Industry Overview

The Science of Microplastics in the World Ocean - WHOI

Brett Howard

10.18.2019

American Chemistry Council

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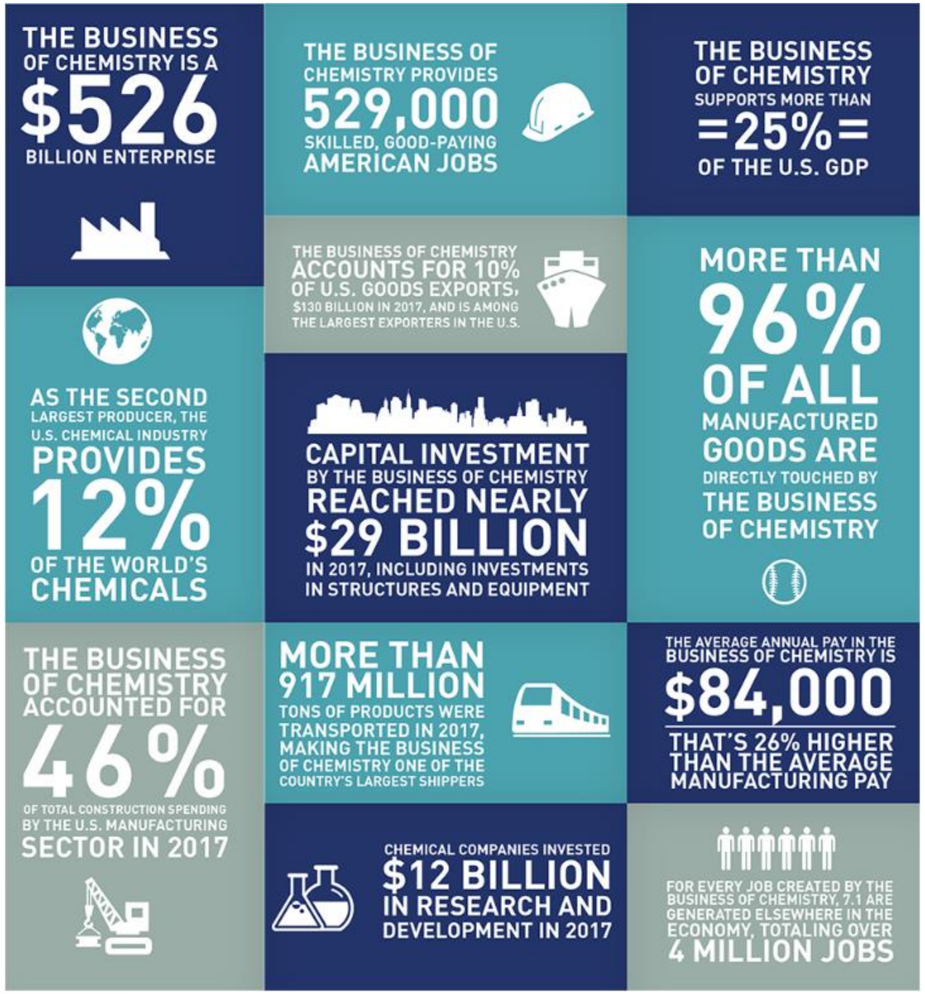
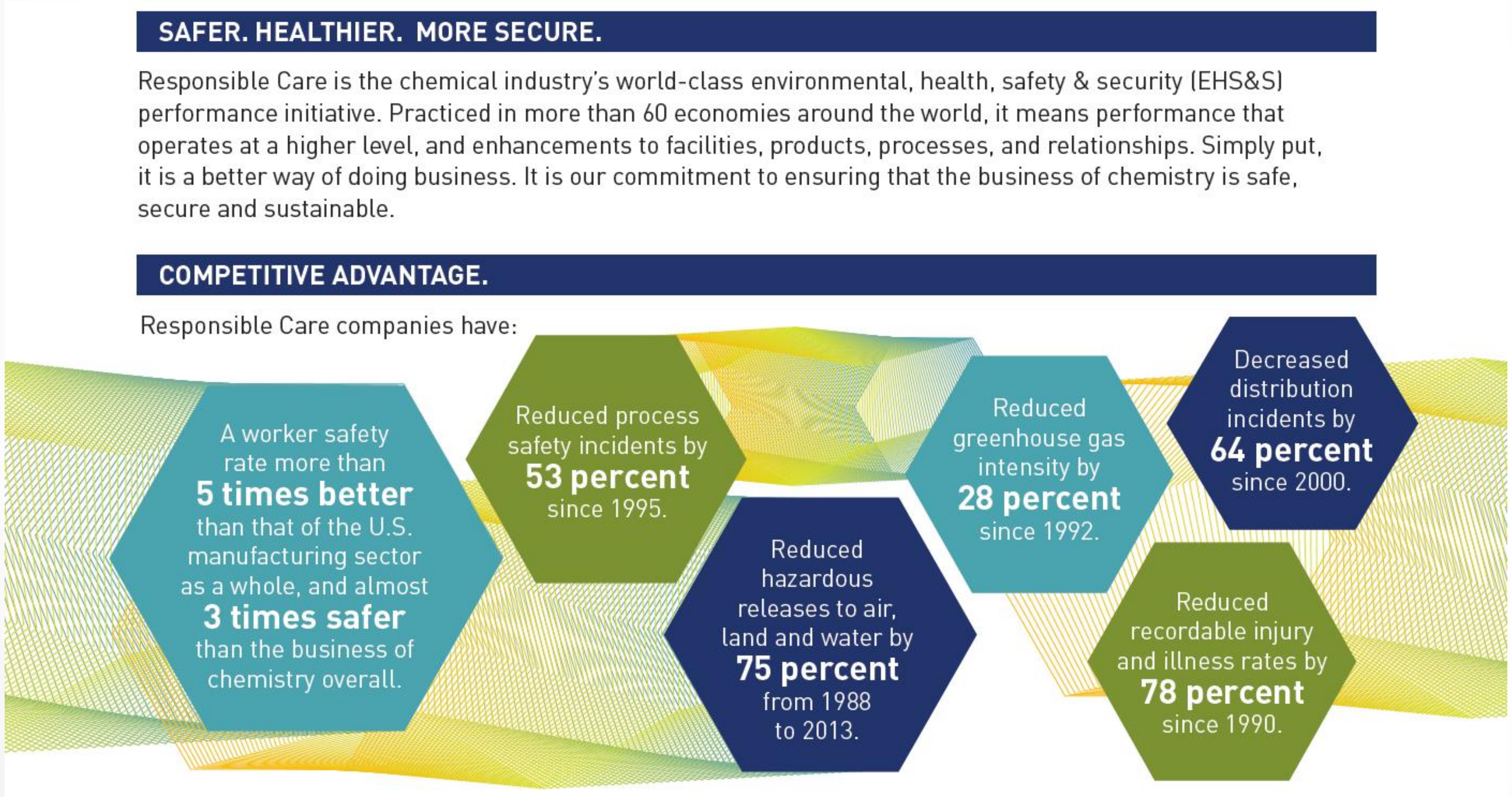
Council

