



GREEN CHEMISTRY
AN INTRODUCTION



The assurance of process efficiencies,
and the guarantee of a cleaner world.



Principles of 'Green Chemistry'

The term green chemistry is defined as: 'the invention, design and application of chemical products and processes that reduce or eliminate the use and generation of hazardous substances'.

There are twelve tenets that form the basis of designing green chemical products and processes.

These are:

- **Prevent waste**
- **Design safer chemicals and products**
- **Design less hazardous chemical syntheses**
- **Use renewable feedstocks**
- **Use catalysts, and not stoichiometric reagents**
- **Avoid chemical derivatives**
- **Maximize atom economy**
- **Use safer solvents and reaction conditions**
- **Increase energy efficiency**
- **Design chemicals and products that degrade after use**
- **Analyze in real time to prevent pollution**
- **Minimize the potential for accidents**

How 'green chemistry' products benefit industry

Savings

- Reduction in regulatory and compliance cost of ETP
- Saving in water consumption

Process

- Increase in plant efficiency
- Reduction of utility cost

Output

- Product differentiation in finished product

Social

- Contribute to community well being
- Successfully showcase 'green efforts'

How green chemicals score over conventional scale and corrosion inhibitors, oxygen scavengers and neutralizers

Conventional treatment

- To inhibit corrosion and scales in the cooling water system, it is zinc, orthophosphates, polyphosphates, phosphonates, nitrates, chromates and low molecular weight polymers that are the main ingredients of treatment programs in wide use for many decades now.
- To inhibit corrosion and scales in boilers, it is chemicals like inorganic phosphates, sodium hydroxide, hydrazine and low molecular weight polymers that have been widely used for tens of years now.

However

- These chemicals are comparatively toxic to the environment
- They are practically non bio-degradable
- They add impurities to effluent
- They keep on accumulating in the environment
- They are not ecological compatible

The 'green chemical' advantage

It is to overcome just such problems, that the concept of 'green chemistry' is being used to design a whole new range of inhibitors, oxygen scavengers and neutralizers that come in-built with manifold advantages:



- Contains no heavy metals
- Eliminates costs of removal of toxic chemical and sludge disposal
- Provides corrosion and scale protection
- Provides more efficient heat transfer
- Conserves water through higher cycles of concentration
- Offers low dosage economy
- Offers simple and easy operator control
- Provides longer retention time period

The case for 'green' biocides

Biocides are typically used in industrial applications to control the growth of micro organisms that, if left unchecked, can cause a variety of problems in process water systems.

Conventional treatment

- There are various conventional forms of biocides that are used to control the growth of bacteria, algae and fungi in industrial cooling systems.

However

- These biocides are highly toxic to humans and aquatic life
- They often persist in the environment, leading to long term damage

The 'green chemical' advantage

It is to address these problems that, leveraging the 'green chemistry' concept, a new and relatively benign class of biocides has been developed with the following characteristics:

- Do not bio accumulate in the environment
- Are inherently biodegradable
- Do not cause problems either to effluent treatment plants or to the environment after discharge into wastewater
- Rapidly break down in the environment through hydrolysis, oxidation, photo degradation and biodegradation
- Do not contain volatile organic compounds

The Thermax range of solutions in 'green chemicals'

For Cooling Water Treatment

- A collection of scale and corrosion inhibitors
- Various types of biocides

For Boiler Water Treatment

- Sludge conditioner
- Scale and corrosion inhibitor for low and medium pressure boilers
- pH booster for low and medium pressure boilers
- Oxygen scavenger for low and medium pressure boilers
- Online scale and corrosion inhibitor
- Oxygen scavengers for high pressure boilers

This entire range of Thermax 'green chemicals' has been developed in compliance with the twelve tenets of 'Green Chemistry'.



Global network: for prompt response



Quality assured manufacturing

Quality is a universally accepted phenomenon. For us, quality is ensuring that customer requirements are not only met, but also surpassed every single time. Besides, we are striving for continuous quality improvement that is in tune with global development. Our ISO 9001 certification is a clear indicator of the quality assurance norms that we follow.



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