GREEN CHEMISTRY

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Brenntag Essentials

BRENNTAG

SAFETY

Pollution Prevention & Waste Minimization

- **Pollution Prevention** – use every resource to keep pollutants within your process. P2 minimizes the release of waste to air, water and land.

- **Waste Minimization** = Reduce the **amount of waste** and/or the **toxicity of waste**

What is Green Chemistry?

The design of chemical products and process that reduce or eliminate the use or generation of hazardous substances. (ACS Green Chemistry Institute)

Life Cycle Assessment (LCA)

Cradle to Grave

“methodology for assessing environmental impacts associated with all the stages of the life cycle of a commercial product, process, or service.” (Wikipedia)

Alter:

- Chemistry
- Biological
- Process

12 Principles of Green Chemistry

1. Prevent Waste
2. Atom Economy
3. Less Hazardous Synthesis
4. Design Safer Chemicals
5. Safer Solvents and Auxiliaries
6. Design for Energy Efficiency
7. Use of Renewable Feedstocks
8. Reduce Derivatives
9. Catalysis (vs. Stoichiometric)
10. Design for Degradation
11. Real-Time Analysis for Pollution Prevention
12. Inherently Safer Chemistry for Accident Prevention

Custom Blends (Principle 1,4)

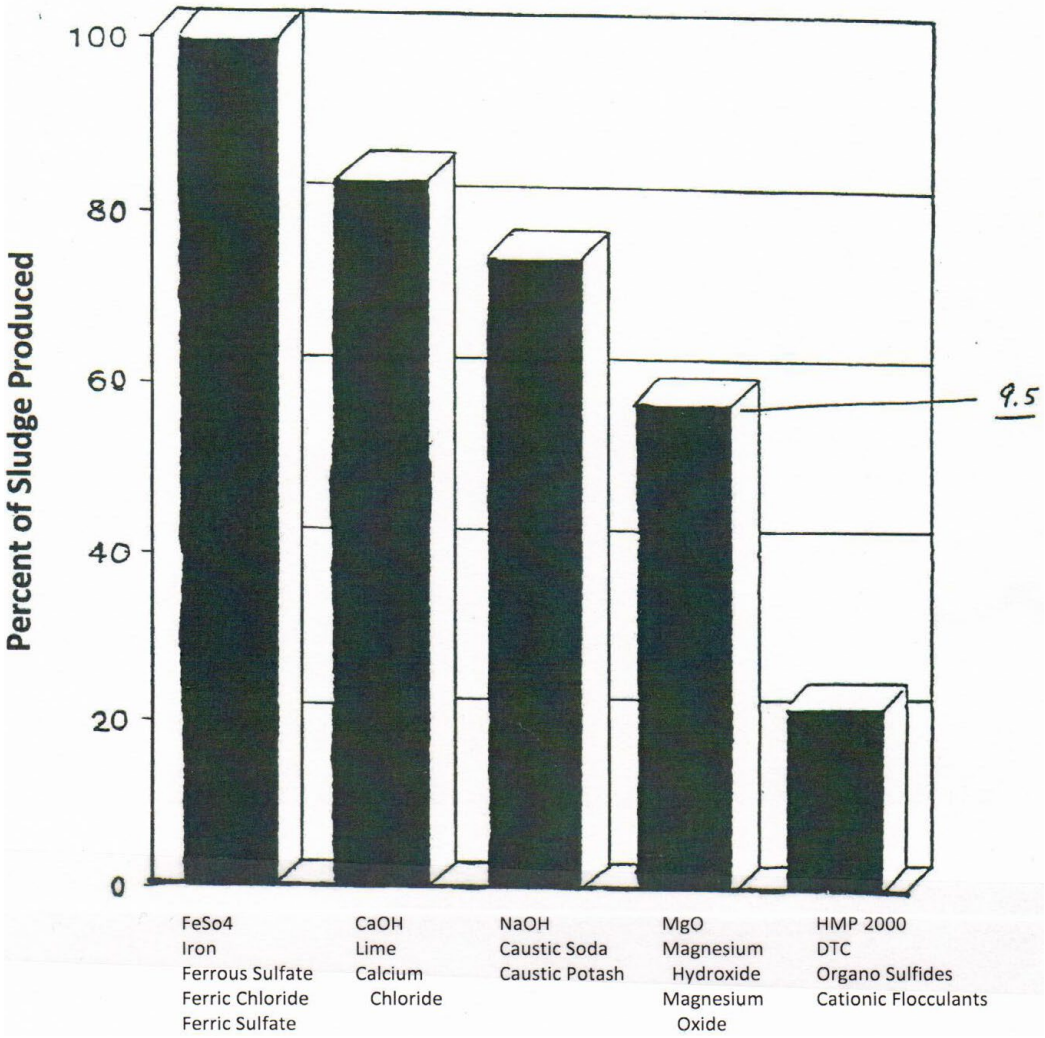
Better for the environment

Reduce contaminants

Lower sludge production

Carbon Reduction

Sludge Volume Comparison Chart



Sustainability (Principle 1,4,6,12)

Environmental

Social

Governance

Brenntag awarded: Platinum 2022 ecovadis

Carbon Reduction
Water Reduction
Pollutant Reduction
Energy Reduction

Green Energy (Principle 6)

Solar Panels on the warehouse/office roof

Solar Panels on roof of covered parking

Wind

Sustainability

- Packaging Recycling
- Circular Products
- Safe Products
- Low-Emission Logistic Solutions
- CO2 Management Services
- Low-Carbon Products

Sustainability in Logistics

Electric vehicles

Biofuels

Warehouse Design

Rainwater Harvesting System

Green Space

Trees

Around 15 Billion trees are felled or destroyed annually

Biocatalysis (Principle 9)

Enzymes to:

Start chemical reactions
Control chemical reactions

Pharmaceuticals

Beer

Wine

Cheese

Wastewater

Enzymes (Principle 4,7,8,9)

Enzymes are the fundamental components of life

Enzymes are no longer single use – improved manufacturing enables the enzyme to be used multiple times & recovered in the process

Bioaugmentation

Nutrient Balance

Process Control

- Reduce – DO
  - Lower Electricity Costs
  - Lower Sludge Production

Product Designations

Generally Recognized as Safe (GRAS)

National Sanitation Foundation (NSF)

Water Quality Association (WQA)

Regulations

U.S. E.P.A.

State Regulations

Clean Water Act

POTW Pretreatment Regulations
NPDES Regulations
Federal Drinking Water Standards
ANSI/NSF
Safe Drinking Water Act

Clean Air Act

NESHAP
Title V

Local Regulations

Sludge Regulations

40 CFR 503
RCRA
Class 1 Biosolids Regulations

*Federal Standards can not be exceeded.
*Local and State regulators have authority to amend regulations that would deliver limits lower than Federal Standards.

Solids Use (Principle 1,9,10)

Biosolids – 40 CFR 503

Disposal:

- Incineration (14%)
- Landfilling (42%)
- Land Application (43%)
- Other (1%)

Class A or B Designation = Pathogen Free!

Comprehensive Environmental Response, Compensation, and Liability Act = CERCLA or Superfund

Terms & Definitions

Green Chemistry

Life Cycle Assessment

Custom Blends

Sustainability

40 CFR 503

Green Energy

Biocatalysis

Enzymes

Questions