Palazzo Marino, Milano

Dalle microplastiche agli enzimi mangia-plastica

Stefano Bertacchi, PhD

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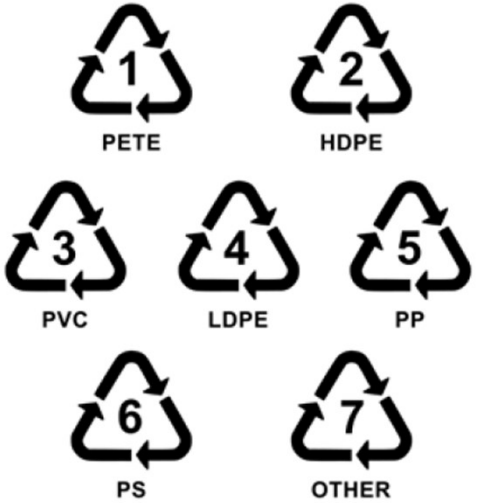
Come differenzio la plastica?

Cercare i simboli e le indicazioni sulla confezione, ma **attenzione**…



1. PET
polietilene tereftalato
2. HDPE
polietilene ad alta densità
3. PVC
polivinilcloruro
4. LDPE
polietilene a bassa densità
5. PP
polipropilene
6. PS
polistirene
7. Other
Altre plastiche

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Microplastiche = frammenti di plastica < 5 mm

Microplastiche nell'ambiente

- **1,8 milioni di tonnellate** – scenario **ottimistico**
- **3,2 milioni di tonnellate** – scenario **intermedio**
- **5,0 milioni di tonnellate** – scenario **pessimistico**

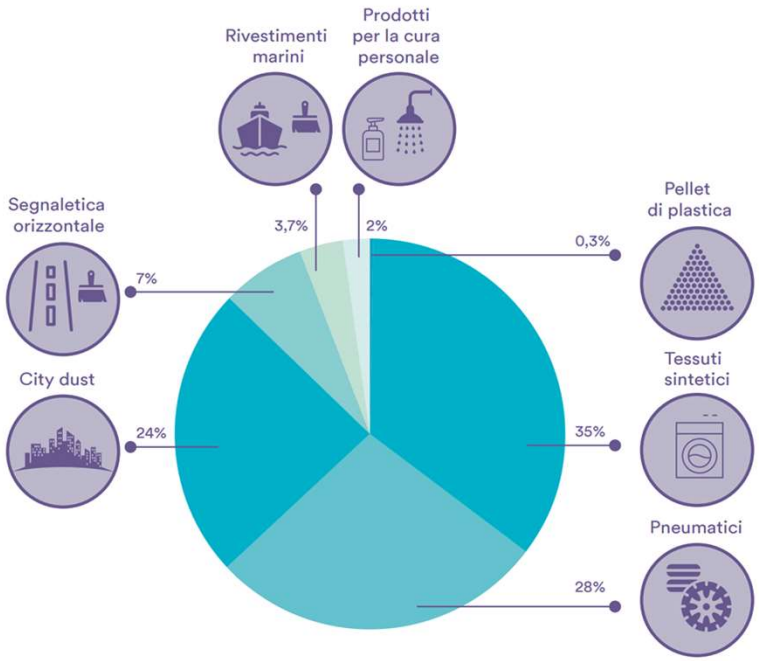
Microplastiche nel mare

- **0,8 milioni di tonnellate** – scenario **ottimistico**
- **1,5 milioni di tonnellate** – scenario **intermedio**
- **2,5 milioni di tonnellate** – scenario **pessimistico**

Se si considera anche la **gomma naturale** si passa da **1,5** a **2,0** milioni di tonnellate

Fonte: Julien Boucher, Damien Friot, *Primary Microplastics in the Oceans: A Global Evaluation of Sources*, IUCN International Union for Conservation of Nature, 2017.

Rilascio di microplastiche primarie negli oceani per fonte (in percentuale)



Fonte: Julien Boucher, Damien Friot, *Primary Microplastics in the Oceans: A Global Evaluation of Sources*, IUCN International Union for Conservation of Nature, 2017.

