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WORLDWIDE TRENDS IN GREEN CHEMISTRY EDUCATION

The time is right to draw the attention of chemists, educators, and others to the global status of green chemistry education. Timely, because of the mismatch between the everyday practice of chemistry teachers at the secondary and post-secondary level and high profile interrelated global initiatives that are guiding scientific and public sustainability discourse. Timely also, because of the opportunity presented to transform that educational practice, to take green and sustainable chemistry out of the aside boxes in textbooks and the margins of curriculum, and infuse it through the body of knowledge included in student learning outcomes and assessments.

Green Research and Teaching at Canadian Institutions

The emergence of green chemistry research activity in Canada began in 2000 at McGill University in Montreal, Quebec, where T.H. (Bill) Chan launched the Canadian Chapter of the Green Chemistry Institute, an organization based in Washington, DC, under its first Director, Joseph Breen. This was soon followed by the launch of a nationwide Green Chemistry Network in 2002 that assembled the names and contacts of all researchers in Canada who were doing any kind of research that fit the aims of green chemistry.

Under the leadership and vision of the then chairman, Bruce Lennox, a stream of new faculty members was recruited to McGill with the mandate to mount vigorous research programmemes in green chemistry.

The second major academic institution offering a green chemistry research programme is Queen’s University in Kingston, Ontario. Green Centre Canada was launched there in 2010 at Queen’s University Innovation Park under the leadership of Philip Jessop, a graduate of the University of British Columbia, who was recruited from UC Davis in 2003. His research work led to the concept of ‘switchable solvents and surfactants’ that use carbon dioxide and amines to form zwitterions as a means to reversibly change the polarities of organic solvents from hydrophobic to hydrophilic and vice versa. This technology was applied to the problem of separating oily substances from water in emulsified solutions such as those encountered in chemical processing in various industries, most notably the plant-based oil and petroleum industries.

The Spanish Network of Sustainable Chemistry (REDQS)

Chemistry is the solution that allows maintaining and improving the current welfare of our societies, without compromising their current sustainability or the resources for the expected quality of life and prosperity of future generations. Within this context, the Spanish Network of Sustainable Chemistry (Red Española De Química Sostenible, REDQS) was formally created in 2003 by a group of university teachers and researchers from different institutions, including professionals and researchers from industry, sharing a common interest in developing and promoting the general principles of green chemistry. In this regard, the main task of the network was defined as: promoting the development of sustainable chemistry and the diffusion of its knowledge in the ambit of the university, research centers—public or private—industries and other centers of production and/or use of chemicals, scientific societies and in the society in general.

For this purpose, carrying out different activities related to sustainable chemistry has been considered since then, including:

- Cooperation with universities, research and development centres, industrial companies and scientific societies, located in Spain and in other countries, in particular in developing countries

- Organization of courses and educational activities for teachers at different educative levels, including university teachers.

Green Chemistry for Malaysian Pre-service and In-service Science Teachers

The introduction of green chemistry experiments as laboratory-based pedagogy was an important step in the teacher education programme at the University of Sains Malaysia. The implementation of green chemistry experiments turned out to be highly feasible as we could integrate these experiments into the existing curriculum without reforming its structure. The existing chemistry experiments as listed in the syllabus were modified or adapted into green chemistry experiments. For instance, in order to teach rate of reaction, sodium thiosulfate is frequently used in the laboratory and to teach heating and cooling curve naphthalene is being used. Both these substances (sodium thiosulfate and naphthalene) are carcinogenic and are harmful to the environment and human health. In the green chemistry approach, these substances were replaced with lauric acid and vitamin C. Both these chemicals are safe to the environment and non-toxic. Introduction of biodiesel production, global warming, and biodegradable polymers was timely since these are knowledge issues relevant to the Malaysian context with a need for a sustainable lifestyle that can support future generations.

Conclusion Green chemistry philosophy and principles, formally articulated two decades ago, have been put forward out of concern that the everyday practice of chemistry be fundamentally transformed so as to start with sustainability and safety considerations.

REFERENCES

1. Kareen T. Gubalane, Edna B. Nabua. Current Trends in Chemistry Education and Challenges. https://www.researchgate.net/publication/355900804_Current_Trends_in_Chemistry_Education_and_Challenges.

2. Vania Zuin, Liliana Mammino. Trends in Chemistry Education, Published by The Royal Society of Chemistry. https://www.researchgate.net/publication/277816085_Education_for_Sustainable_Development_and_Chemistry_Education.