GRANT INDUSTRIES REGULATORY UPDATE

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TOPICS

1. D4/D5/D6 - Europe regulations only
2. Silicones and the environment - Degradation
3. Sustainability of silicones
4. Plastics and microbeads
5. Chemical sunscreens - Reef health

1. D4/D5/D6: Silicone Industry Position

- A recent US industry-funded study suggested that D4 poses a "negligible risk to the environment", based on data collected under an EPA enforceable consent order (Real data).
- U.S. (CIR), Health Canada, Australia, regulatory bodies have concluded that D4,D5 and D6 do not pose any risk or environmental concern and extremely safe for human use.
- On April 2nd 2018 representatives of European and U.S. silicon industry associations began a legal action against the EU Commission.
  - See: Official Journal of the European Union Volume 61, 11 June 2018, (Case T-226/18) (2018/C 200/57). They argue that the criteria for SVHC defined in Annex XIII of REACH regulation are inappropriate to describe the properties of siloxanes correctly.

2. Silicones in the Environment

- Silicone fluids have been used for decades
  - From medical to countless industrial applications
- Scientific studies have shown silicones are safe and that they degrade in the environment
- Testing has shown that samples taken from oceans and waste water treatment facilities contain very low presence of silicone
- OECD Protocol-Inherent Biodegradability in soil "CO2 test" does not really fit the mechanism of polymer degradation
- Analytical chemistry is so advanced, that much of the EU numbers are based on PPT – Part per trillions. Exceedingly difficult to comprehend how low these numbers are and what effects they really indicate

Silicones in the Environment

- **Degradability vs Biodegradability** (Ref. Dictionary.com)
  - **Degradable** – Relating to a compound that breaks down into simpler compounds by stages. During the degradation of a degradable compound, well-defined intermediate products are created.
  - **Biodegradable** – Capable of being decomposed by the action of biological agents, especially bacteria.

Silicones in the Environment

- Thus consistent with laboratory studies showing polymer hydrolysis followed by biodegradation and/or volatilization of the monomer to natural components (CO2 and inorganic silicate). The overall reaction is:

$$\underset{PDMS}{Me_3SiO(SiMe_2O)_nSiMe_3} \xrightarrow[H_20]{Soil} \underset{DMSD}{Me_2Si(OH)_2}, \text{ followed by:}$$

$$Me_2Si(OH)_2 \xrightarrow[\text{or light}]{\text{Microbes}} CO_2 + \text{Inorganic Silicate}$$

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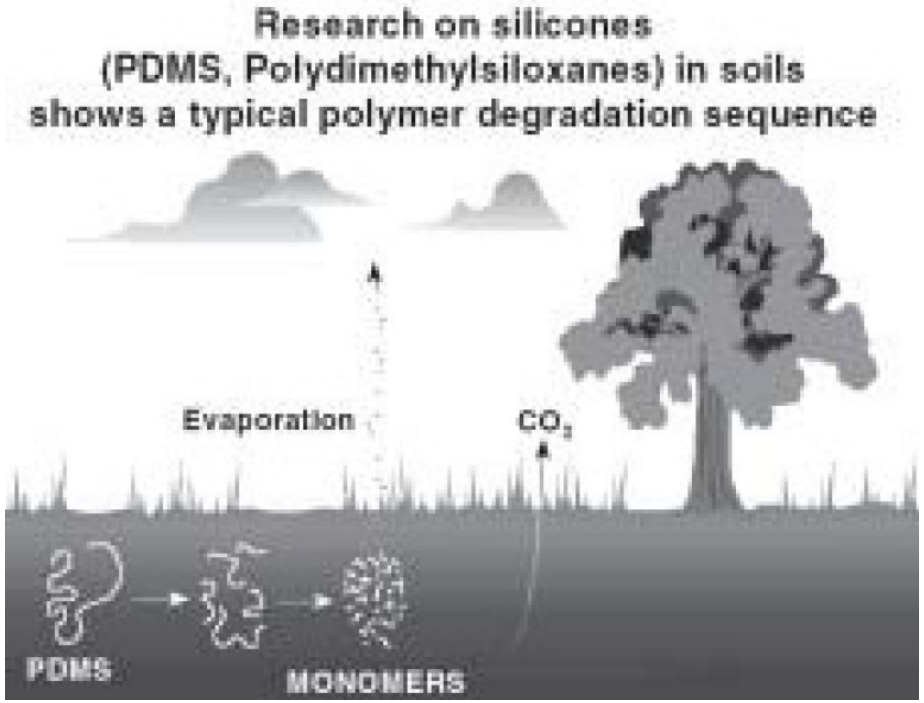
Silicones in the Environment



