



Investigating microplastics and chemical additives in wastewater treatment

Ashley King, *PhD Student*

Plastics Research



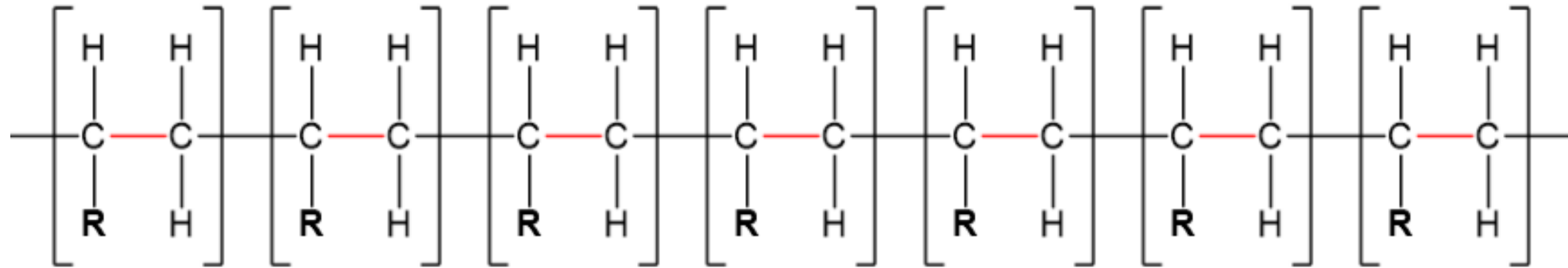
NOAA MDP



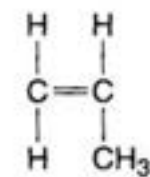
Plastics in the Human World



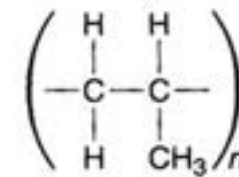
Polymers



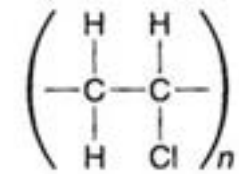
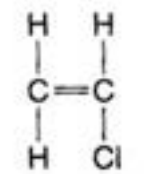
Monomer



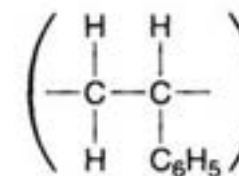
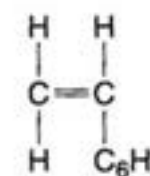
Polymer



