

Modelling of microbial interaction in degradable polymers under simulated water environment

EGU21-115

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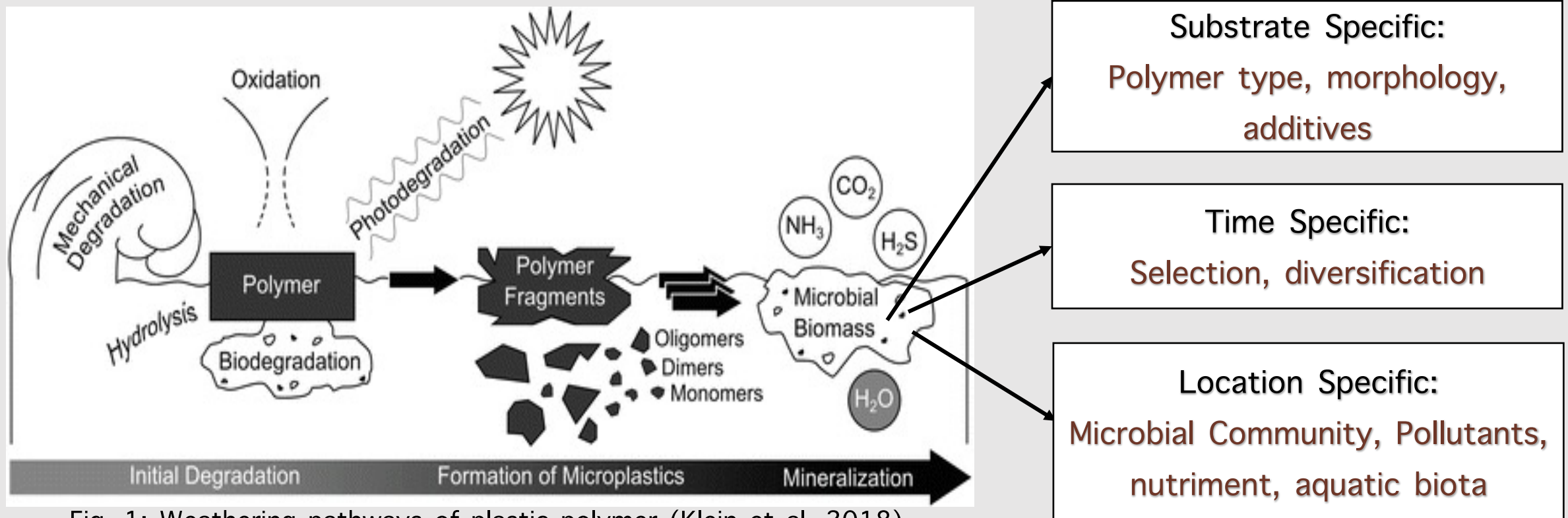
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Fate of Degradable Polymers

- Types: photodegradable and biodegradable
- They possess **greater affinity towards microbial activity**
- Dynamics of microbial interaction with such polymers especially with MPs are limited (Caruso, 2015)