Depending on the application, silicones can be found in nature as PDMS (Polydimethylsiloxane, a polymeric silicone fluid, ex. Dimethicone) and VMS (Volatile methylsiloxanes)

Silicone fluids degrade naturally in soil into monomers - **within days!**

Once in monomeric form, it will undergo microbial degradation!

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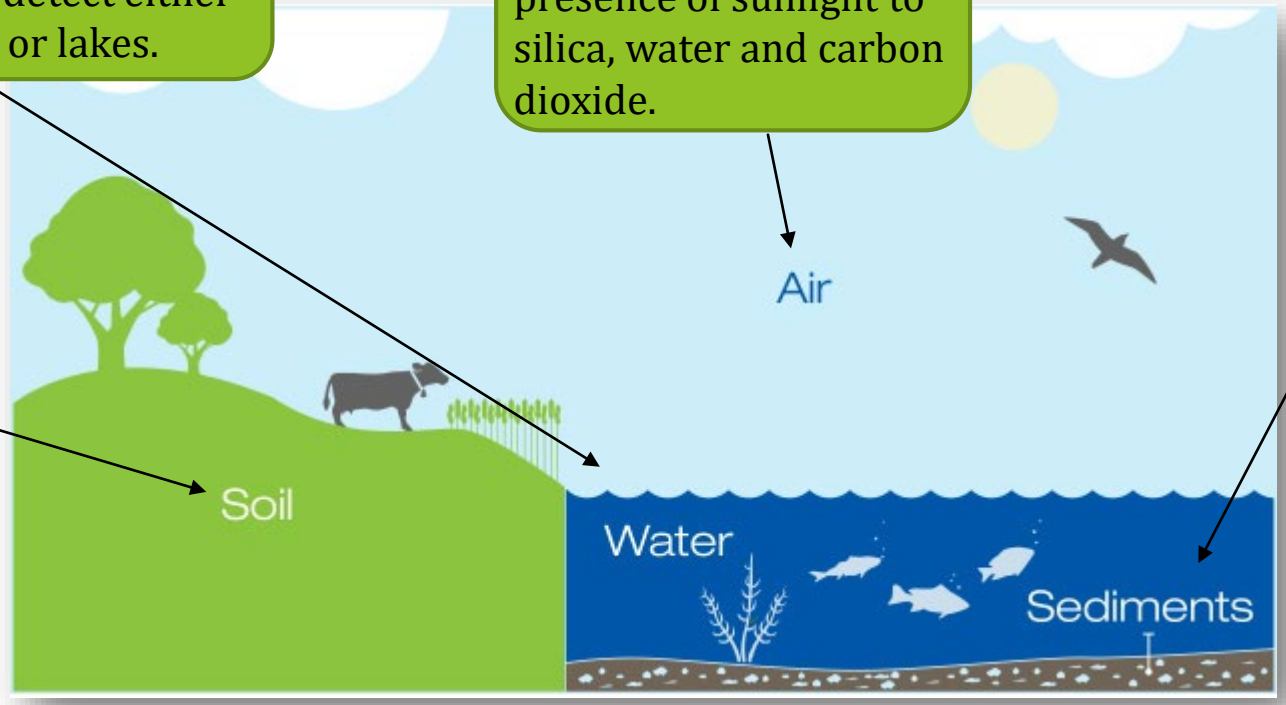
VMS are rapidly lost into the air and PDMS does not dissolve in water. Rare to detect either of them in rivers or lakes.