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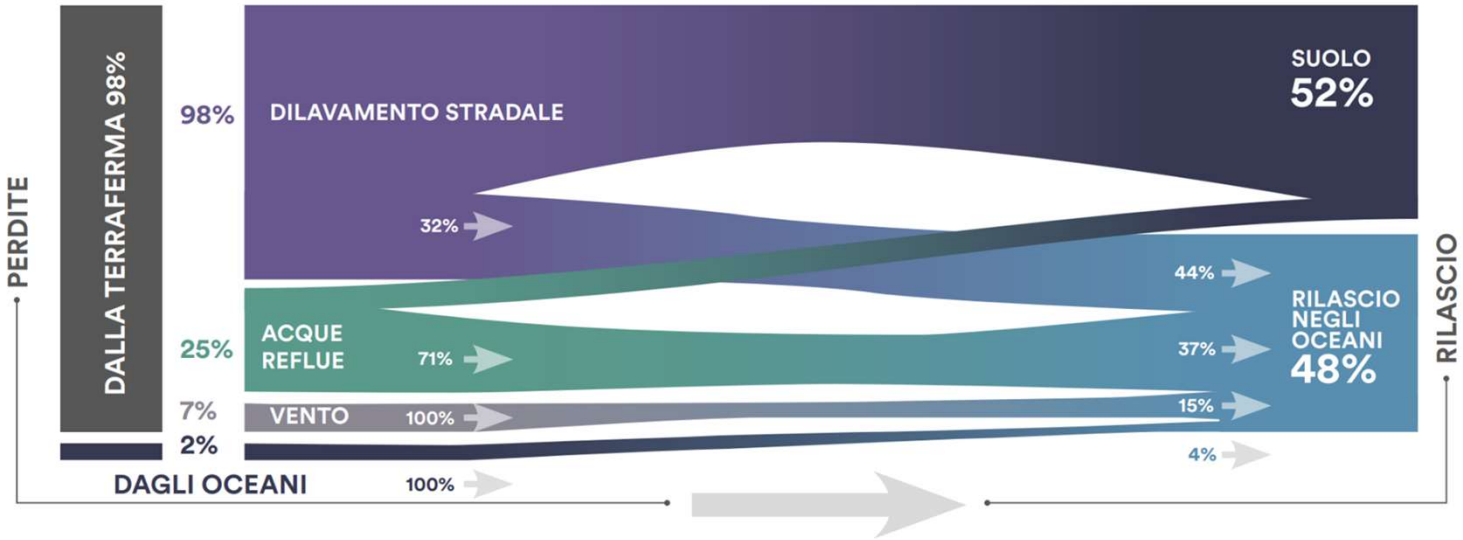
Via di rilascio di microplastiche primarie negli oceani



Fonte: Julien Boucher, Damien Friot, *Primary Microplastics in the Oceans: A Global Evaluation of Sources*, IUCN International Union for Conservation of Nature, 2017.

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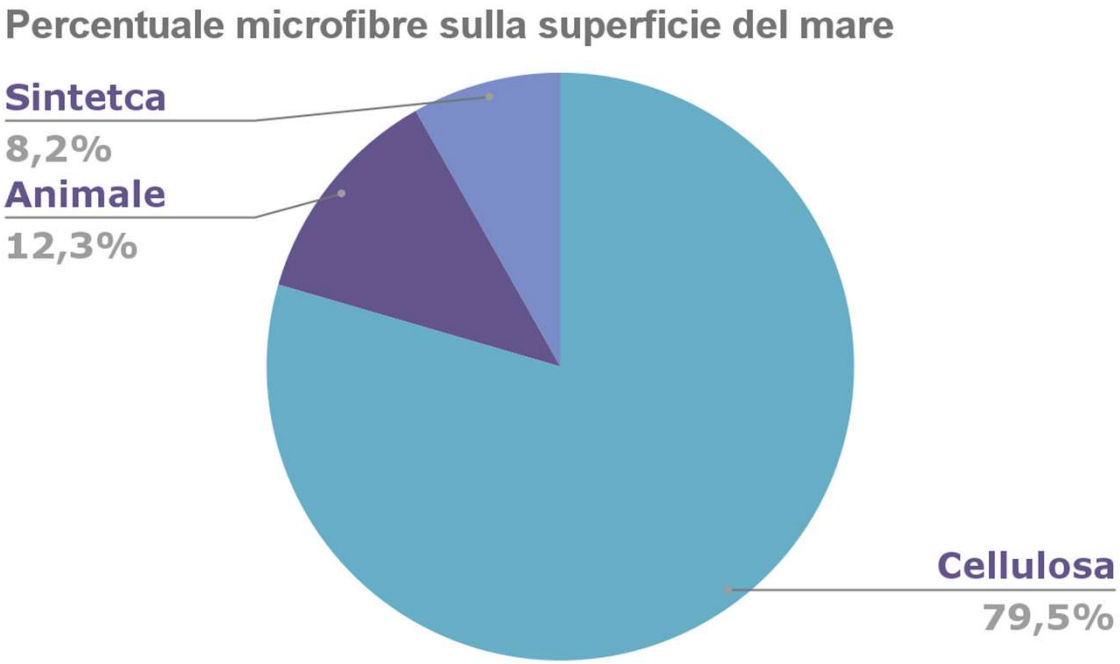