Polypropylene

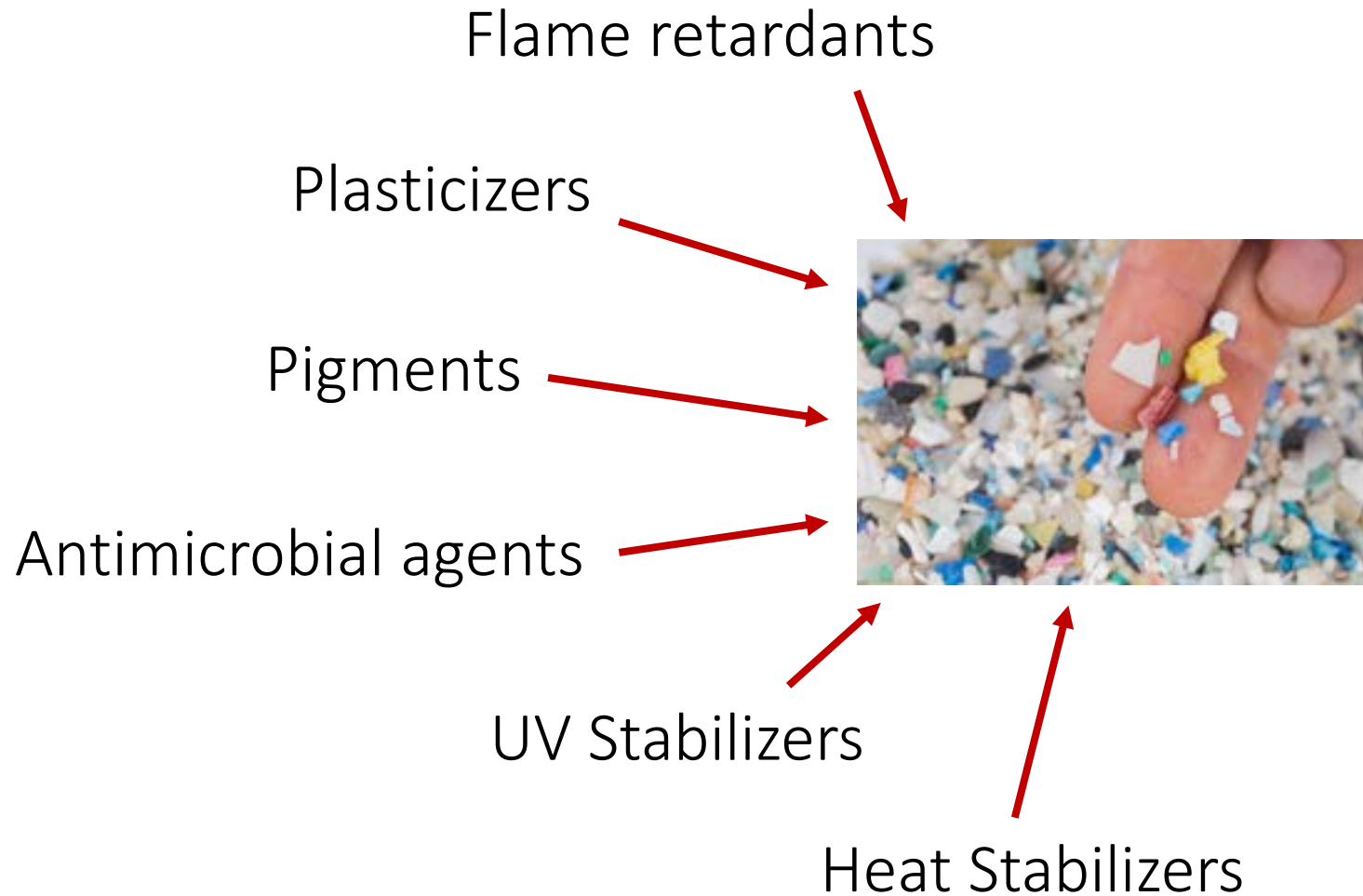


Polyvinyl Chloride

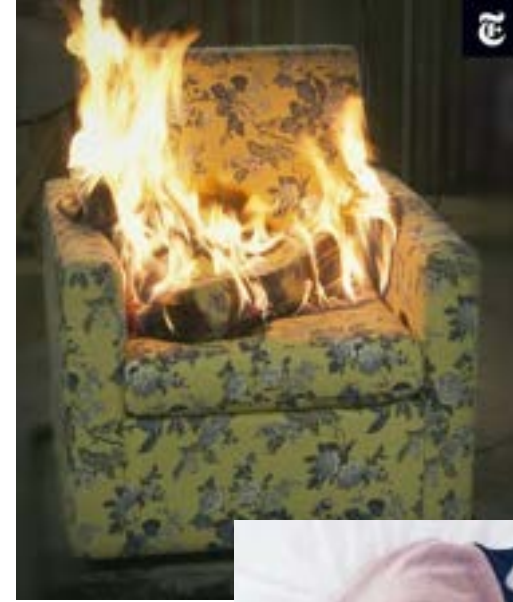


Polystyrene

Additives



