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A scientific Essay-Metathesis

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Title

Conservative evolution and industrial metabolism in Green Chemistry

Green Chemistry is defined as invention, design, development and application of chemical products and processes to reduce or to eliminate the use and generation of substances hazardous to human health and environment.1 The green chemistry revolution is providing an enormous number of challenges to those who practice chemistry in industry, education and research. With these challenges however, there are an equal number of opportunities to discover and apply new chemistry, to improve the economics of chemical manufacturing and to enhance the much-tarnished image of chemistry. Green chemistry is a philosophy and study of the design of products or substance.es that will not involve materials harmful to the environment. The ideal scenario is to virtually stop pollution before it can even begin through the use of non pollutants. Green chemistry is a relatively new area of chemistry that emerged by the need to reduce the hazardous effect of chemicals and to reduce the amount of environmental pollution that chemicals have. All these will be discussed in this article[(1,2)]

History

Green chemistry emerged from a variety of existing ideas and research efforts (such as atom economy and catalysis) in the period leading up to the 1990s, in the context of increasing attention to problems of chemical pollution and resource depletion. The development of green chemistry in Europe and the United States was linked to a shift in environmental problem-solving strategies: a movement from command and control regulation and mandated reduction of industrial emissions at the "end of the pipe," toward the active prevention of pollution through the innovative design of production technologies themselves. The set of concepts now recognized as green chemistry coalesced in the mid- to late-1990s, along with broader adoption of the term (which prevailed over competing terms such as "clean" and "sustainable" chemistry).([3)(4])

In the United States, the Environmental Protection Agency played a significant early role in fostering green chemistry through its pollution prevention programs, funding, and professional coordination. At the same time in the United Kingdom, researchers at the University of York contributed to the establishment of the Green Chemistry Network within the Royal Society of Chemistry, and the launch of the journal Green Chemistry.

Green solvents

Solvents are consumed in large quantities in many chemical syntheses as well as for cleaning and degreasing. Traditional solvents are often toxic or are chlorinated.

Green solvents, on the other hand, are generally derived from renewable resources and biodegrade to innocuous, often a naturally occurring product.([5)(6])

Synthetic techniques

Novel or enhanced synthetic techniques can often provide improved environmental performance or enable better adherence to the principles of green chemistry. For example, the 2005 Nobel Prize for Chemistry was awarded, to Yves Chauvin, Robert H. Grubbs and Richard R. Schrock, for the development of the metathesis method in organic synthesis, with explicit reference to its contribution to green chemistry and "smarter production."[(7)] A 2005 review identified three key developments in green chemistry in the field of organic synthesis: use of supercritical carbon dioxide as green solvent, aqueous hydrogen peroxide for clean oxidations and the use of hydrogen in asymmetric synthesis.[(8)] Some further examples of applied green chemistry are supercritical water oxidation, on water reactions, and dry media reactions.[citation needed]

Bioengineering is also seen as a promising technique for achieving green chemistry goals. A number of important process chemicals can be synthesized in engineered organisms, such as shikimate, a Tamiflu precursor which is fermented by Roche in bacteria. Click chemistry is often cited [citation needed] as a style of chemical synthesis that is consistent with the goals of green chemistry. The concept of 'green pharmacy' has recently been articulated based on similar principles .[(8)]

The evolution of Green Chemistry, as a collection of guiding concepts, can be considered as one of the first responses for these purposes, focusing on materials and processes that could operate in harmony with Nature and minimize their risk on the environment.[(9),(10)] Although it is indeed hard to apply all of the principles of Green Chemistry together at the same time, the more of them that result in the realization of alternative processes, the more that environmentally benign processes can be realized.9 As an analogy to biological metabolism, that involves the elimination of superfluous substances from an organism, industrial metabolism was born as a concept, and realizes the importance of material and energy integration and the turnover of industrial systems.[(10)] Therefore, a generalization of industrial metabolism is a concept of a circular economy, representing a regenerative system, where resource input and waste and emissions, as well as energy leakage, are minimized by optimizing materials and energy loops.[(11)] The concept of conservative evolution refers to the observation that during the history of the universe only new construction blocks survived, which were based on ones that already existed.[(12)] The

proton, the neutron and the electron appeared very early after the Big Bang and these particles conserved their properties and have been the basic constituents of molecular matter up until the very present. A variety of different molecules was formed and though these can be decomposed under specific conditions, some of them conserved their role over billions of years. The most important groups are amino and nucleic acids, which have been the basic molecular building blocks of living systems for more than three billion years. Water has a specific role in life as a safe and very effective solvent. Thus, the vast majority of biochemical processes take place in an aqueous environment and this has not changed since the first living cell appeared on Earth. Furthermore, cells, though differentiated into dozens of forms, have remained the basic constituents of living systems throughout the history of life. Catalysis plays a fundamental role in the efficient transformation of molecules and energy production in living organisms. Life has evolved through the harmonious utilization of renewable resources and treatment of waste. Lots of further examples can be given for the manifestation of conservative evolution. Consequently, the adaption of these fundamental observations could lead to the establishment of greener and cleaner chemical processes. Herein, we call attention to the chemical substances and processes that play a key role in the twelve principles of Green Chemistry representing conservative evolution and/or industrial metabolism .[8] Our examples primarily refer to the work of Professor István T. Horváth, whose contribution to this field is spectacular.

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