ADVONEX INTERNATIONAL

and Green Chemistry Principles

Prevention It is better to prevent waste than to treat or clean up waste after it has been created.	• **The Advonex process uses catalytic chemistry that targets selective segments of the feedstock molecules. This minimizes the production of by-products.**
Atom Economy Synthetic methods should be designed to maximize the incorporation of all materials used in the process into the final product.	• **The selectivity of our process technology enables us to incorporate 84+ percent of the feedstock material into finished products.**
Less Hazardous Chemical Syntheses Wherever practicable, synthetic methods should be designed to use and generate substances that possess little or no toxicity to human health and the environment.	• **Our process eliminates the need for harsh or toxic chemicals or reagents.**
Designing Safer Chemicals Chemical products should be designed to affect their desired function while minimizing their toxicity.	• **Our products are hydrocarbons derived from biologically-sourced materials which do not contain the impurities and contamination that crude oil contains.**
Safer Solvents and Auxiliaries The use of auxiliary substances (e.g., solvents, separation agents, etc.) should be made unnecessary wherever possible and innocuous when used.	• **Use methanol, which is safer than many other solvents (i. e. hexane)** • **No auxiliaries are used in our process**
Design for Energy Efficiency Energy requirements of chemical processes should be recognized for their environmental and economic impacts and should be minimized. If possible, synthetic methods should be conducted at ambient temperature and pressure.	• **Electrolysis is a highly selective process** • **Our innovation focuses on reducing electrical energy use** • **Hydrocarbon production occurs at close to ambient temperature and pressure**
Use of Renewable Feedstocks A raw material or feedstock should be renewable rather than depleting whenever technically and economically practicable.	• **Primary feedstock comes from sustainably-grown plants** • **Process electricity can be sourced from wind or solar farms** • **Hydrogen can be source from renewable source**

Reduce Derivatives Unnecessary derivatization (use of blocking groups, protection/deprotection, temporary modification of physical/chemical processes) should be minimized or avoided if possible, because such steps require additional reagents and can generate waste.	• **No derivatives are used in our process**
Catalysis Catalytic reagents (as selective as possible) are superior to stoichiometric reagents.	• **Advonex uses only catalytic reagents**
Design for Degradation Chemical products should be designed so that at the end of their function they break down into innocuous degradation products and do not persist in the environment.	• **Our products are designed to match industry standards for environmental degradation**
Real-time analysis for Pollution Prevention Analytical methodologies need to be further developed to allow for real-time, in-process monitoring and control prior to the formation of hazardous substances.	• **Automation and environmental monitoring will be standard practice for our production facilities.**
Inherently Safer Chemistry for Accident Prevention Substances and the form of a substance used in a chemical process should be chosen to minimize the potential for chemical accidents, including releases, explosions, and fires.	• **Our processes use steam, and alcohol in self-contained, oxygen-free environments to minimize chemical spill, explosion and/or fire potential.**