VMS evaporates into the air degrading in the presence of sunlight to silica, water and carbon dioxide.

PDMS degrades when added to agricultural or other soils (clay)!



Integral part of the aquatic environment. During waste water treatment, in particular non-volatile silicones bind tightly to particulates. They are thus removed from waste water during treatment and are processed as part of the sludge.
The sludge is normally either sent to landfill, incinerated or used to improve the quality of soils used for agriculture or other purposes (e.g. for golf courses, landscaping, etc.).

Wildlife Protection - Treatment with PDMS of otters caught in a large oil spill in Arctic waters. After using detergents to remove the oil, a PDMS coating gave their fur the necessary protection against the freezing waters until their natural waterproofing system could recover. They would not otherwise have survived!

Silicones in the Environment – Behavior

Volatile methylsiloxanes (VMS) and polydimethylsiloxanes (PDMS)

3. Sustainability of Silicones

- Silicone play important role in promoting sustainability
  - Made from Quartz (sand)
  - Silicon - All together, accounts for approximately 15 percent of the Earth's mass
  - Third most abundant element (Silicon)
  - Enhances performance and durability of commercial and industrial products
- Characteristics with other materials
  - Allows products to last longer
  - Spreads better
  - Stays flexible or rigid
  - Withstands extreme temperature or humidity
  - Reduces the resource and energy consumption of the products in which silicones are used
- The use of silicones, siloxanes, and silanes saves energy and reduces greenhouse-gas emissions, outweighing the impacts of production and end-of-life disposal by a factor of nine

Sustainability of Silicones

"The study found that Si-chemistry products in Europe, North America and Japan allow for net CO_2 emission reductions of about 52 million tons per year."

Also, the value of silicones to the EU economy in terms of offsetting greenhouse gases was not considered in their earlier assessment and is a powerful fact.

4. Plastics and Microbeads

We should instead focus on real environmental issues!!!

- **Plastics**
  - **1,000 years**
    - Plastic waste is one of many types of waste that take too long to decompose. Normally, plastic items can take up to **1,000 years** to decompose in landfills.

    - Plastic bags we use in our everyday life take up to **1,000 years** to decompose, while plastic bottles can take **450 years** or more.

