Kingston University London

Characteristics of microplastic (MP) pollution

- considerations for the inclusion of plastics in commercial products

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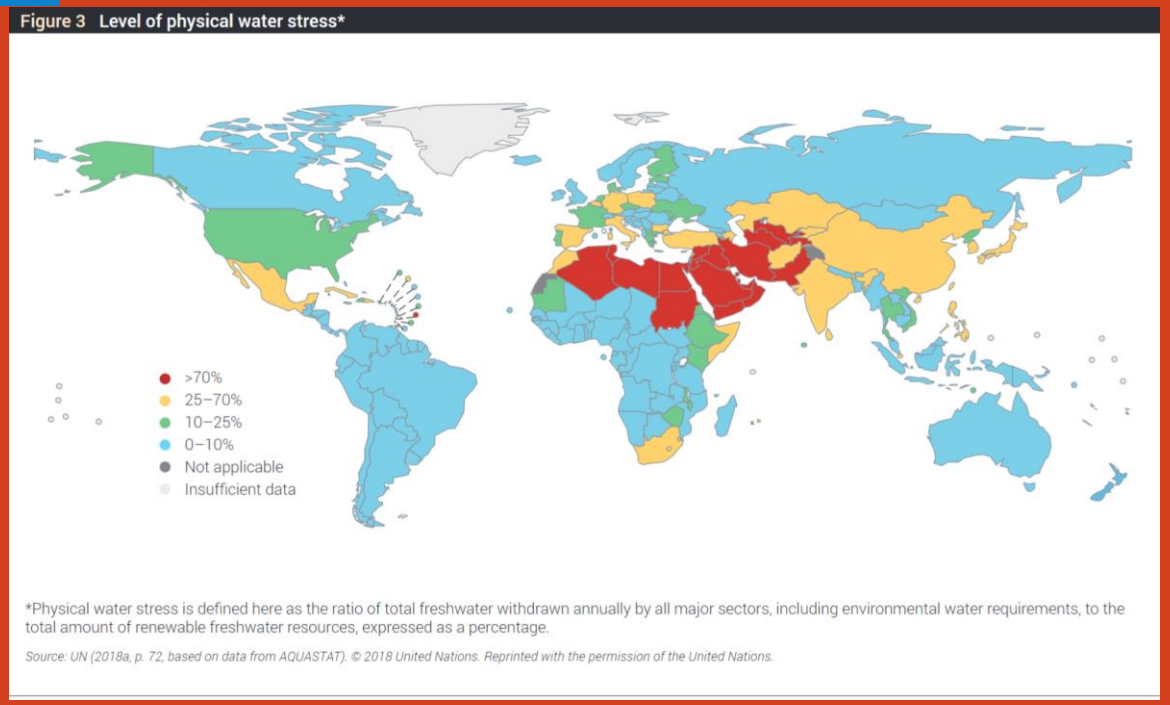
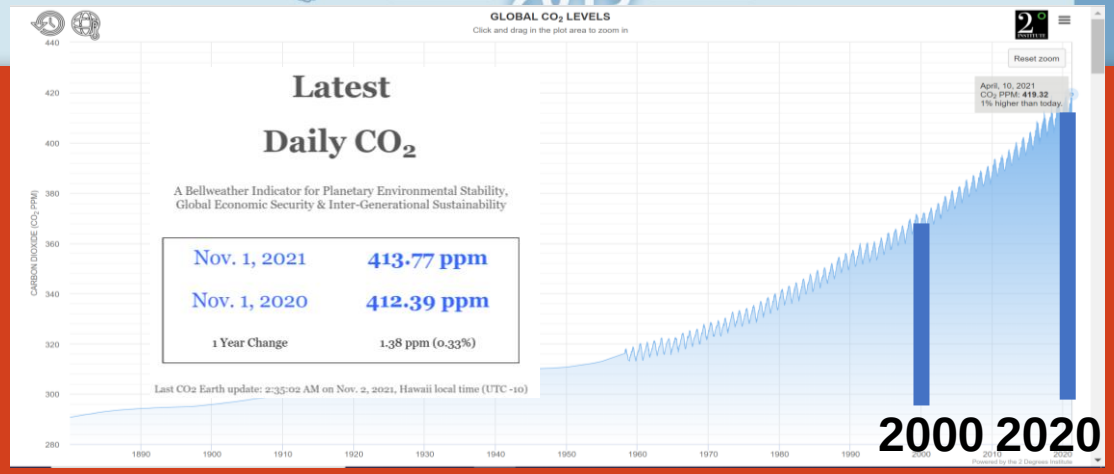
Environmental problems: CO_2, H_2O scarcity and pollution.



