

# Microplastics Waste Solution?

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Microplastics Panel

3/28/19



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# Microplastics

- Come from discarded plastics, that did not end up landfilled properly.
- In the land, waterways, and oceans.
- Larger pieces of plastic become degraded by the sun, and broken apart from wind and mechanical interaction.
- Small-micro
- Smaller- nano



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# Overview

- Rutgers proposition- develop profitable businesses to recycle plastics, and generate profits for recyclers.
- History- PET Recycling system developed at RU-CPRR
- Over 4 Million Tons of rigid plastic non-PET bottles (mostly HDPE) per year are disposed of, in USA.
- Plastic lumber with increasingly engineering grade properties has been developed and patented by Rutgers using new thinking and IMPB's.
- What's in the floating ocean microplastics?
- Where does it come from, and why?
- What's a reasonable solution?
- All above= opportunity?



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# Curbside Tailings

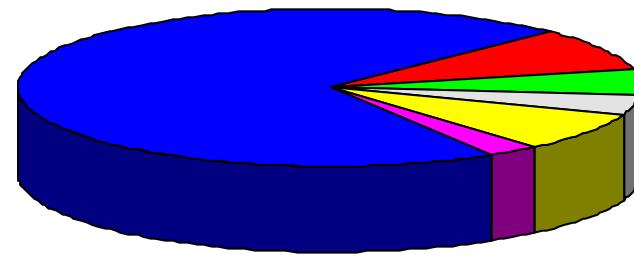


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# TYPICAL COMPOSITION OF CURBSIDE TAILINGS

- HDPE 55 - 75%
- LDPE 5 - 10%
- PP 2 - 7%
- PET 1 - 5%
- PS 2 - 10%
- Misc. 0 - 5%



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# What floats?

- HDPE
- LDPE
- PP
- Foams
- Closed bottles with air
- Disposable lighters
- Ocean plastics roughly the same composition of Curbside Tailings, with a little organic mat'l

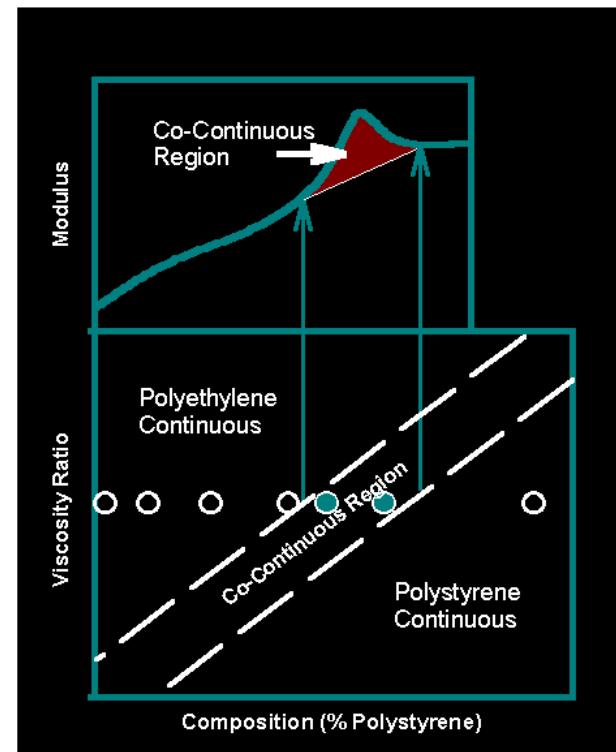


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# PS-PE Blends

- Both Modulus and Strength increase with PS%
- Generally near the law of mixtures line
- Peak in curve at  $\sim 35\%$  PS (co-continuous)
- Efficient Stress Transfer between the phases.
- All mixtures up to 50% PS Stiffer than HDPE, tougher than PS



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# Applications

- Structural Plastic Lumber
- Railroad ties - Commercial Success- Polywood
- I-Beams
- Vehicular bridges
- Marine Pilings
- Structural Panels
- Etc.



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# I-Beam Sub-Structure



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# 2008-9 Bridge Projects

- Ft. Bragg bridges T-8518, 19, and 20
- Composite bridges capable of handling tank loads
- Tank- 73 tons, 13'X12' footprint
- Installed cost including pilings less than \$700 per square foot. Less expensive than any alternative.
- All materials built by Axion International, Inc.



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# Lowell W. Stevens and Tank



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# 2010 Bridge Projects

- Two Railway Bridges at Ft. Eustis, Bridges 3 and 7.
- Rating is 130 Tons.
- Bridge 3 is 40 feet, Bridge 7 is 75 feet.
- Bidding against traditional materials, recycled thermoplastic composites least expensive on an installed cost basis.



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# 120 ton engine



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# Where do Ocean Plastics come from?