American Chemistry Council



ACC – Responsible Care



SAFER. HEALTHIER. MORE SECURE.

Responsible Care is the chemical industry's world-class environmental, health, safety & security (EHS&S) performance initiative. Practiced in more than 60 economies around the world, it means performance that operates at a higher level, and enhancements to facilities, products, processes, and relationships. Simply put, it is a better way of doing business. It is our commitment to ensuring that the business of chemistry is safe, secure and sustainable.

COMPETITIVE ADVANTAGE.

Responsible Care companies have:

- A worker safety rate more than **5 times better** than that of the U.S. manufacturing sector as a whole, and almost **3 times safer** than the business of chemistry overall.
- Reduced process safety incidents by **53 percent** since 1995.
- Reduced hazardous releases to air, land and water by **75 percent** from 1988 to 2013.
- Reduced greenhouse gas intensity by **28 percent** since 1992.
- Decreased distribution incidents by **64 percent** since 2000.
- Reduced recordable injury and illness rates by **78 percent** since 1990.

ACC - Health Product & Science Policy

Mission

To provide leadership on health and science policy issues of importance to the chemical industry by managing programs which:

•Stimulate balanced discussions on existing and emerging human health and related ecosystem issues;

•Minimize duplicative testing and maximize industry input in the implementation of various government testing initiatives on emerging public health issues

Objectives

•Public policy that is: risk-based, cost-effective and that will safeguard public health and the environment and set public health priorities so that resources are focused on credible risks

•Recognition of industry as a:

- •Responsible corporate citizen, actively engaged in protecting health and the environment
- •Manufacturer of products which have societal benefits

•Enhance relationships with the scientific community


Standards Development

Standards Development

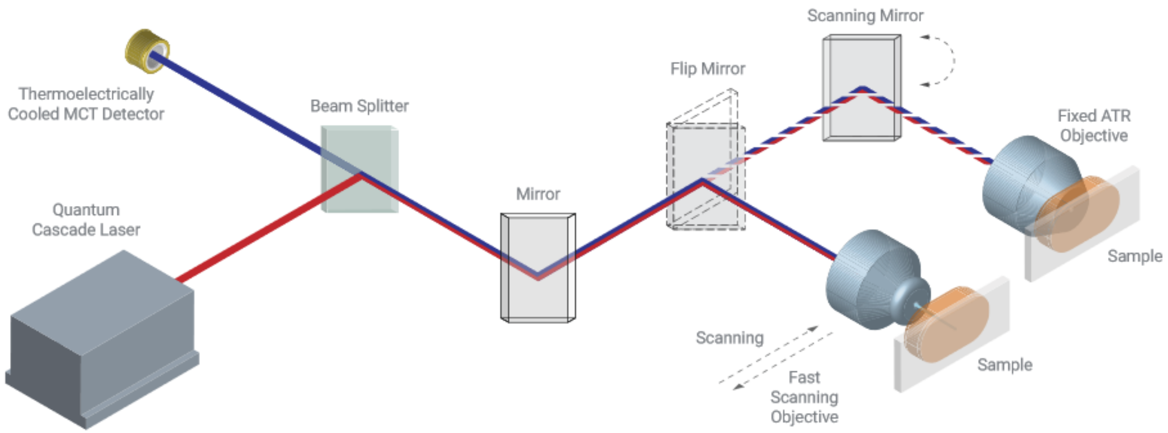
ASTM D19.06	Methods for Analysis for Organic Substances in Water
ASTM D20.61	Biodegradability, biobased plastics, carbon and environmental footprint, microplastics and ocean/terrestrial environments, recycling, waste management, and circular economy

ASTM Standards - D19.06

Group	Standards in Development Name	Title	Status
WW Sampling	ASTM WK67565	Standard Test Method for the Spectroscopic Identification and Quantification of Microplastic Particles in Water Using Raman and IR Spectroscopy	Draft
WW Sampling	ASTM WK67563	Collection of Wastewater Samples for the Identification and Quantification of Microplastic Particle	Draft
WW Sampling	ASTM WK67564	Preparation of Wastewater Samples Allowing the Identification and Quantification of Microplastic Particles using Raman and FTIR Microscopy	Draft
WW Sampling	ASTM WK67788	Identification of Microplastic Particles and fibers in Municipal Wastewater using Pyrolysis-GC/MS	Draft
Fibers	ASTM WK62604	New Test Method for Qualitative and Quantitative Fiber Release of Fabrics - Dry Method	Proposed
Fibers	ASTM D7841 - 13	Standard Practice for Sustainable Laundry Best Management Practices	Active

Analytical Instrumentation

Agilent 8700 Laser Direct Infrared System



- Ability to survey and image large sample areas and then interrogate smaller areas of interest in more detail without changing any optics

Bonner Denton

PROFESSOR, GALILEO CIRCLE FELLOW

DEGREES AND APPOINTMENTS

- B.S. 1967, Lamar State College of Technology
- B.A. 1967, Lamar State College of Technology
- Ph.D. 1972, University of Illinois