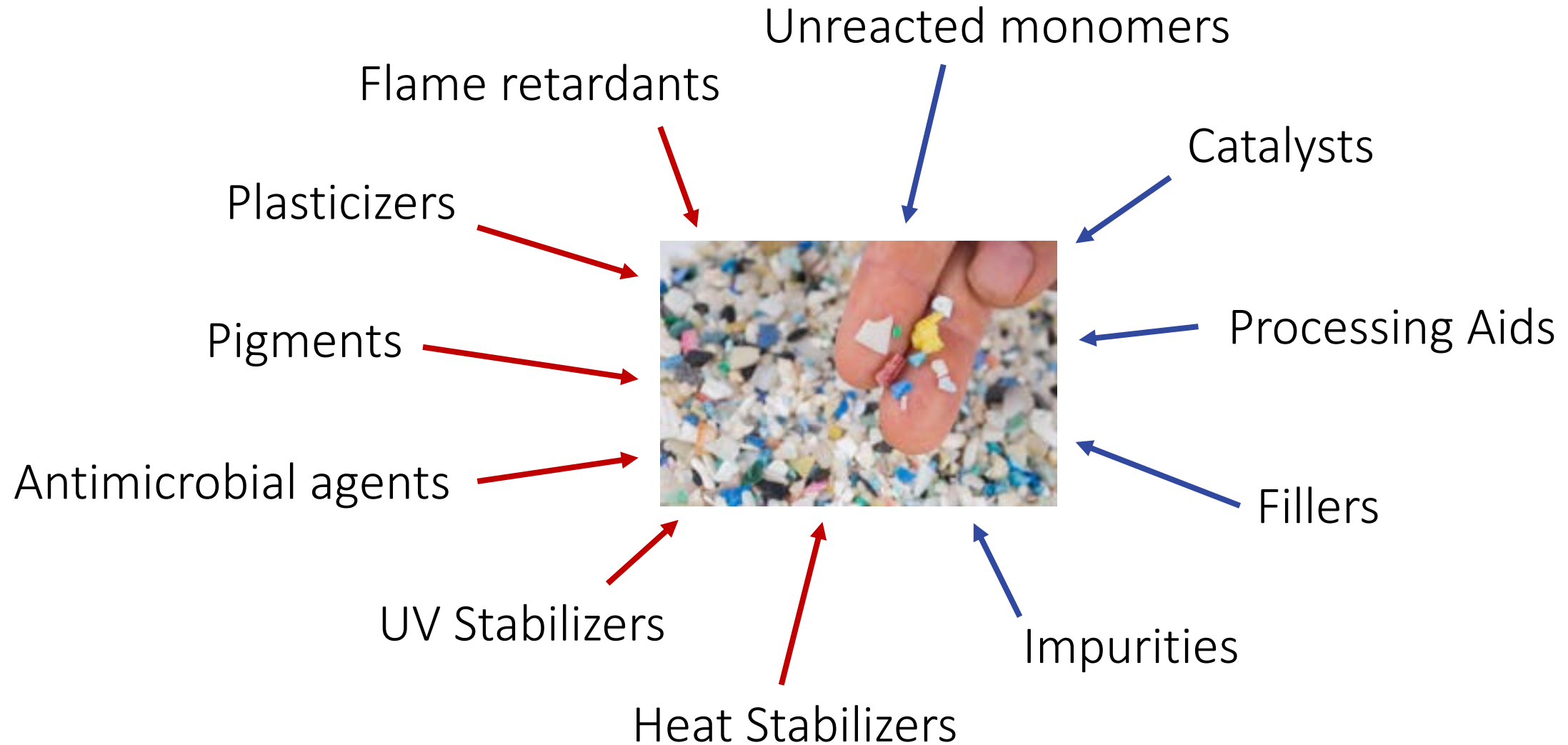
Additives



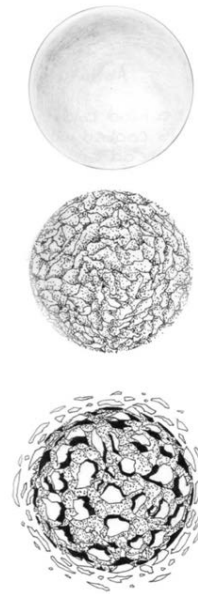
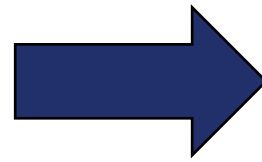
PFAS

