

Sustainable processes in the chemistry department: from green chemistry education in the laboratory to environmentally friendly engineering designs

Thomas A. Logothetis^{1*}

¹University of Southampton, Chemistry, Highfield, Southampton, SO17 1BJ, United Kingdom

*Corresponding author: thomas.logothetis@soton.ac.uk

Scientific topic: Green Chemistry Education and Policy

Keywords: Green Chemistry Education, laboratory practicals, energy-saving design

Abstract

Ever since the twelve principles of green chemistry have been formalised [1] have chemists had the impetus and reference for their pursuit to develop sustainable products and processes. Scientists, not only in chemistry and chemical engineering, have naturally thought about more environmentally benign reactions and design solutions beforehand, although the motivation might have been as diverse as a financial stimulus, an indefensible waste problem or an improved awareness of energy consumption. This appreciation of a possibility of a better future for all has incensed also chemistry to respond with a mindfulness for limited resources and driven green topics in research and education.

However, in order to retain attention and to advance consciousness about environmental solutions and green chemistry a concerted effort is crucial. In this presentation, different angles will be highlighted, starting with undergraduate laboratory instruction, to innovative construction design solutions as well as raising awareness through policies and committee work.

Examples from chemistry education include classical approaches like teaching green metrics, *e.g.* atom economy and reaction efficiency, via different reaction trajectories (*e.g.* organo-catalytic versus organometallic catalysis to stoichiometric), to various improvements through simple changes in the apparatus reactions are performed in (*e.g.* sonication, microwave, mechano-chemistry versus standard heating) and a choice of recyclable over less favourable products with the same or comparable properties.

Cases in the area of design solutions include energy efficient, solvent recycling and water saving laboratory equipment (*e.g.* recirculating [2], air-cooling or Peltier condensers) implemented in our teaching and research laboratories as well as innovative engineering solutions that significantly reduce the carbon-footprint of our department.

Lastly, the presentation will discuss the various stages at which we think it is important to engage people to secure their full and continued support, emphasising outreach, undergraduate and postgraduate education, and how departmental committees influence faculty policies.

To conclude, green ideas from the basic undergraduate laboratory to policy briefs, green chemistry is centre-stage in Chemistry at the University of Southampton and goes beyond faculty borders. Pinnacles from the previous years' accomplishments will be appraised.

References

- [1] P. T. Anastas, J. C. Warner, *Green Chemistry: Theory and Practice*, OUP, New York, 1998.
- [2] E. W. Baum, J. J. Esteb, A. M. Wilson, *J. Chem. Educ.*, **2014**, *91*, 1087-1088.