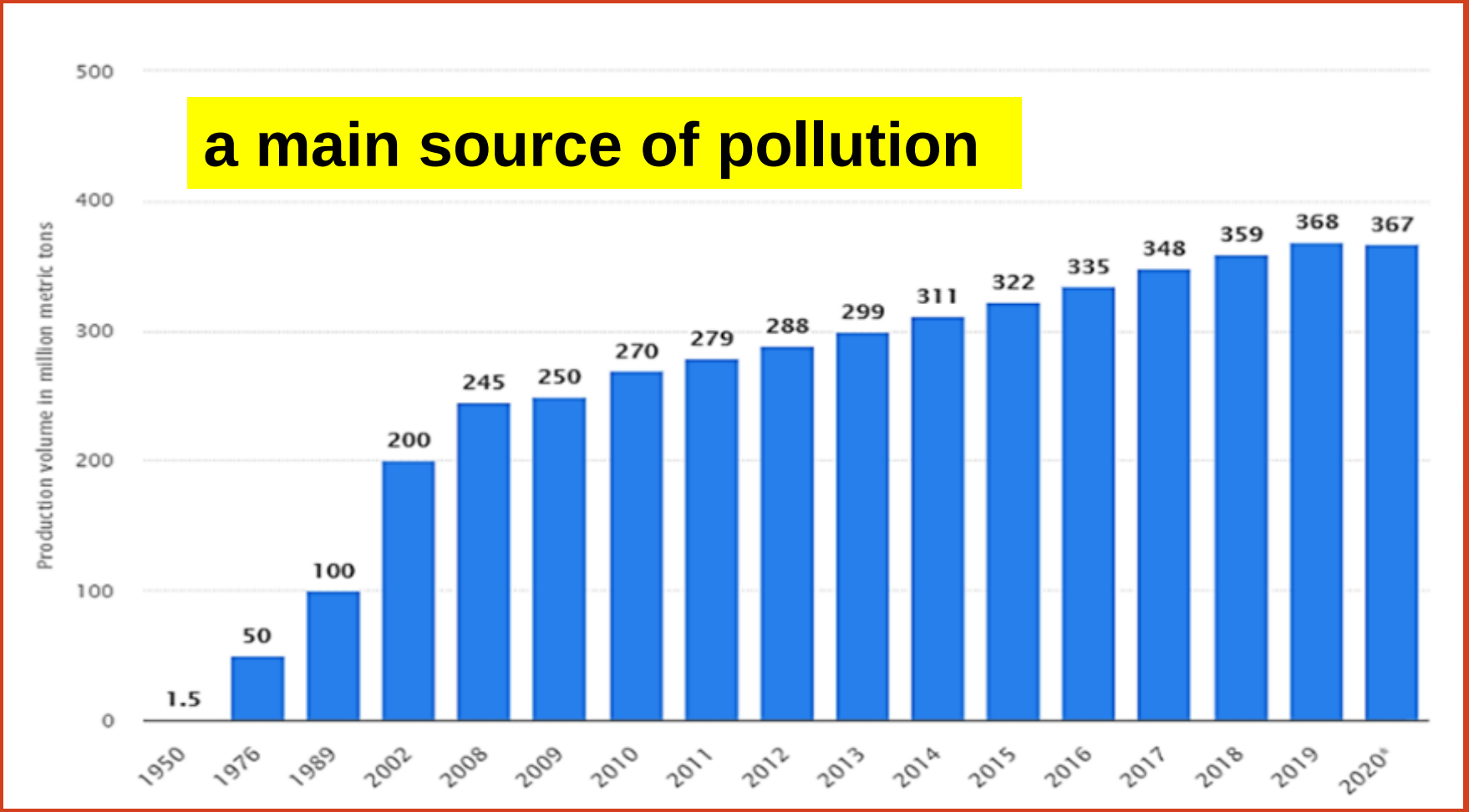


Source: The United Nations World Water Development Report 2019

[Daily CO2]