BPA

Additives & other chemicals



Microplastics



Andrady 2017

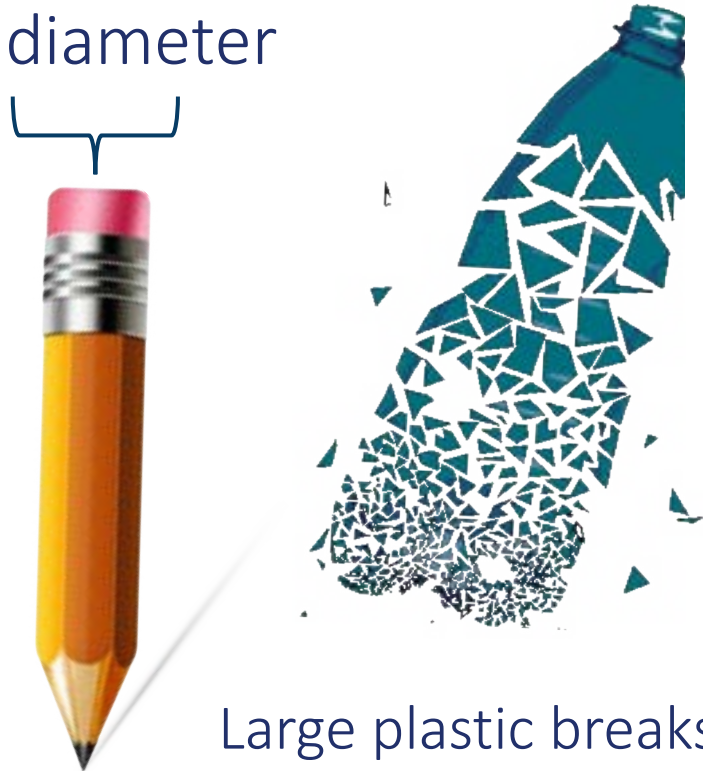


SEA



Microplastics

Microplastics =
plastic particles less
than 5 mm in
diameter



Large plastic breaks down into increasingly smaller pieces of plastic.

Plastics in the Human World

Occurrence of Polyethylene Terephthalate and Polycarbonate Microplastics in **Infant and Adult Feces**

Junjie Zhang, Lei Wang, Leonardo Trasande, and Kurunthachalam Kannan*

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Volume 146, January 2021, 106274



Available online 24 March 2022, 107199



In Press, Journal Pre-proof 

Full length article

Discovery and quantification of plastic particle pollution in **human blood**

Heather A. Leslie ^a, Martin J. M. van Velzen ^a, Sicco H. Brandsma ^a, Dick Vethaak ^{a, b}, Juan J. Garcia-Vallejo ^c, Marja H. Lamoree ^a 

Plasticenta: First evidence of microplastics in **human placenta**

Antonio Ragusa ^a, Alessandro Svelato ^a  , Criselda Santacroce ^b, Piera Catalano ^b, Valentina Notarstefano ^c, Oliana Carnevali ^c, Fabrizio Papa ^b, Mauro Ciro Antonio Rongioletti ^b, Federico Baiocco ^a, Simonetta Draghi ^a, Elisabetta D'Amore ^a, Denise Rinaldo ^d, Maria Matta ^e, Elisabetta Giorgini ^c

Volume 831, 20 July 2022, 154907

Detection of microplastics in **human lung** tissue using μ FTIR spectroscopy

Lauren C. Jenner ^a, Jeanette M. Rotchell ^b, Robert T. Bennett ^c, Michael Cowen ^c, Vasileios Tentzeris ^c, Laura R. Sadofsky ^a 

What goes to a WWTP?

WWTP = Wastewater Treatment Plant



WWTPs receive plastics in influent



Where does it go?

WWTP = Wastewater Treatment Plant



Microplastics on land

Billions of microplastics per day go into a single WWTP's sludge



60% of sludge is applied to land as fertilizer



It's estimated that up to **300,000 tons** of microplastics are applied to land every year in North America

Microplastics on land

What happens to the microplastics during treatment and how does that affect toxicity in the environment?