Agilent 8700 Laser Direct Infrared System

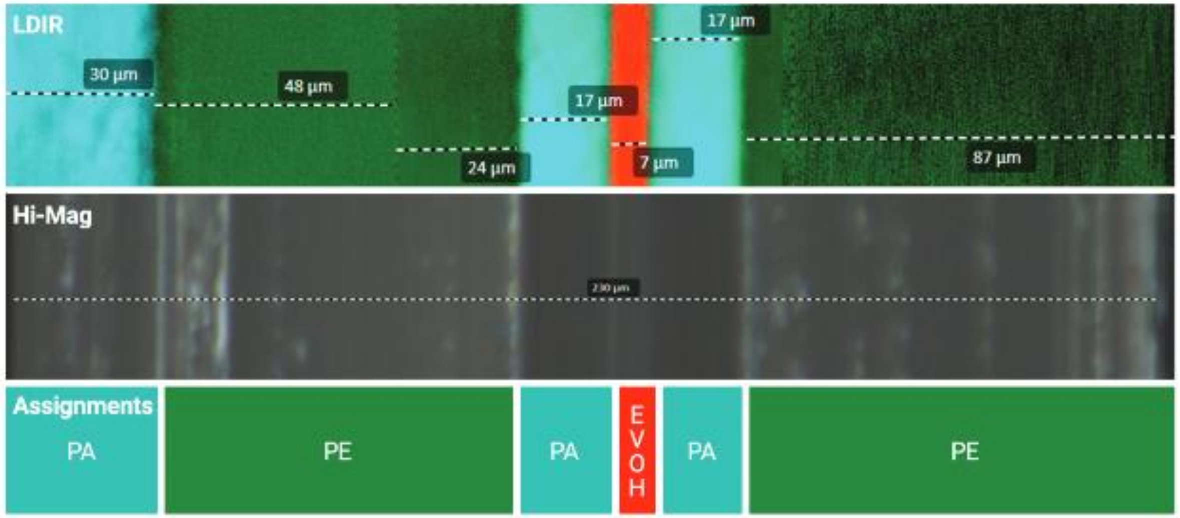


Figure 6. (Top) LDIR chemical image obtained using a multi-peak analysis of the laminate sample showing different layers and thickness. (Middle) High-magnification visible light image of the laminate. (Bottom) Identities of each layer: Polyamide (PA), Polyethylene (PE), and Ethylene Vinyl Alcohol (EVOH).

