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Green Nanovision for Environment Protection

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Abstract: *This review paper presents a view of the past, present and future of green nanotechnology which affects the human life as the novel properties of nanomaterials investigated using green chemistry would play an important role in future. Further the size reduction to nanometer range would play an important role in all aspects as everyday life will get affected and would require changes in experimentation, risk assessment and application of nanotechnology.*

Key Words*: Nanotechnology, Green chemistry, Green nanotechnology.*

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I. Introduction

Every year industry all around the world generates billions of tons of waste that creates potential risks to human health and the environment. Also, waste generation comes with a high price tag. Managing wastes costs hundreds of billions of dollars annually; and these costs are mushrooming as regulatory measures increase in numbers, in the world. As industry continues to expand and permissible exposure limits to atmosphere and surroundings continue to decrease, waste treatment and the associated risks with waste management strategies are becoming less cost efficient and more difficult to handle. This general trend observed over time is to reduce emission limits along with increased industrial growth.

II. What is Nanotechnology?

The study and control of matter in the dimensions 1 to 100 nanometers is nanotechnology. In this range, matter takes on new and interesting properties - for instance, while bulk metals are not very chemically active, electrical conductivity and magnetism can potentially be tuned by changing size and shape of nanoparticles.

III. Principles of Green Chemistry

Green chemistry is the design of chemical products and processes that reduce or eliminate the use and generation of hazardous substance. It seeks human attention to drop the pollution rate by preventing waste, designing safer chemicals and products, designing less hazardous chemical synthesis, maximizing the incorporation of raw materials, using renewable feedstock, using catalysts not the stochiometric reagents, avoiding chemical derivatives, maximizing atom economy, using safer solvents and reaction conditions, designing chemicals and products to degrade after use, analyzing in real time to prevent pollution, minimizing the potential for accidents and increasing energy efficiency.

IV. Green Chemistry around us

The US EPA and the ACS Green Chemistry Institute have played a major role in promoting research and education in pollution prevention and the reduction of toxins over the past three decades. Governments and scientific communities throughout the world recognize that the practice of green chemistry and engineering not only leads to a cleaner and more sustainable earth, but also is economically beneficial with many positive social impacts. These benefits encourage businesses and governments to support the development of sustainable products and processes. The United States, desiring towards future and celebrating significant achievements in Green Chemistry, has given out an annual award since 1996, the Presidential Green Chemistry Challenge Award. Numerous examples of green chemistry illustrate how green chemistry impacts wide array of fields, from pharmaceuticals to house wares, and offer a pathway to a better world.

V. Principles of Green Engineering

Green engineering is the development and commercialization of engineering industrial processes that are economically and financially feasible and reduce the risk to human health and the surrounding environment. Green engineering likewise, create engineering solutions beyond current or dominant technologies; improve, innovate and invent technologies to achieve sustainability, processes and products holistically, use systems analysis and integrate environmental impact assessment tools, conserve and improve natural ecosystems while

protecting human health and well-being, use life cycle of thinking of engineering activities, minimize depletion of natural resources, strive to prevent waste, develop and apply engineering solutions while being cognizant of local geography, aspirations and cultures, actively engage communities and stakeholders in development of engineering solutions and ensure that all material and energy inputs and outputs of the processes are as inherently safe and not dangerous to health as far as possible.

VI. Green Engineering around us

There are lot many examples of green engineering all around. Whether it's a Nissan LEAF electric car, a new downtown office tower built to Leadership in Energy and Environmental Design LEED standard, or biodegradable cups from the local coffee shop, green engineering has become a part of our daily lives. As a good engineer knows, before start building, the need of a solid plan: when it comes to green engineering, the people who design products start with a set of basic principles to govern how they perform their work.

VII. What is Green Nanotechnology?

Green chemistry/ engineering might seem like an odd mate for nanotechnology, but in fact both respect and see to emulate natural processes. A growing number of researchers are merging green chemistry and green engineering with nanotechnology, the challenges and opportunities are explored, the fusion emerged and is best known as green nanotechnology.

VIII. Risk Assessment Software Tools

Risk assessment considers the extent of harm a chemical and its uses pose to human health and the environment mathematically, it is a function of hazards and exposures. Traditional pollution prevention techniques focus on reducing waste as much as possible however, risk assessment methods used in pollution prevention can help quantify the degree of environment impact for individual chemicals. With this approach, engineers intelligently design processes and products by focusing on the most beneficial methods to minimize risk. Risk assessment software tools are available to academia and industry through a Pollution Prevention Tools Suite, which includes a compilation of risk assessment tools as well as methods and models to assess releases and exposures in the work place, recommended by Environmental Protection Agency (EPA). All these tools can assist engineers in the prioritization, design and selection of "greener" processes and products.

IX. From Research to Practical use

The green approach relies on Life Cycle Assessment (LCA), a way of examining the impacts that a particular product has on the environment. This approach requires, rather takes into account that the engineer consider the product's manufacture, it's use over many years and it's ultimate decomposition. Ideally, LCA examine each step in the product's life span for opportunities to make better choices for environment.

In 2005, the Noble Prize in chemistry was awarded for the discovery of a catalytic chemical process called- metathesis- it significantly reduces energy and greenhouse gas emissions for many key processes in chemical industry. Woodrow Wilson International Centre for Scholars, Washington, DC launched a program in 2006 to aware and encourage replacement of existing products. In 2012, Elevance Renewable Sciences won Presidential Green Chemistry Challenge Award by using metathesis to breakdown natural oils and recombine the fragments into high- performance chemicals for many uses, such as highly concentrated cold- water detergents that provide better cleaning. Green chemists and engineers are continuously taking their research and innovations out of the lab and into the board room through the creation of viable industrial products.

X. Today and the Future

Despite all of the research advancements in green chemistry and green engineering, mainstream chemical business have not yet fully embraced the technology. More than 98% of all organic chemicals are still derived from petroleum. The number nanoproducts continue to grow. Although the idea of commercialization of green nanotechnology is in its early stage. But the opportunities for pollution prevention are tremendous. Need of more people- and planet- friendly clean / green techniques, advocating the use of nanoproducts and spreading their awareness could help in transporting the idea of GREEN NANO VISION.

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