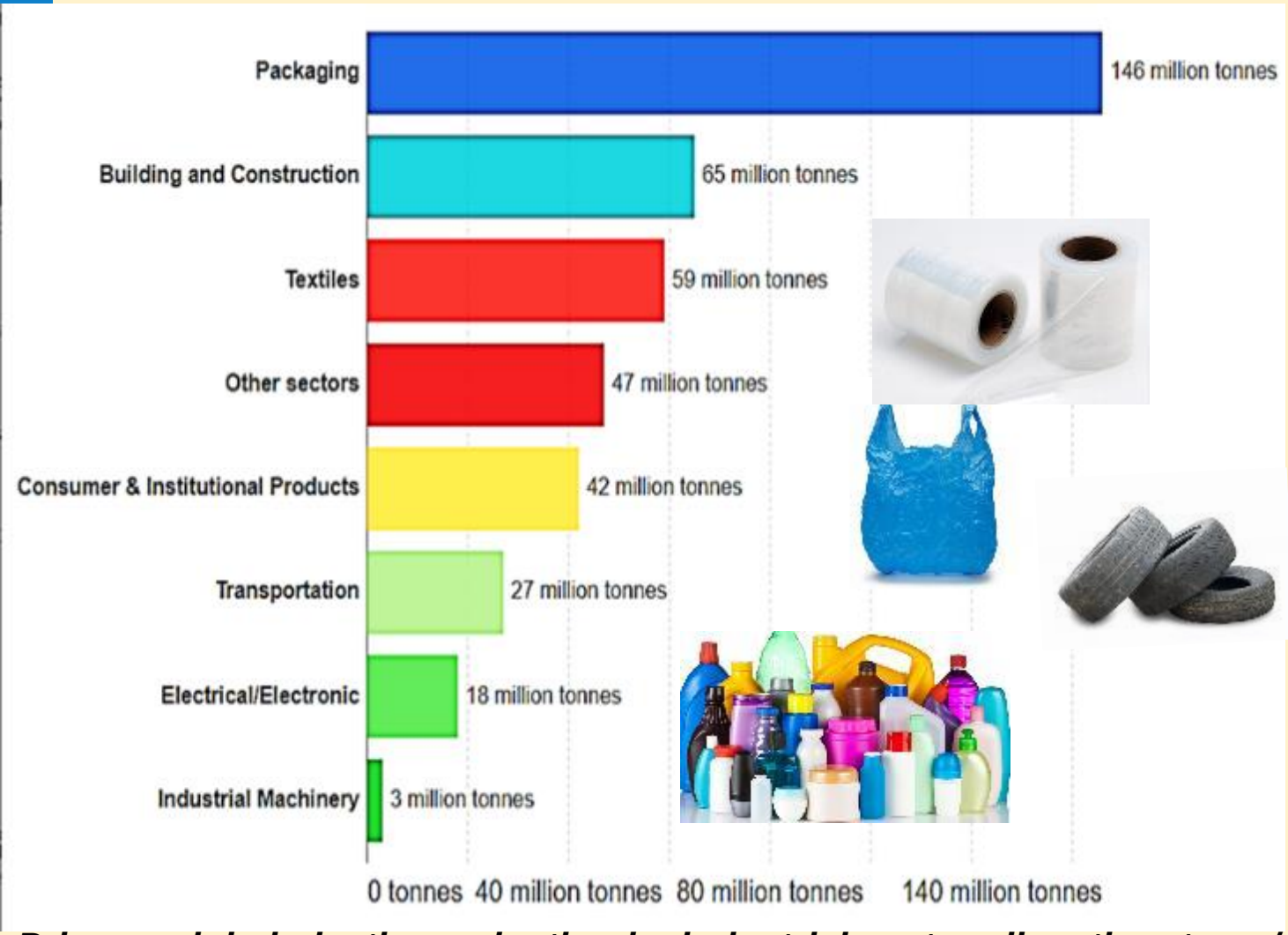
[CO2 Emissions | Global Carbon Atlas]

Global Plastic Production (1950-2020)



Global production of plastics (1950 – 2020, **million tons /year**), Statista (2021)
https://www.statista.com/statistics/282732/global-production-of-plastics-since-1950/

Where is plastic used?