Plastic Fate

Plastic Fate

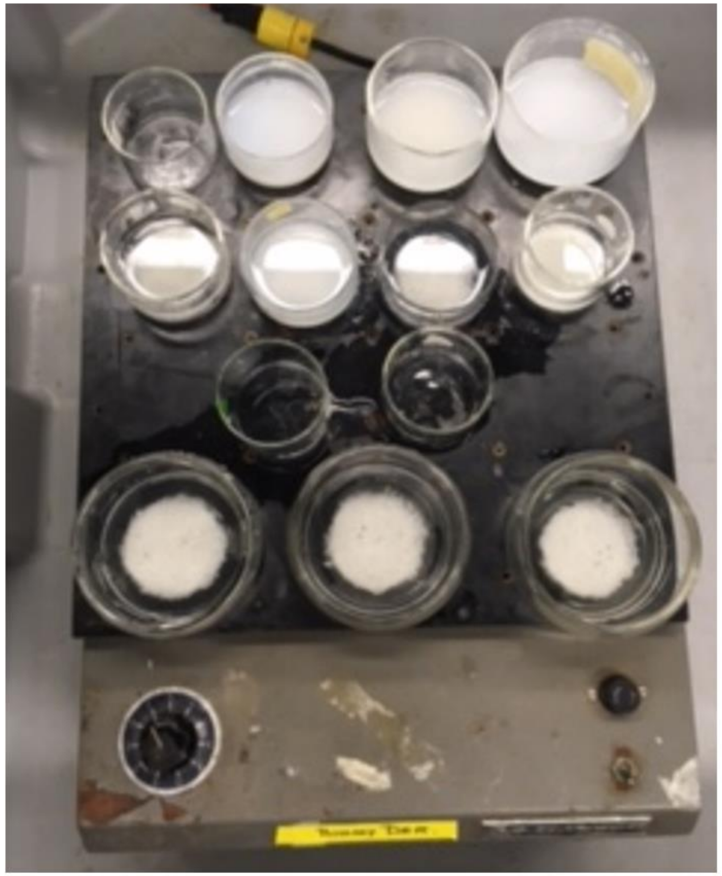


Figure 1. The photograph on the left shows an example experimental setup to simulate the high-energy wave environment in Woods Hole. Natural Vineyard Sound seawater is being incubated in glass dishes using 6 treatments with 3 replicates each. The polymers being tested include PVC, HDPE, PP and PET. The 6 treatments include: (1) UV plus sand plus mechanical agitation; (2) UV alone plus mechanical agitation; (3) no UV plus mechanical agitation; (4) UV plus sand no mechanical agitation; (5) UV alone no mechanical agitation; (6) no UV no mechanical agitation. Note the dishes with a milky appearance have been running for two weeks and PP has broken down from ESD 180 μm to ESD 90 μm. The lid of the box has the UV lights mounted in it such that each dish has its own 80W UVB lamp. Rotation rate is 4 Hz = 240 rpm = shear of ~60,000 s-1.