- Export of Plastic Debris by Rivers into the Sea
- Christian Schmidt\*†, Tobias Krauth†‡, and Stephan Wagner§
- † Department of Hydrogeology, Helmholtz-Centre for Environmental Research - UFZ, Permoserstrasse 15, 04318 Leipzig, Germany
- ‡ Department of Environmental Engineering, University of Applied Sciences Weihenstephan-Triesdorf, Markgrafenstrasse 16, 91746 Weidenbach, Germany
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# Quote:

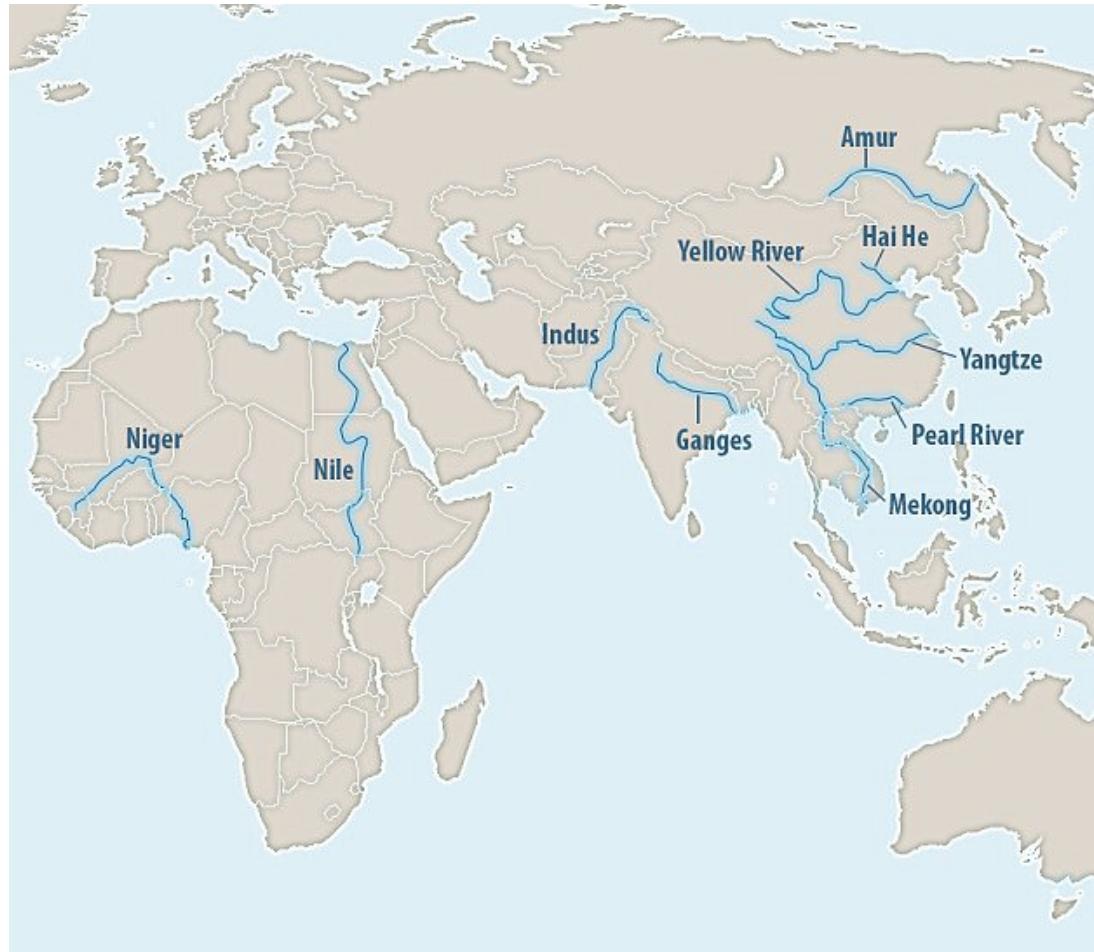
- “The 10 top-ranked rivers transport 88–95% of the global load into the sea. Using MMPW as a predictor we calculate the global plastic debris inputs from rivers into the sea to range between 0.41 and 4 Million t/y”



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# 10 Top Rivers



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# Mostly, a lack of proper waste management.

- **THE 10 MOST POLLUTING RIVERS**

- Yangtze East China Sea Asia
- Indus Arabian Sea Asia
- Yellow River Yellow Sea Asia
- Hai He Yellow Sea Asia
- Nile Mediterranean Africa
- Ganges Bay of Bengal Asia
- Pearl River South China Sea Asia
- Amur Sea of Okhotsk Asia
- Niger Gulf of Guinea Africa
- Mekong South China Sea Asia



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# Important to note:

- Much of the plastic waste has been shipped for decades, to China, Malaysia, India, etc.
- California, for example has virtually no plastics recycling.
- Same with Germany, and several other European countries.
- Many of the countries accepting these materials have stopped, in recent months.



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# Huge rise in US plastic waste shipments to poor countries following China ban **Beijing's crackdown on foreign waste prompts redirection of US recycling to developing countries in south-east Asia**



Plastic debris washed away by rain hangs from trees along the Los Angeles River. US plastic waste exports to Thailand, Malaysia and Vietnam have increased since a ban by China. P

hotograph: David McNew/Getty Images

Exports of plastic waste from the US to developing countries have surged following China's crackdown on foreign waste imports, new research has shown.



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# Processing

- Like plastic lumber, process like PP or PE
- There will be contamination, so make thick cross sections
- There will be opportunities to improve stiffness. IP is licensed to Sicut, Ltd.
- A powered barge with equipment to dry the debris, extrude and mold should be attempted. IMO. Perhaps several.



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# Problem

- 2 solutions,
- Stop as much plastic as possible from exiting rivers.
- Convert floating debris into products.
- 4 Million Tons/year are equivalent to the output of 5-8" extruders converting into plastic lumber.



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# Concept:

- Park barges in the garbage patch, and anchor them. The spinning field of debris brings new material to the feed stream. One or more plastic lumber making machine feeds in dried debris, turning it into plastic lumber.
- Finished plastic lumber can be floated, and towed in nets to shores, and used for construction.
- Optimistically, a business.



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