Primary global plastic production by industrial sector allocation, tons /year *(Geyer* et al. *2017)*

Where plastic ends up?

Fate: Sea (and animals)

Sediment, soil and landfill

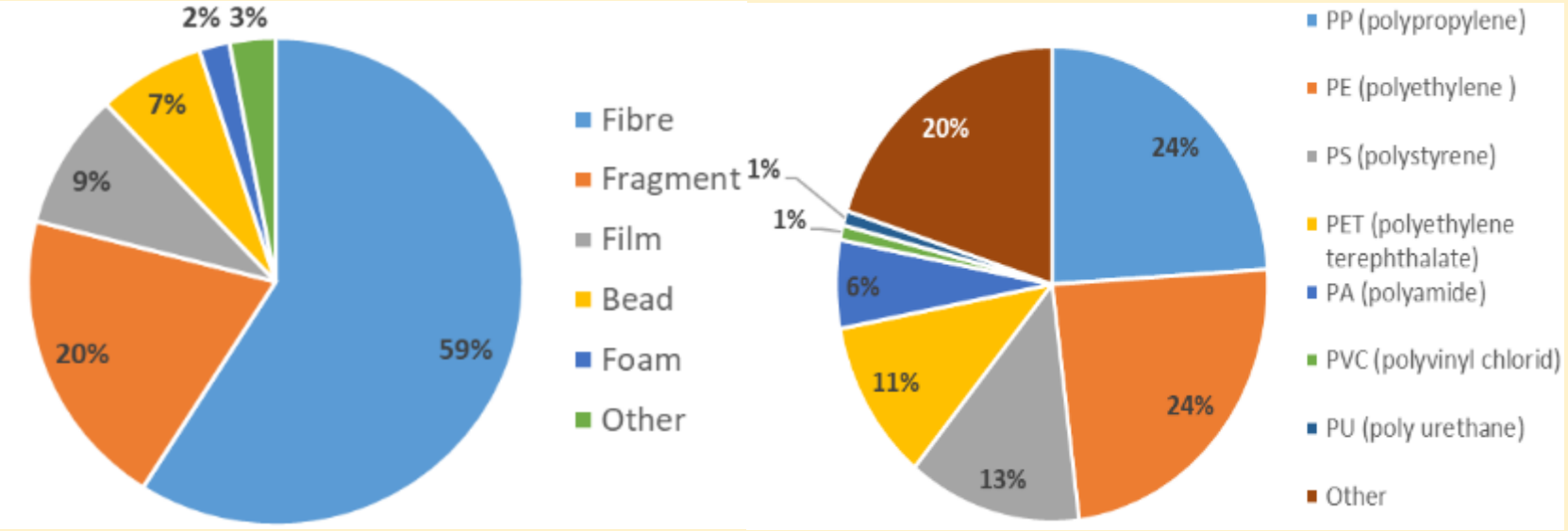
Pathways: air,

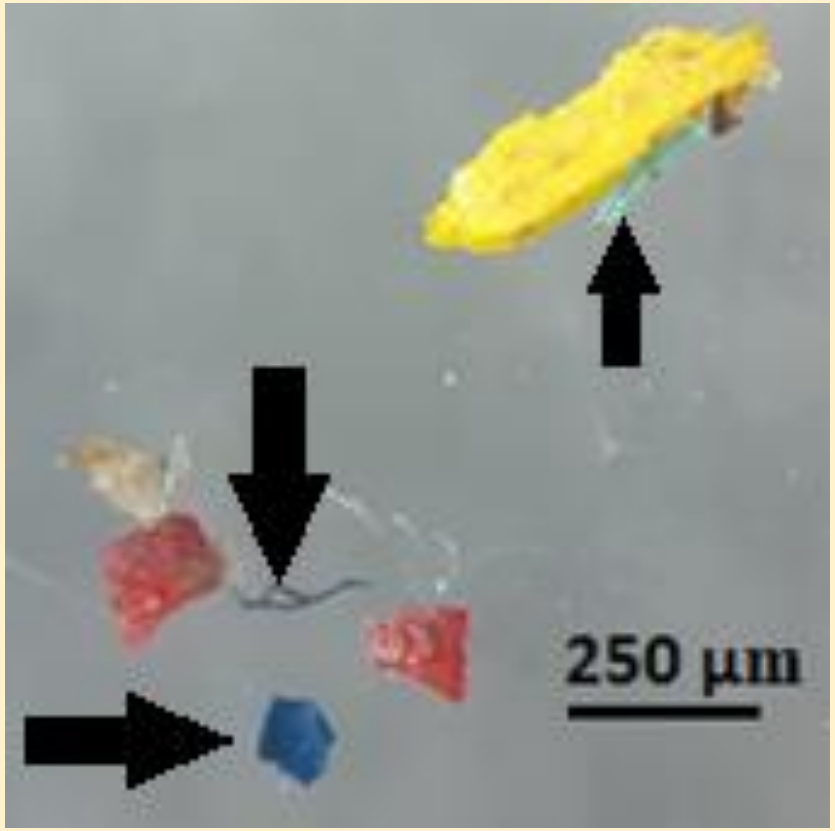
wastewater

river

Plastic → **Microplastic**
(1µm-5 mm)