Plastic Fate

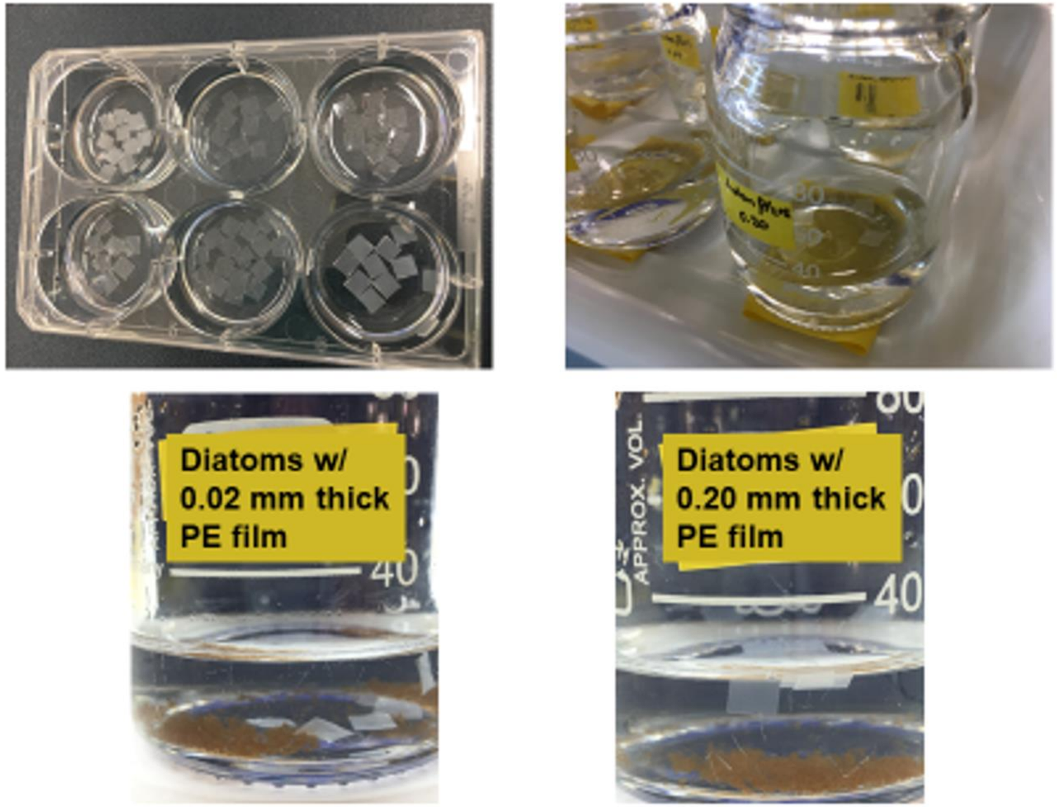
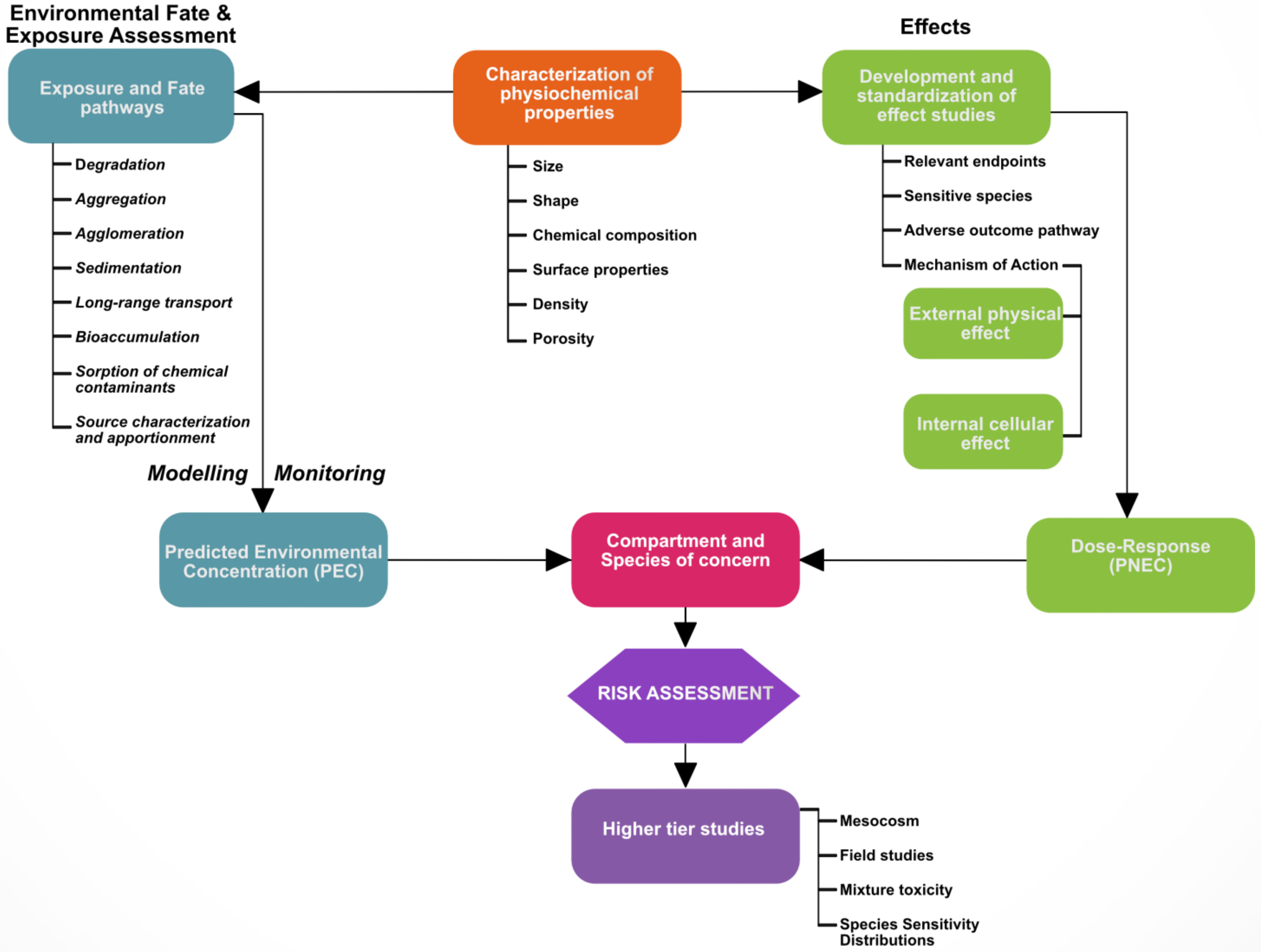


Figure 5. Density Experiment #2. Similar experiment as Experiment #1 but now with 5x5 mm pieces of PE film rather than pellets. Note that both the 0.02 mm thick film became colonized and sank to the bottom of the flask, while the 0.20 mm thick film did not.