Biosolids = treated sludge

VIMS Research



Project Title:

Elucidating the occurrence of known and emerging chemical contaminants in wastewater biosolids and the influence of treatment and management processes on their fate, mobility, and bioavailability



Rob Hale



BK Song



Mark LaGuardia



Drew Luellen

Thermal hydrolysis pretreatment (THP)

Sewage sludge



Thermal Hydrolysis

High temperature
(150-190°C) = (300-375°F)

High pressure
(6-9 bar) = (approx. 6-9 atm)

Soil amendment



How does thermal hydrolysis impact microplastics & additives?

THP in Our Region

Blue Plains Plant, Washington D.C.

- Biggest THP plant in the world
- Generates 1.2 million pounds of biosolids every day for use in agricultural fields

Hampton Roads Sanitation District

- THP system became operational this summer at the Atlantic Plant (Virginia Beach)



Methods



Conditions

Pressure reactor
(Parr)

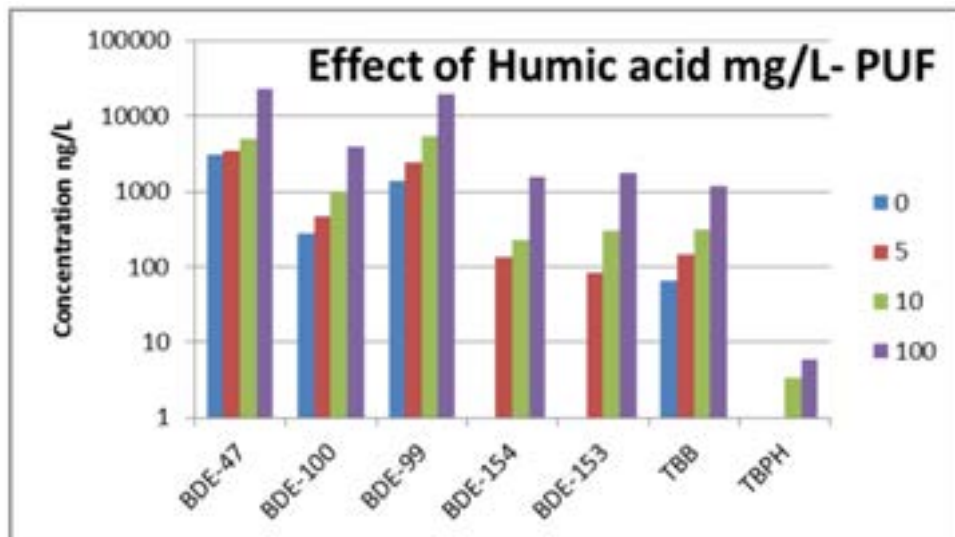
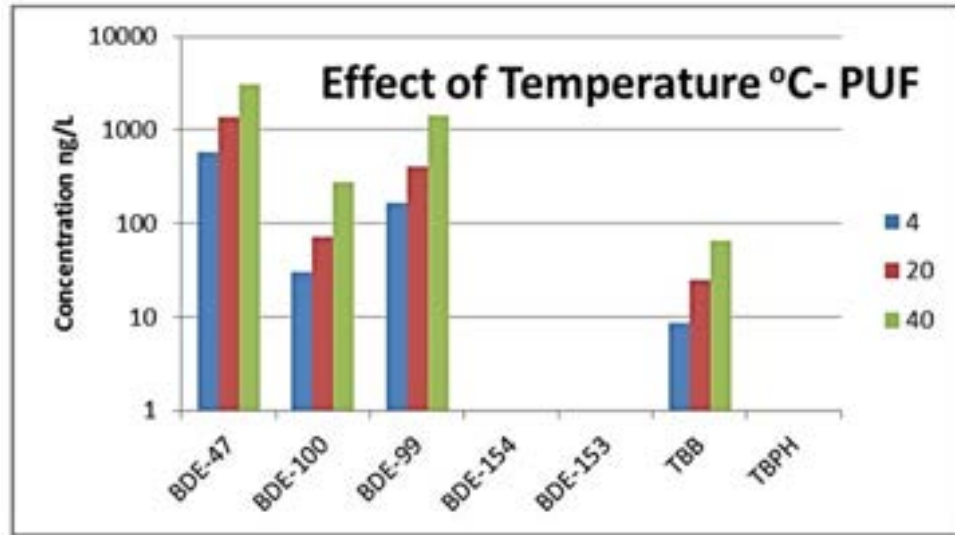


