Opportunities for Greener Alternatives from a Formulator’s Perspective

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The Next, Next Generation

Kelsey
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The Formulators Roundtable members are committed to creating safe products!
Overview

• The ACS GCI Formulator’s Roundtable
  – Who are we?

• What are the opportunities?
  – Better & more sustainable ingredients

• We seek your collaboration
  – How you can play a role in the ACS GCIFR
ACS-GCI Formulator’s Roundtable Membership Definition

Any corporation, or subsidiary, division or unit thereof, significantly engaged in the formulation of soap, detergents and cleaning preparations and/or perfumes, cosmetics, and other toilet preparations under its own brand names.

This includes all corporations identifying with SIC Industry Group 284.

Annual membership contributions = $1,000 - $10,000 (according to annual sales volume)
Members as of Oct 15, 2010

Combined purchasing power exceeds $1 billion
Mission

To be a driving force in the formulated products industry to use Green Chemistry in creating innovative products that are environmentally sustainable throughout its product life cycle and safer to make and use.
Strategic Priorities

• Promote transparency and consistency through a set of green chemistry principles for formulated products.

• Drive good science in the development of environmentally preferred products standard/certification.

• Inform and influence suppliers and academia to develop greener alternatives.

• Be recognized leaders in Green Chemistry Formulations.

• Incorporate risk-based decision making into green chemistry.
“Green Chemistry” is a Continuous Endeavor

12 Principles of Green Chemistry

1. Prevention
2. Atom Economy
3. Less Hazardous Chemical Syntheses
4. Designing Safer Chemicals
5. Safer Solvents and Auxiliaries
6. Design for Energy Efficiency
7. Use of Renewable Feedstocks
8. Reduce Derivatives
9. Catalysis
10. Design for Degradation
11. Real-time analysis for Pollution Prevention
12. Inherently Safer Chemistry for Accident Prevention


“Green” definition will continuously evolve - is not a destination
Opportunities for Greener Alternatives

- Antimicrobials
- Solvents
- Small Amines
- Chelants & Sequestrants
- Boron Replacements
- Fragrance Raw Materials
- Corrosion Inhibitors
- Alkanolamide Replacements
- Surfactants
- UV Absorbers

Key ingredient categories in formulations identified for improvement
General “Greener” Criteria

• Increased sustainability
• Reduced Toxicity
• Increased biodegradability
• No Bioaccumulation
• Cost Effective
Greener Antimicrobials

- Cleaning and personal care products are constantly challenged by microbes
- Contaminated products can become off odor, lose functionality, and potentially pose a risk to the user

Antimicrobials are designed to kill so a “Greener Alternative” is challenging.
Desirable Characteristics of “Greener” Antimicrobials

- Rapid acting
- Broad Spectrum (gram positive and gram negative bacteria, yeasts and molds)
- Compatible with a wide range of ingredients
- Stable and active over a wide pH - 2.5 to 11.5
- Acceptable odor
- Acceptable color; will not react with colors
- Soluble in product base, water or oil
- Cost effective

Difficult criteria, but certainly a green opportunity
Greener Solvents

- Crucial to formulating
- Unique performance attributes
- Potential environmental concerns (VOC, GWP)
- Adverse health concerns
- Bio-based solvents can reduce bio-diversity
- Bio-based can negatively impact food supplies
Characteristics of Greener Solvents

• Performance to meet current materials
• Renewable source - preferably based on non-food supply
• Reduce carbon footprint and VOC emissions
• Low toxicity; high biodegradability
• Less resource-intensive production
• Minimal odor and color
• Meet US EPA Design for the Environment criteria
• Cost effective
Greener Amine Replacement

Small amines (MEA, DEA, TEA) are used by Home and Personal Care formulators for key benefits:

– Lower pH source of alkalinity.
– Superior stability in high concentration formulas.
– Improved grease removal, corrosion inhibition and film and streak prevention.

Secondary amines can form nitrosamines so a greener alternative is needed.
Characteristics of a “Greener” Small Amine Replacement

- “Organic” alkalinity requiring less water than inorganic counter ions.
- Neutralize anionic surfactants & relatively low pH fatty acids.
- Compatible with a wide range of ingredients.
- Acceptable/minimal odor and color.
- Positive impact on finished product physical properties (reduced viscosity, improved freeze-thaw recovery, freeze point depression) over inorganic alkalinity sources.
- Corrosion protection, grease removal, film prevention.
- Cost effective
Greener Surfactants

• Large Market Potential
  – >$20 Billion Market (Home, Personal and I&I) SRI Consulting

• Renewable Sourcing is a Growing Marketing Desire

Watch for negative impact of biodiversity reduction.
Characteristics of Greener Surfactants

- Biodegradability (readily biodegradable).
- Aquatic toxicity (LC50 >10mg/l).
- Preferably feedstock has no adverse impact on food supply.
- Prefer feedstock will not have a negative impact on eco-diversity.
- Manufacturing processes should be designed considering the 12 Principles of Green Chemistry.
Characteristics of a Greener Chelating Agent

• Reduced toxicity
• Increased biodegradability
• Chelating capacity over a broad pH range
• Reasonable cost

Preferred Metal Chelation Capacity

<table>
<thead>
<tr>
<th>Metal</th>
<th>Part chelant per parts metal (w/w)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ca</td>
<td>16-20</td>
</tr>
<tr>
<td>Mg</td>
<td>25-35</td>
</tr>
<tr>
<td>Fe</td>
<td>10-20</td>
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<tr>
<td>Cu</td>
<td>10-15</td>
</tr>
<tr>
<td>Mn</td>
<td>10-15</td>
</tr>
</tbody>
</table>

L-glutamic acid, MGDA acid and IDS are examples of promising green chelants.
Other Green Ingredient Opportunities

• Boron (builder, buffer & deodorizer)
• Fragrance Raw Materials
• Corrosion Inhibitors
• Alkanolamide (viscosity & foam modifier)
• UV absorbers
Opportunity for Collaboration

• Industry
  – Formulator’s Roundtable
  – Chemical Manufacturer’s Roundtable

• Academia
  – Research Funding

• Government
  – Regulatory Input

• NGO
  – Communication and Cooperation
Contact Information

ACS GCI Formulator’s Roundtable
Website: www.acs.org/gciformulators
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Ideas, suggestions, collaborations are encouraged…
Get in touch whenever you feel inspired!