In rivers: fibres, fragments, PP, PE dominate

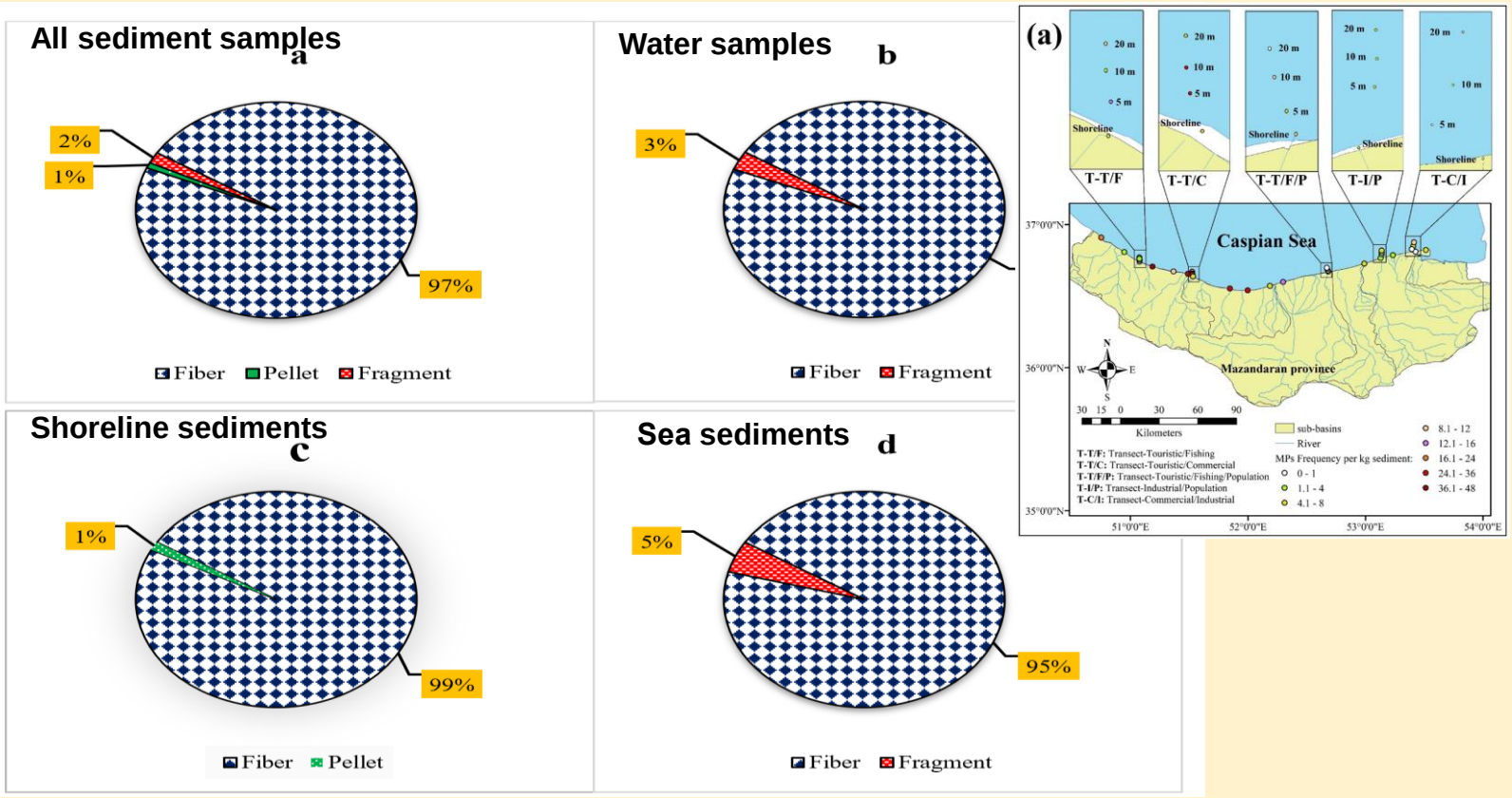




Li, C., Busquets, R., Campos, L.C. (2020). **Assessment of microplastics in freshwater systems: A review,** STOTEN 707, 135578

Microplastic occurrence in settled indoor dust in school. Mohammad Javad Nematollahi, Fatemeh Zarei, Behnam Keshavarzi, Mehdi Zarei Farid Moore, Rosa Busquets, Frank J. Kelly. STOTEN 2021

In the sea (Iran): fibres, fragments, 250-500µm, PET dominates



Neuston/ Manta Net – continuous flow net with pore size typically between 100-500µm, either fixed in place (river) or pulled from a boat