Environmental Risk Framework

Environmental Risk Framework



Chemical Recycling

Chemical Recycling

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RECYCLING

Plastic has a problem; is chemical recycling the solution?

Under public pressure, plastics makers are increasingly looking to partner with companies to develop chemical recycling processes

by *Alexander H. Tullo*

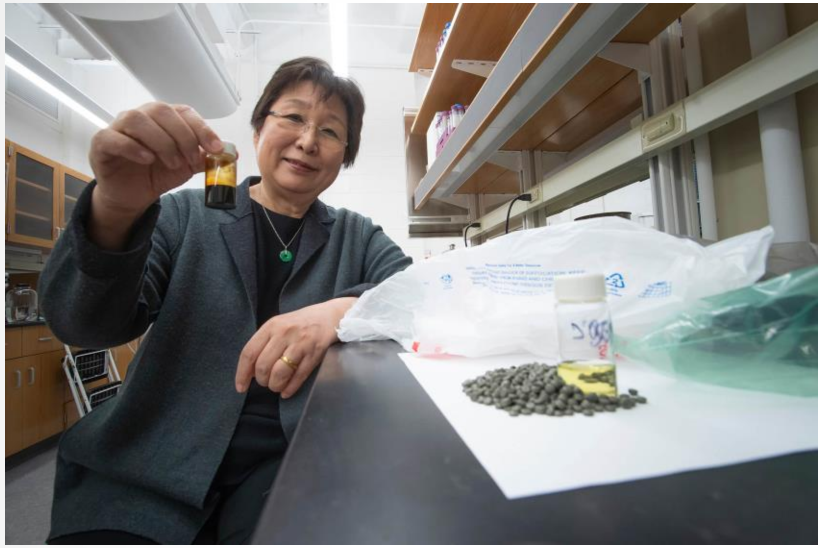
OCTOBER 6, 2019 | APPEARED IN **VOLUME 97, ISSUE 39**

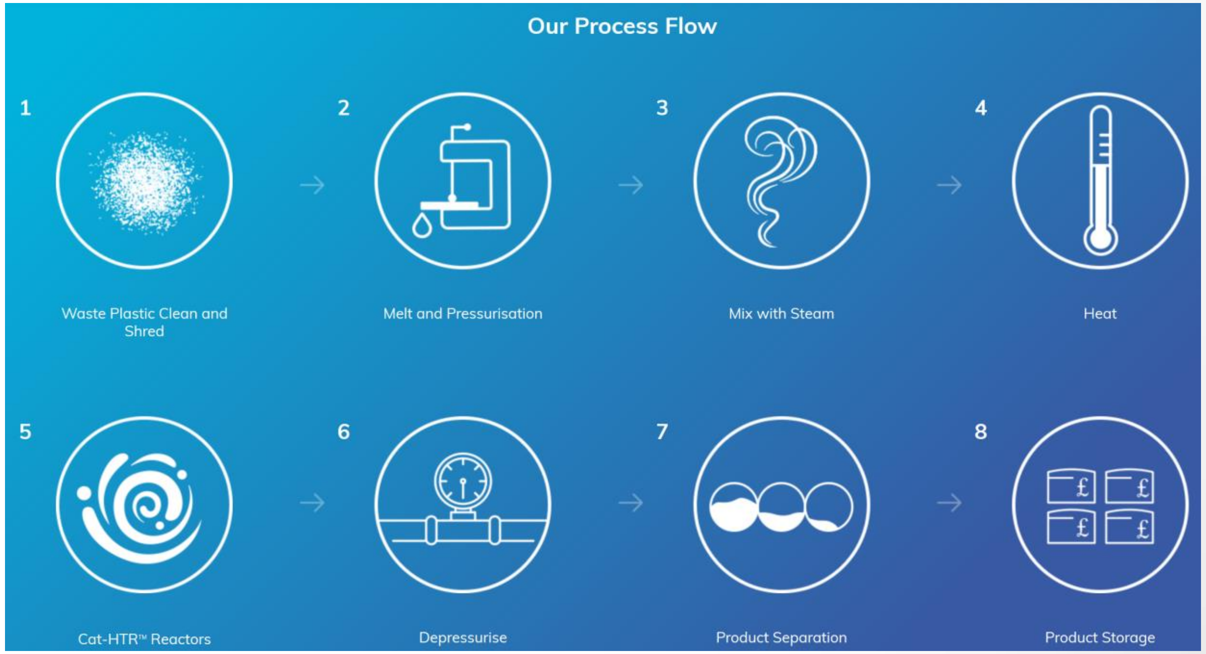
Decomposition of mixed plastics into fuels, including naphtha, via pyrolysis and other processes