Microplastic analysis

LDIR
(Agilent)

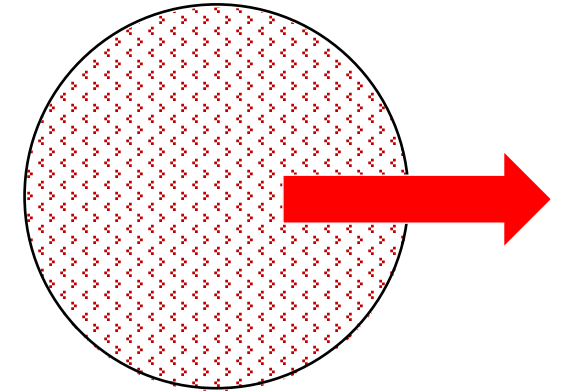


Additives and high temperature, DOC

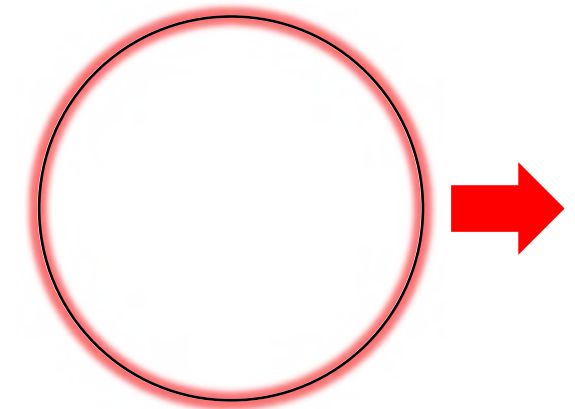


Hale & Chen, 2016

Leaching increased significantly with temperature and DOC (dissolved organic carbon)



What about thermal hydrolysis temperature (165°C) and DOC (up to 1000mg/L)?



Hypothesis: More extreme conditions in THP will amplify release of additives from microplastics in sludge

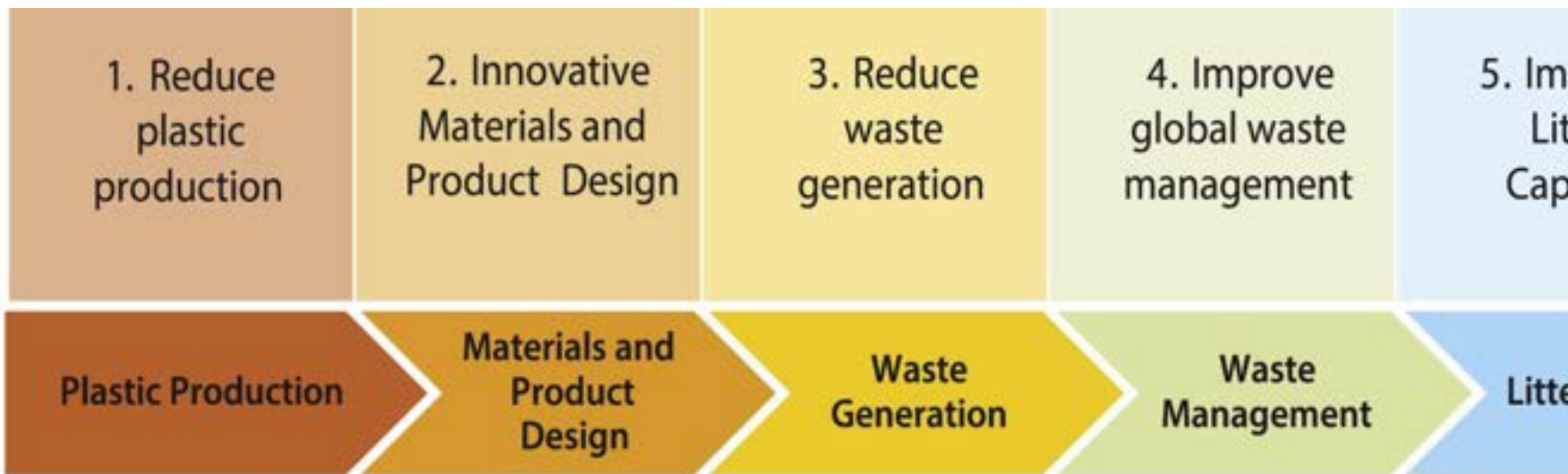
THANK YOU!