H_2O_2

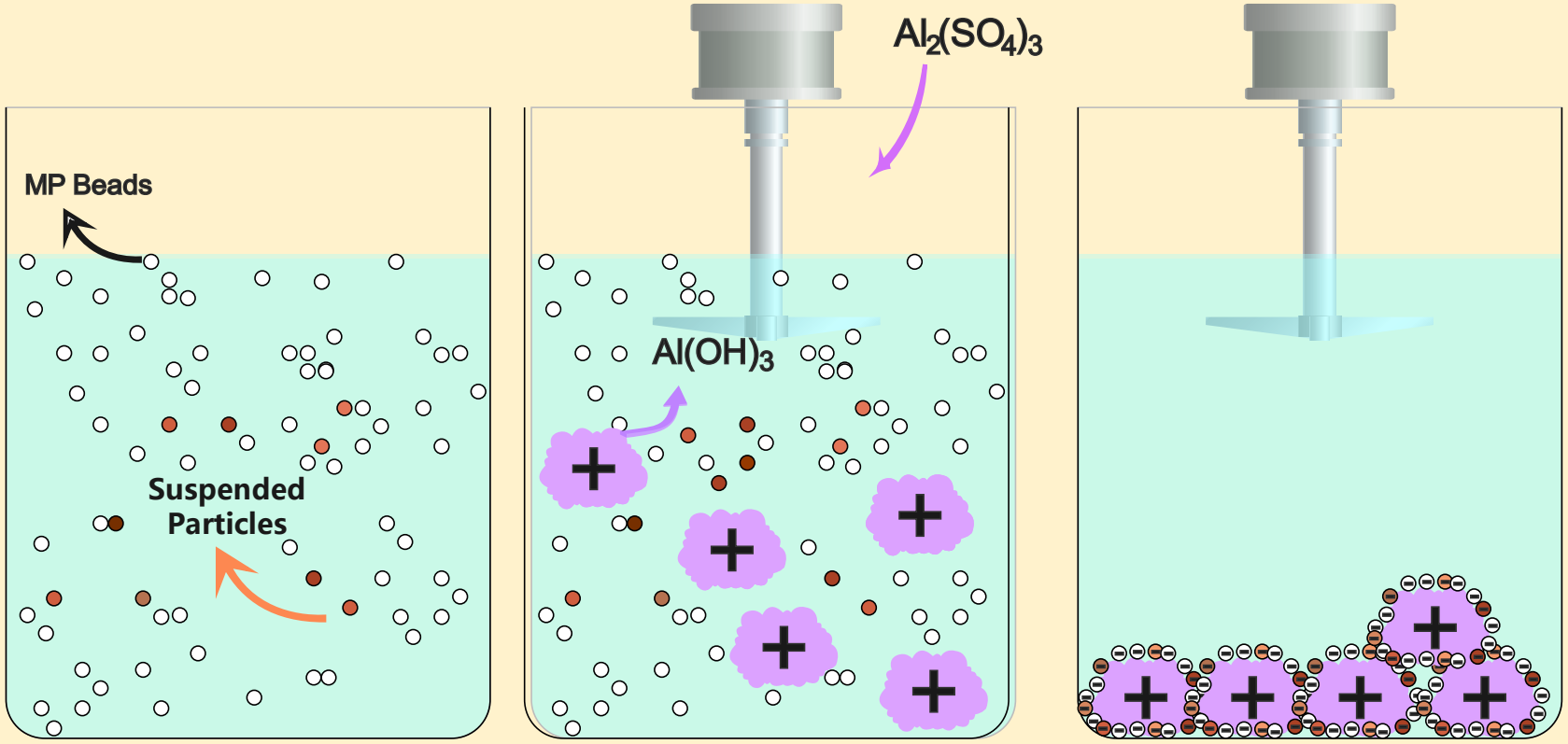
Density separation with NaBr or ZnCl2

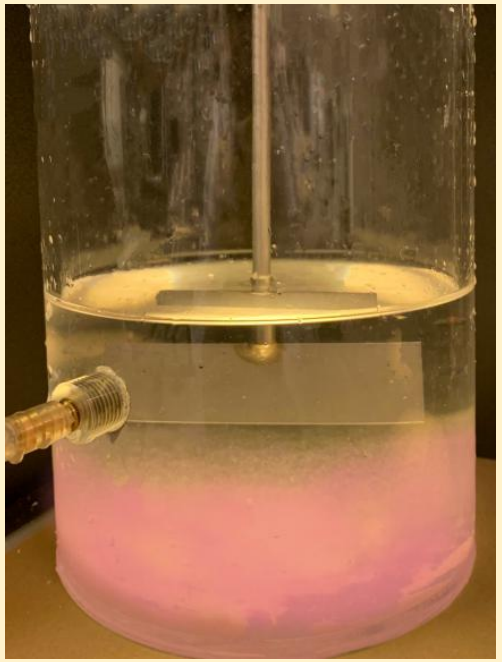
Characterisation: Raman, IR µIR, µRaman: for composition; SEM for wethering

Counting Optical microscopy and ImageJ

Nematollahi, MJ, Moore, M, Keshavarzi, B, Vogt RD, Saravi, HN, Busquets R. (2020) Microplastic particles in sediments and waters, south of Caspian Sea: frequency, distribution, characteristics, and chemical composition. Ecotoxicology and Environmental Safety, 206,111137.

Solution for water treatment





Conditions can be optimised.
Low density plastics (PE, PS) are a problem

Li, Chaoran, Busquets Rosa, Moruzzi, Rodrigo B. and Campos, Luiza C. (2021) Journal of Water Process Engineering, 44, 102346.

Solution for water treatment ?

can you avoid plastic…

and is biomass the solution for replacing plastic
+ cleaning effluents?

Summary

- ✓ Plastic and microplastics pollute water, air and soil. Pollution involved in global warming.
- ✓ Fibres and fragments <500µm are common in all compartments worldwide
- ✓ Low density plastic (e.g PE, PS) is specially problematic in water treatment and in the environment. It should be avoided (banned?)
- ✓ Coagulation, flocculation and sedimentation can be reoptimised to reduce plastics in effluents
- ✓ Biomass can be transformed and be produced with properties that can help to improve the environment, if produced with sustainable practices.
- ✓ International and industry/ academia collaboration impact on 6th SDG and help to introduce new and more sustainable solutions

Thank you!

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