COMPANY	HEADQUARTERS
Agile Process Chemicals	Mumbai, India
Agilyx	Tigard, Oregon
Anhui Oursun Resource Technology	Hefei, China
Blest	Kanagawa, Japan
Brightmark Energy	San Francisco
Climax Global Energy	Allendale, South Carolina
EcoFuel Technologies	Livonia, Michigan
Enval	London
Fuenix Ecogy	Weert, Netherlands
Golden Renewable Energy	Yonkers, New York
JBI	Niagara Falls, New York
Jeplan	Tokyo
Klean Industries	Vancouver, British Columbia
New Hope Energy	Tyler, Texas
Nexus Fuels	Atlanta
Plastic Energy	London
PolyCycl	Kalka, India
Recycling Technologies	Swindon, England
ReNew ELP	Redcar, England
Renewlogy	Salt Lake City
Resynergi	Rohnert Park, California
Vadxx	Cleveland

https://cen.acs.org/environment/recycling/Plastic-problem-chemical-recycling-solution/97/i39

Chemical Recycling





Chemical Recycling Alliance

- *Advocating on behalf of technologies that convert post-use plastics to monomers, chemical feedstocks, transportation fuels and other valuable products of advanced plastics recycling and recovery technologies*

Chemical Recycling Alliance
SUSTAINABLE SOLUTIONS FOR PLASTICS

agilyx
BME BRIGHTMARK ENERGY
Golden Renewable Energy
GREENMANTRA TECHNOLOGIES
NEW HOPE ENERGY
RENEWLOGY

AmSty
Sealed Air

Ravago
TETRA TECH

Company Highlight - Agilyx

Overview:

Agilyx uses a Mixed Plastics-to-Crude system to produce lower-carbon crude oil for fuel production and a Polystyrene-to-Styrene Monomer system which produces styrene oil.

Feedstock:

All forms of polystyrene (#6), e.g. coffee cups, block packaging, meat trays, to-go containers, etc.

End-Products:

Styrene oil, naphtha feedstock

Partners:

Delta Airlines/Monroe Energy, Americas Styrenics, INEOS Styrolution

agilyx

Location:

Tigard, Oregon

Technology Type:

Conversion (thermal)

Decomposition (thermal)

Stage of Maturity:

Early commercial

Additional Activities

New: Plastics Division Sustainability Goals

✓ **2040 Goal**

- 100% of plastics packaging is reused, recycled or recovered

✓ **Interim Goal (2030)**

- 100% of plastics packaging is recyclable/recoverable

✓ **Best practice goal**

- 100% of Division’s U.S. manufacturing sites participate in Operation Clean Sweep Blue by 2020, with all North American sites by 2022

Achieving the 2040 Goal

100% of plastic packaging is recycled or recovered by 2040

- Design & Invent new circular business models
- Expand access
- Educate consumers and change behavior
- Invest in new infrastructure and transformational technology
- Create Partnerships with Prominent Orgs and Other Leaders

Policy

Save Our Seas Act

- Signed into law

Supported Microbeads Free Waters Act of 2015

Straw on request

Alliance to End Plastic Waste

FOUR PART STRATEGY

INFRASTRUCTURE

Infrastructure Development to collect and manage plastic waste, and increase recycling in areas of greatest need.

INNOVATION

Innovation to advance and bring to scale new technologies that make recycling and recovering plastics easier and create value from all post-use plastics.

EDUCATION

Education and Engagement of governments, businesses, and communities to mobilize action.

CLEAN UP

Clean Up to help stop plastic waste at its source, focusing on cities and major rivers that carry significant amounts of plastic waste to the ocean.

Questions