email: aeking@vims.edu

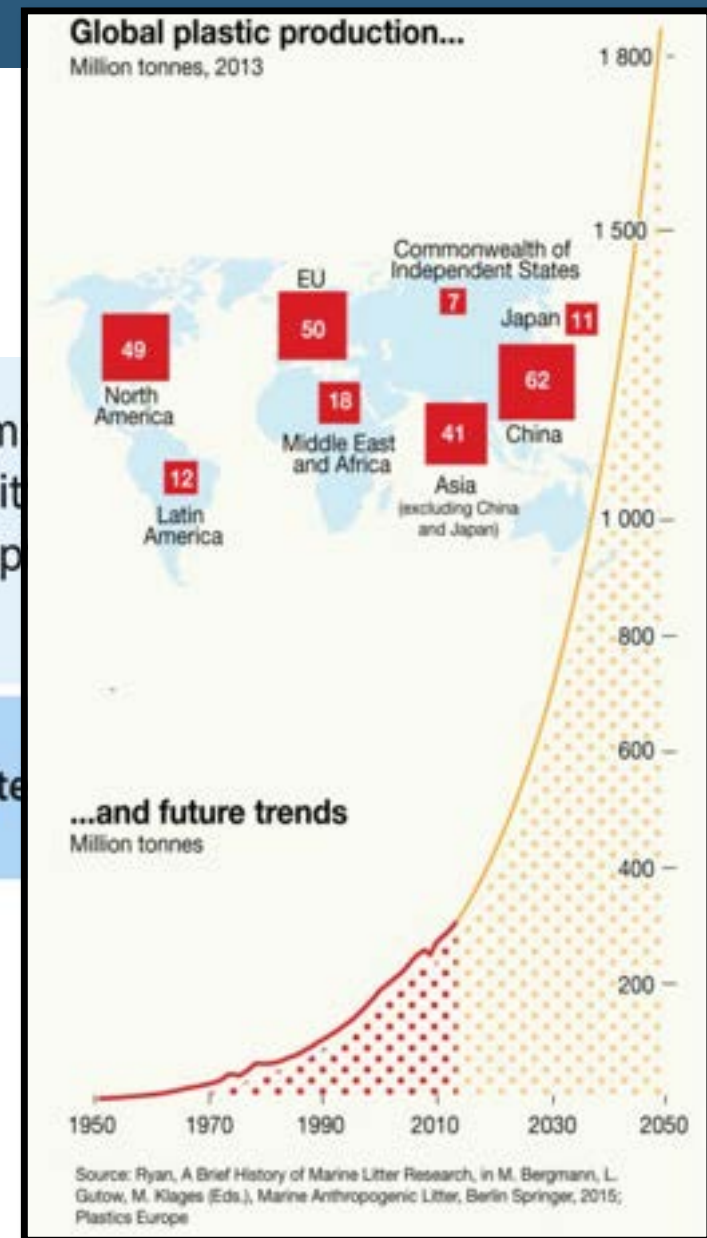
 [@AshleyE_King](https://twitter.com/AshleyE_King)



What Can We Do?



Modified from Jambeck, ET AL., "Plastic Waste Inputs from Land into the Ocean." Science 347, 2015



What Can We Do?



What Can We Do?

If you see one of these symbols on an item, it doesn't mean that you can recycle it.



All of these items have the same code on the bottom:



→ This cap can be recycled if kept with the plastic bottle.

→ This plastic bottle can be recycled if empty, clean, & dry.

→ This soft flexible plastic container & lid go in the garbage.

→ This prescription bottle is too small to recycle, it goes in the garbage.

Seattle Public Utilities

SINGLE-USE PLASTICS



“Wish-cycling”

When in doubt, throw it out BUT reduce your doubt as much as possible

What Can We Do?