- <u>Silicones are not plastics or Microbeads!</u>

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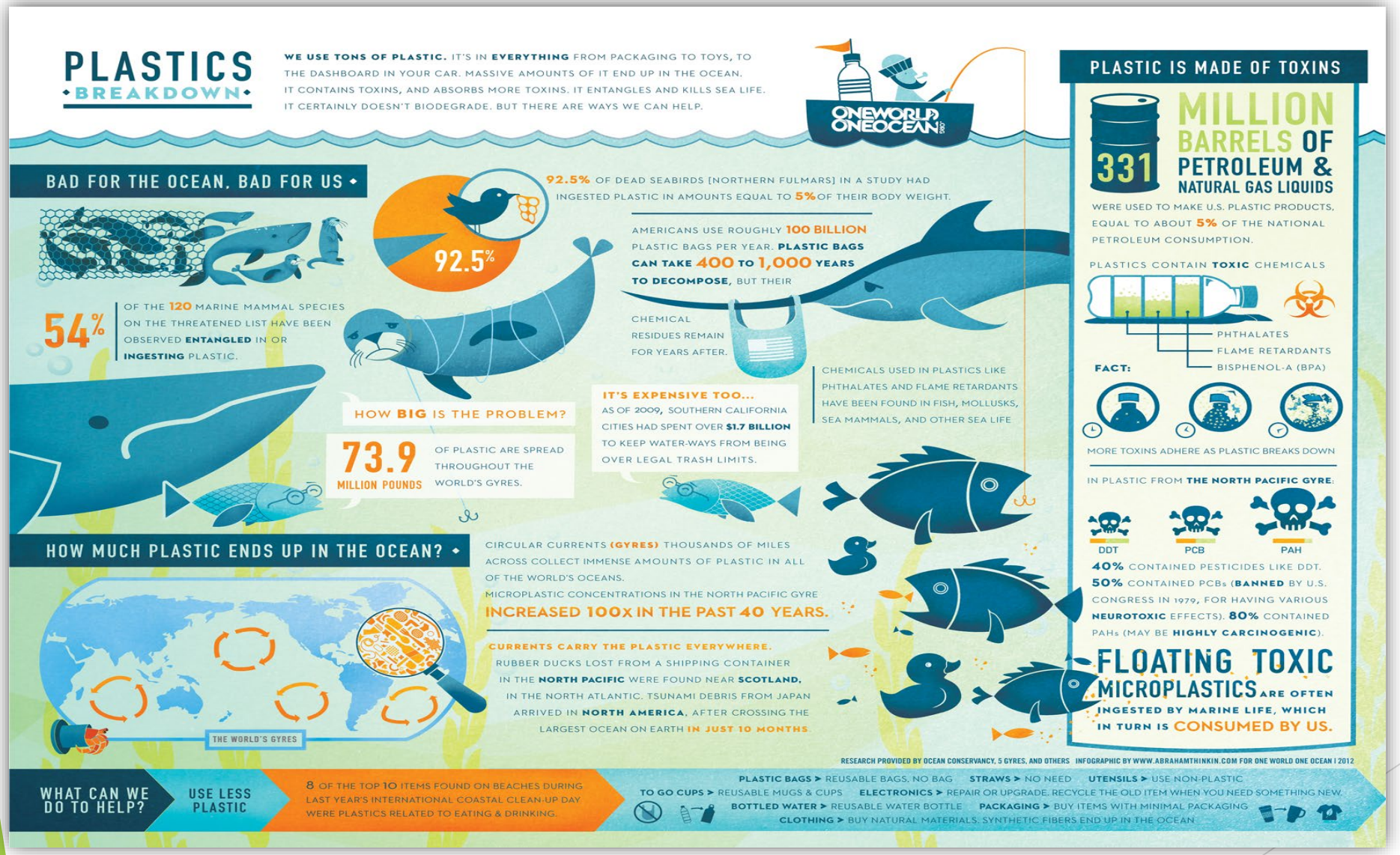

Plastics and Microbeads – Non-Biodegradable

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Plastics and Microbeads – Rate of Decay

5. Sunscreens

- Chemical (organic) vs Mineral (Inorganic)
  - Mineral only TiO2 and ZnO
  - TiO2 and ZnO approved in all regions
- UV filters - Active ingredients
- UVA vs UVB - Skin damage vs Sun burn

UVA Filters	UVB Filters	UVA + UVB Filters
• Avobenzone • Diethylamino Hydroxybenzoyl Hexyl Benzoate* • Disodium Phenyl Dibenzimidazole Tetrasulfonate*	• Homosalate • Octisalate • Octinoxate • Octocrylene • Ensulizole • Octyl Triazone* • Ethylhexyl Triazone*	• Oxybenzone • Bis-Ethylhexyloxyphenol Methoxyphenyl Triazine* • Methylene Bis-Benzotriazolyl Tetramethylbutylphenol* • Tris-Biphenyl Triazine* • Titanium Dioxide • Zinc Oxide

EU Approved Sunscreen List

Chemical Sunscreens

- Often mislabeled as organic sunscreens
  - They are NOT organic from a natural standpoint – the term only relates to organic chemicals in reference to synthetic chemistry
- July 3rd 2018 - Hawaii state signed the first bill in US that bans the sale and distribution of chemical sunscreens that are harmful to coral reefs:
    - Oxybenzone (Benzophenone-3) and Octinoxate (Ethylhexyl Methoxycinnamate)
      - Cause bleaching, deformities, DNA damage, death of coral
- Jan 21st 2021- Any sunscreen containing these chemicals will be prohibited
- Grant Industries' UV CUTS – mineral based sunscreens for both UVA+UVB!
  - Variety of emollient options available in TiO_2 and ZnO

Questions? regulatory@grantinc.com

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