energy consumption and optimizing solvents used in reactions.

The adoption of sustainability in chemical research and industry requires the availability of resources and reaction feasibility. In developing nations, the adoption of sustainable chemistry can be severely restricted by the availability of resources as well as by lower regulatory infrastructure and enforcement[5]. Fortunately, projects are currently underway to improve global access to sustainable practices in chemistry. Enhanced chemistry education for the purpose of improving processes and technology will also be necessary to expand access to sustainable chemistry resources.

Nature Reviews Methods Primers and *Nature Reviews Chemistry* have put together a collection of articles on sustainable chemistry that we hope will help researchers think about the different ways in which they can integrate sustainability in the lab. This living collection will expand with our ever-growing number of publications in sustainable chemistry. The collection currently includes Primers on designing sustainable polymers, electrochemical stripping analysis, nitrogen reduction and synthesizing ionic liquids, and will soon include articles on carbon capture and water electrolysis. In future Primers, we will also encourage all authors, regardless of discipline, to include discussion of sustainability in experimental design. We hope these steps will encourage all readers to do their part to safeguard the planet for future generations while addressing current global needs.

1. Lopez, G. et al. Hydrogen generation from biomass pyrolysis. *Nat. Rev. Methods Primers* **2**, 20 (2022).
2. Mohanty, A. K. et al. Sustainable polymers. *Nat. Rev. Methods Primers* **2**, 46 (2022).
3. Jain, N. Integrating sustainability into scientific research. *Nat. Rev. Methods Primers* **2**, 35 (2022).
4. Hitchin, J. R. The scale up of chemical reactions. *Nat. Rev. Methods Primers* **2**, 28 (2022).
5. Barra, R. & González, P. Sustainable chemistry challenges from a developing country perspective: education, plastic pollution, and beyond. *Curr. Opin. Green Sustain. Chem.* **9**, 40–44 (2018).