Need of Microbial-Microplastic interactive models

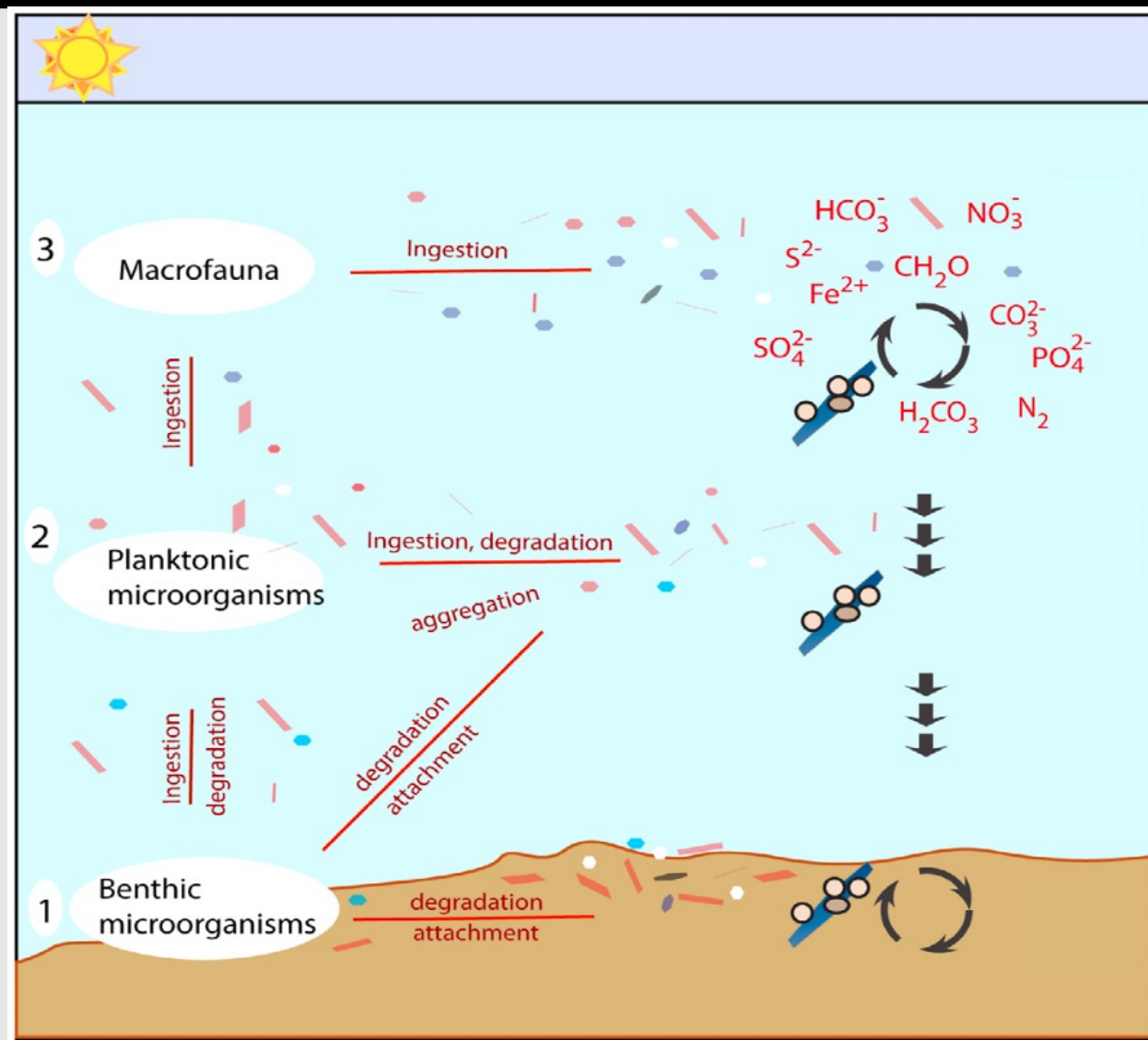


Fig. 2: Microbial interaction with MPs (Rogers et al. 2020)

1) Do microbial communities on microplastic biofilms differ from natural assemblages?

Morphology
Physiological characterization
Phylogenetic characterization

2) What are the ecological roles of microbial biofilms on microplastics?

Metabolomics
Metaproteomics
Metatranscriptomics
Microbial activity measurements

Community
composition/assembly

Community function
(degradation/element cycles/etc.)

Microbe-microbe and
microbe-substrate interactions

Fig. 3: Methodological approaches to study on biofilm (Yang et al. 2020)

Dynamics of Biofilm studies

Table 1: Future studies on biofilm dynamics (Caruso 2015)

Biofilm Formation and Development	Biofilm Components	Biofilm Control
Extracellular polymeric matrix composition	Heterogeneous microhabitats within the biofilms' structure	Processes related to the synthesis of biofilm matrix
Variables and mechanisms that favour and stabilize the formation of biofilm	Intercellular communication/signalling (i.e., quorum sensing)	-Novel and environmentally friendly methods to prevent biofilm formation and/or to remove biofouling -Interactions (inhibition/induction) of microbial biofilm members responsible for antifouling resistance -Application of specific enzymes (i.e., proteases and oxidases); quorum sensing inhibitors; use of bacteriophages
Biofilm structural and functional diversity	-Nutrient acquisition and recycling by biofilm components -Antibiotic resistance and virulence factors of biofilm components	Mechanisms involved in biofilm tolerance to biocides and other stressors
Habitats/substrates supporting biofilm formation	Responses of microbial consortia to surface adhesion	

Mechanistic biofilm-based models yield the following traits (Sgier et. al., 2016),

- Spatial distribution of biofilm binding**
- Competitiveness of biofilm species**
- Simulation of real-world environment**

These probabilistic models aim *to find the right microbe at the right time to a specific polymer type binding for a hotspot ligand for degradation*

References

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