

GC3 Roundtable

Renewable and Sustainable Esters



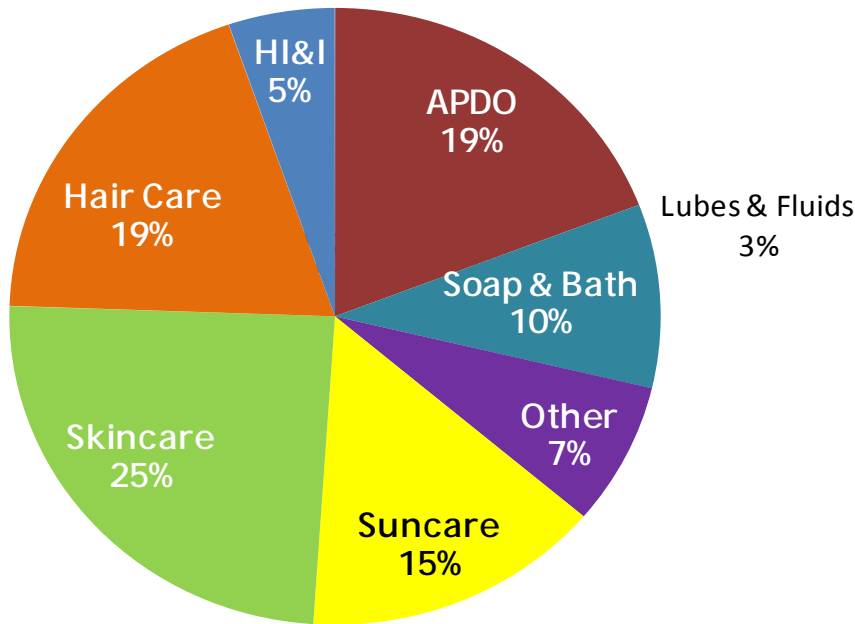
Stephen O'Rourke
Technical Director
Polymer Additives



HALLSTAR COMPANY PROFILE

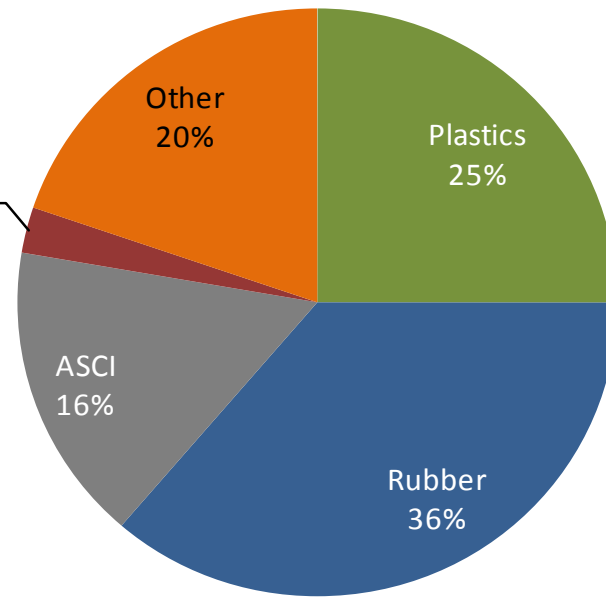
- ✦ Privately held rapidly growing mid-market specialty chemical ingredients supplier
- ✦ Providing customized solutions through innovation and technical expertise
- ✦ Global Facilities:
 - ✦ Headquarters in Chicago
 - ✦ Manufacturing in US and Italy
 - ✦ Sales in Asia, Europe, South America and US
 - ✦ R&D in US and Italy
- ✦ Bring innovative solutions to customers based on our expertise in ester chemistry, polymer science, and photostabilization
- ✦ Core Competencies
 - ✦ Esterification chemistry
 - ✦ Polymer material modification and optimization
 - ✦ Photostabilization sciences
 - ✦ Nature derived solutions
 - ✦ Anti-aging sciences

MARKETS SERVED



43 % of revenue

Lubes & Fluids
3%



57 % of revenue



RENEWABLE ESTERS AND PHTHALATE ALTERNATIVES

- ✦ Several monomeric and polymeric esters based on renewable raw materials have been developed
- ✦ Biopolymer modification-initial development
PLA, PHA, PSM
- ✦ Traditional polymers also can utilize this technology
Thermoplastics and Elastomers
- ✦ Phthalate Alternatives
Synthetic and Renewable

USDA CERTIFIED BIOBASED

✦ The following HallStar products earned the USDA Certified Biobased Product Label:

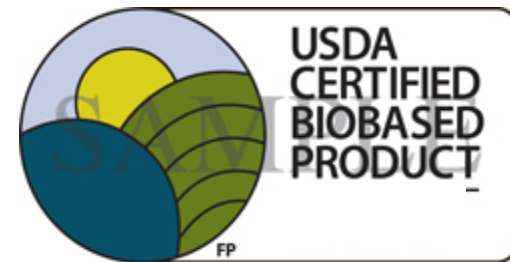
✦ HALLGREEN® R-3020 with 100% biobased content

✦ HALLGREEN® IM-8830 with 38% biobased content

✦ HALLGREEN® R-8010 with 99% biobased content

✦ HALLGREEN® R-9010 with 100% biobased content

✦ PLASTHALL® PR-A610 with 100% biobased content



SHADES OF GREEN

	Phthalate	Adipate	Petro-based Bio-degradable	100% Renewable and Bio-degradable
Rubber				
PVC				
PLA				
PHA				
PHB				

Cost and Performance
Plasthall® PR-series

Bio Polymer - Green Focus
HallGreen® R-series
Renewable
HallGreen® B-series
Bio-degradable

BARRIERS AND OPPORTUNITIES

Barriers

- Pricing-mainly due to available raw materials
- Regulatory-cost of getting TOSCA, FDA, USP, REACH registrations, especially for our size company
- Capacity-infrastructure for phthalates well established globally but minimal capacity for renewable esters
- Lack of viability of a variety renewable raw materials to make polymer grade esters
- Outside EU no other legislative bans or restrictions on phthalate esters

Opportunities

- LEED Green Building Standard-driving wire & cable, adhesives and wall covering compounders to renewable content
- EU directive to discontinue certain phthalates
- Composting and biodegradable plastics