Decrease your single-use plastic footprint

BLUELAND



cleancult

We're Breaking Up With Plastic

Real ingredients, zero-waste packaging, and a powerful clean that's better for you and the planet.

[GET STARTED NOW](#)



What Can We Do?

Prevent microfiber pollution from your laundry



GUPPYFRIEND WASHING BAG

Scientifically approved solution against microplastic pollution from washing.



What Can We Do?

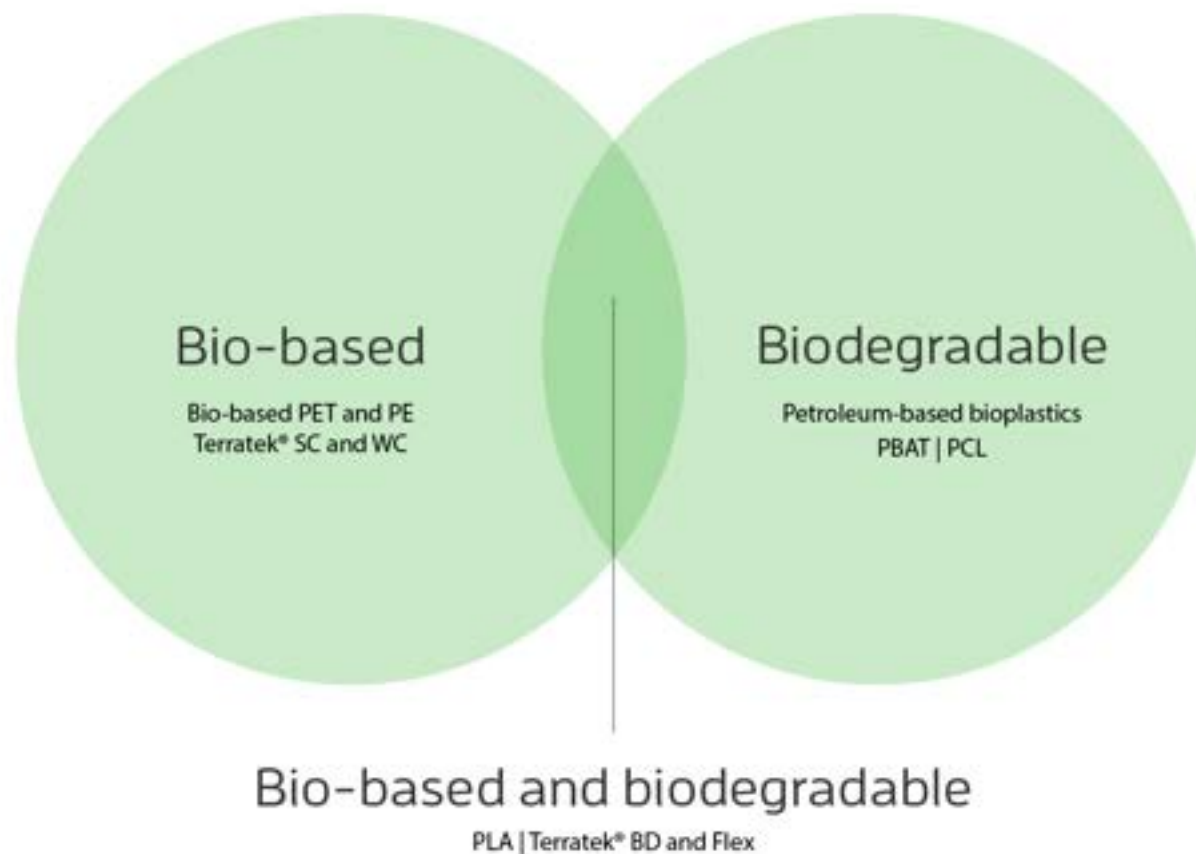
“biodegradable” plastics



MARCH 9, 2021

'Biodegradable' plastic will soon be banned in Australia—that's a big win for the environment

by Jenni Downes, Kim Borg and Nick Florin, The Conversation



What Can We Do?

Clean up!

