# Case Studies in Green Chemistry: Successful Industrial Applications

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## Introduction

Green chemistry, a vital approach to sustainable development in the chemical industry, has led to numerous successful industrial applications. By implementing the principles of green chemistry, companies have been able to innovate processes, reduce waste, and create safer products. Here, we explore several case studies that highlight the successful adoption of green chemistry in industry. IKEA, the global home furnishings giant, has made significant strides in integrating green chemistry into its product design and manufacturing processes. One notable example is IKEA's use of renewable raw materials, particularly in the production of its particleboard. Traditionally, particleboard production involves formaldehyde-based resins, which can release harmful volatile organic compounds (VOCs). IKEA replaced these resins with bio based adhesives derived from plant materials, significantly reducing the VOC emissions. This change not only improved indoor air quality for consumers but also lessened the environmental impact of IKEA's manufacturing processes. This shift aligns with the green chemistry principle of using renewable feedstock's and designing for degradation, ensuring the materials used are sustainable and have a lower environmental footprint.

## Description

DuPont, a leader in science and technology, developed a ground-breaking method for producing 1,3-propanediol (Bio-PDO) using a renewable biological process instead of the traditional petrochemical route. Bio-PDO is a key ingredient in the production of various polymers and resins. DuPont's method uses corn sugar as a feedstock and a specially engineered microorganism to convert it into Bio-PDO through fermentation [1,2]. This process not only reduces reliance on non-renewable petroleum but also cuts down greenhouse gas emissions by over 40% compared to conventional methods. Additionally, the bio-based process generates fewer hazardous by-products, aligning with several green chemistry principles, including the use of renewable feedstock's, energy efficiency, and the reduction of hazardous substances. Pfizer, a leading pharmaceutical company, has integrated green chemistry principles into its drug development and manufacturing processes. A prime example is the synthesis of sildenafil citrate, the active ingredient in Viagra. Originally, the manufacturing process for sildenafil citrate was complex and generated significant amounts of hazardous waste. Pfizer re-engineered the synthesis pathway to be more efficient, reducing the number of steps involved and eliminating the need for several toxic solvents and reagents. The new process not only improved yield but also decreased waste by over 80%, demonstrating how green chemistry can enhance efficiency while minimizing environmental impact. Dow Chemical has made significant advances in the development of eco-friendly plasticizers for use in flexible PVC applications. Traditional plasticizers, such as phthalates, have raised health and environmental concerns due to their potential toxicity and persistence in the environment. In response, Dow developed DOW ECOLIBRIUM™ bio-based plasticizers, derived from renewable plant-based feedstock's. These plasticizers offer comparable performance to traditional phthalates while significantly reducing environmental impact. They comply with stringent regulatory standards and have been widely adopted in products ranging from flooring to wire and cable insulation. This innovation showcases the successful application of green chemistry principles, including the use of renewable resources and the design of safer chemicals. Novozymes, a biotechnology company specializing in enzyme production, has leveraged green chemistry to revolutionize the detergent industry. Traditional detergents rely on harsh chemicals to achieve cleaning efficacy, which can be detrimental to the environment and human health [3,4].

## Conclusion

Novozymes developed enzyme-based detergents that use natural catalytic proteins to break down stains and soils at lower temperatures. This not only reduces the energy required for laundering but also minimizes the release of harmful chemicals into wastewater systems. Enzyme-based detergents are biodegradable and safe for aquatic life, aligning with green chemistry principles of designing for degradation and enhancing energy efficiency. These case studies illustrate the tangible benefits and successful outcomes of applying green chemistry principles in industrial settings. Companies like IKEA, DuPont, Pfizer, Dow Chemical, and Novozymes have demonstrated that sustainable practices can lead to innovation, cost savings, and improved environmental and health outcomes. By continuing to adopt and refine green chemistry approaches, the chemical industry can play a pivotal role in promoting sustainability and protecting our planet for future generations.

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## Conflict of Interest

We have no conflict of interests to disclose and the manuscript has been read and approved by all named authors.

## References

1. L. Buglioni, F. Raymenants, D.A. Stefan Zondag, A. Noël. Technological innovations in photochemistry for organic synthesis: Flow chemistry, high-throughput experimentation, scale-up, and photoelectrochemistry. Chem Rev 122(2):2752-2906. 2022.
2. A. Nagaki, N. Takabayashi, Y. Moriwaki, J. Flash chemistry: Fast chemical synthesis by using microreactors. Chemistry 18(38):11871-11875. 2012.
3. H. Kim, K. Min, K. Inoue, D. Im, J. Kim. Yoshida, Submillisecond organic synthesis: Outpacing fries rearrangement through microfluidic rapid mixing. Science 352(6286):691-694. 2016.
4. H. Cheng, T. Yang, M. Edwards, S. Tang, S. Xu. Picomole-scale transition metal electrocatalysis screening platform for discovery of mild C-C coupling and C-H arylation through in situ anodically generated cationic Pd. J Am Chem Soc 144(3):1306-1312. 2022.