

The EnduroSOLV Solution

Responsible Water Treatment

Manufactured By AP Tech Group, Inc. www.aptechgroup.com

Twelve Principles of Green Chemistry*

1. **Prevent waste:** Design chemical syntheses to prevent waste, leaving no waste to treat or clean up.

All EnduroSolv products are designed to be used in their entirety, with the distinctive Green container being recyclable as well as the carton in which it arrived.

No fillers, or other product modifiers, are added to our products.

The manufacturing process produces no byproduct, and only rinse water is used to clean the production equipment.

In the case of sticks products (STX) which are frequently used in start-up, lay-up, or catch-up situations; the product is packaged in water soluble bags and requires no operator contact with the product.

2. **Design safer chemicals and products:** Design chemical products to be fully effective, yet have little or no toxicity.

EnduroSolv products use state-of-the art chemical technology to provide the same, or better, scale prevention, corrosion protection, microbial control, and fouling minimization found in liquid equivalents.

Using EnduroSolv products will allow the facility to maximize energy, waste, and chemical dollar savings, while minimizing impact to the environment, employees, and customers of the facility.

EnduroSolv products are designed to provide the following safety benefits:

No liquid storage of hazardous chemicals, eliminating the risk and liability issues associated with the same.

No potential for chemical contact with the employees, and customers of the facility.

No noxious odors, as may be experienced from liquid chemicals.

No disposal issues. The design allows for 100% use of the products. When the product is completely used, the container can be recycled.

No triple rinsing or potential for unwanted disposal of toxic products into the waste stream.

3. **Design less hazardous chemical syntheses:** Design syntheses to use and generate substances with little or no toxicity to humans and the environment.

No acids and minimal caustics are added during the manufacturing process. In most liquid water treatment chemicals, substantial amounts of hazardous caustic are required to be added to maintain solubility of the components. EnduroSolv products do not require this addition.

4. **Use renewable feedstocks:** Use raw materials and feedstocks that are renewable rather than depleting. Renewable feedstocks are often made from agricultural products or are the wastes of other processes; depleting feedstocks are made from fossil fuels (petroleum, natural gas, or coal) or are mined.

EnduroSolv is packaged in renewable containers, including the shipping cartons.

5. **Use catalysts, not stoichiometric reagents:** Minimize waste by using catalytic reactions. Catalysts are used in small amounts and can carry out a single reaction many times. They are preferable to stoichiometric reagents, which are used in excess and work only once.

During the manufacturing process, there are no stoichiometric reagents used. The only catalysts required are heat and cooling during the process. No waste is produced in the process.

6. **Avoid chemical derivatives:** Avoid using blocking or protecting groups or any temporary modifications if possible. Derivatives use additional reagents and generate waste.

Production of the EnduroSolv products does not require the addition of binders, or supplemental caustics to enhance solubility of the product.

7. **Maximize atom economy:** Design syntheses so that the final product contains the maximum proportion of the starting materials. There should be few, if any, wasted atoms.

By not using binders or solubility enhancers in the production process, all of the raw materials added are utilized and no by products or other forms of waste are produced in production or at the point of application.

8. **Use safer solvents and reaction conditions:** Avoid using solvents, separation agents, or other auxiliary chemicals. If these chemicals are necessary, use innocuous chemicals.

No solvents or other auxiliary chemicals, such as acids and/or caustics are used in the production of EnduroSolv products.

9. **Increase energy efficiency:** Run chemical reactions at ambient temperature and pressure whenever possible.

EnduroSolv products are designed to be utilized at ambient temperatures, including normal "tap" water temperatures for the dissolving action. Dissolving pressures are regulated and controlled through the feeder, using normal city water pressures.

10. **Design chemicals and products to degrade after use:** Design chemical products to break down to innocuous substances after use so that they do not accumulate in the environment.

Most of the components utilized in the EnduroSolv products are biodegradable.

11. **Analyze in real time to prevent pollution:** Include in-process real-time monitoring and control during syntheses to minimize or eliminate the formation of byproducts.

EnduroSolv products are designed to be tested and controlled using the same test kits, controls, and feed activation systems as those used in feeding and controlling liquid chemicals.

On line monitoring of system cycles, feed activated by demand, and other types of feed and control are the same as between those utilized with liquid chemicals.

Because of the lower solution strengths required, overfeed or underfeed of the products is seldom an issue when proper delivery techniques are applied as outlined with the products.

12. **Minimize the potential for accidents:** Design chemicals and their forms (solid, liquid, or gas) to minimize the potential for chemical accidents including explosions, fires, and releases to the environment.

EnduroSolv products are among the safest chemicals to be designed and available for use in facilities operations. In addition to those items already mentioned there are also other benefits of using “solid” water chemistry.

A case of EnduroSolv products, weighing less than 50 lbs., will deliver as much active chemicals as 30-100 gallons of a liquid (depending on the manufacturers’ solution strength). A 55 gallon drum typically weighs over 500 lbs. If all of the current liquid water treatment products were replaced with EnduroSolv solid water treatment products, the carbon footprint would be the equivalent of removing 31,000 automobiles from US highways – each, and every year.

In addition to reducing the carbon footprint, our roadways and waterways would be safer from the potential of hazardous chemical spills during transportation of the products.

Employee safety is another consideration. In many facilities, a “small” 5 gallon container of liquid chemicals is transported throughout the facility to apply small make-up amounts at the point of application. These containers typically weigh 45-50 lbs which is not an easy weight to manage. The potential for back injuries is significant, when measured against transporting the EnduroSolv solid sticks products that weigh 1 lb. or less, and have no potential for spillage.

*Originally published by Paul Anastas and John Warner in **Green Chemistry: Theory and Practice** (Oxford University Press: New York, 1998)