Fonte: Giuseppe Suaria, Aikaterini Achtypi , Vonica Perold, Jasmine R. Lee, Andrea Pierucci, Thomas G. Bornman, Stefano Aliani, Peter G. Ryan, *Microfibers in oceanic surface waters: A global characterization*, in “Science Advances”, 2020.

AN AVERAGE PERSON COULD BE INGESTING APPROXIMATELY 5 GRAMS OF PLASTIC PER WEEK. THE EQUIVALENT OF ONE CREDIT CARD.

Fonte: World Wide Fund For Nature, No Plastic in Nature: Assessing Plastic Ingestion From Nature To People, 2019

Ingeriamo mediamente 0,7g di plastica a settimana

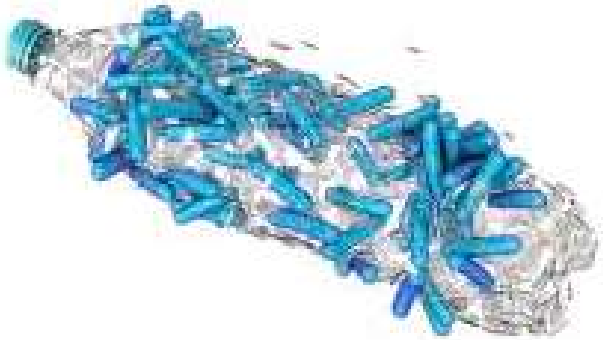
con un intervallo che va da **0,1** a **5g**.

Fonte: Kala Senathirajah, Simon Attwood, Geetika Bhagwat et al., Estimation of the Mass of Microplastics Ingested – A Pivotal First Step Towards Human Health Risk Assessment, in "Journal of Hazardous Materials", 404, 2021.

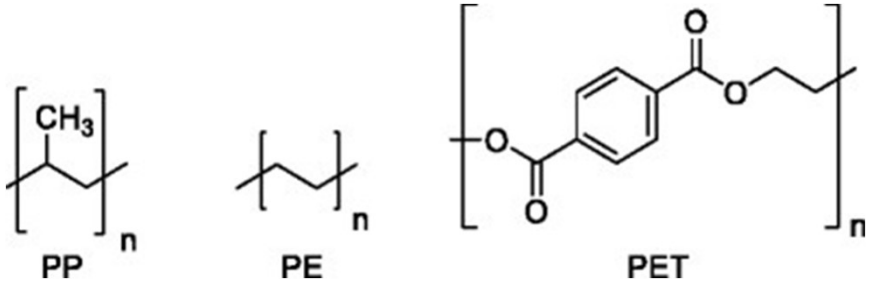
Non ci sono ancora abbastanza dati per una quantificazione dell'esposizione umana alle microplastiche.

Fonte: World Health Organization, *Dietary and Inhalation Exposure to Nano- and Microplastic Particles and Potential Implications for Human Health*, 2022.

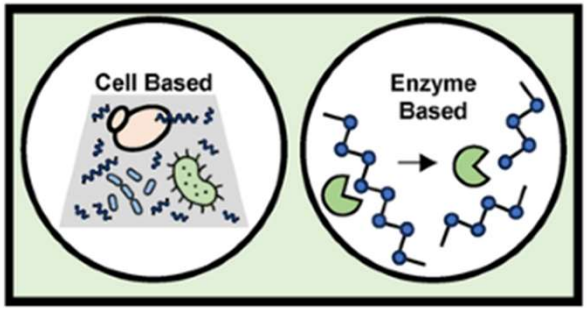
I batteri e gli enzimi «mangia-plastica»



1) Quale plastica?



2) Quale protagonista?



3) Quale scopo?

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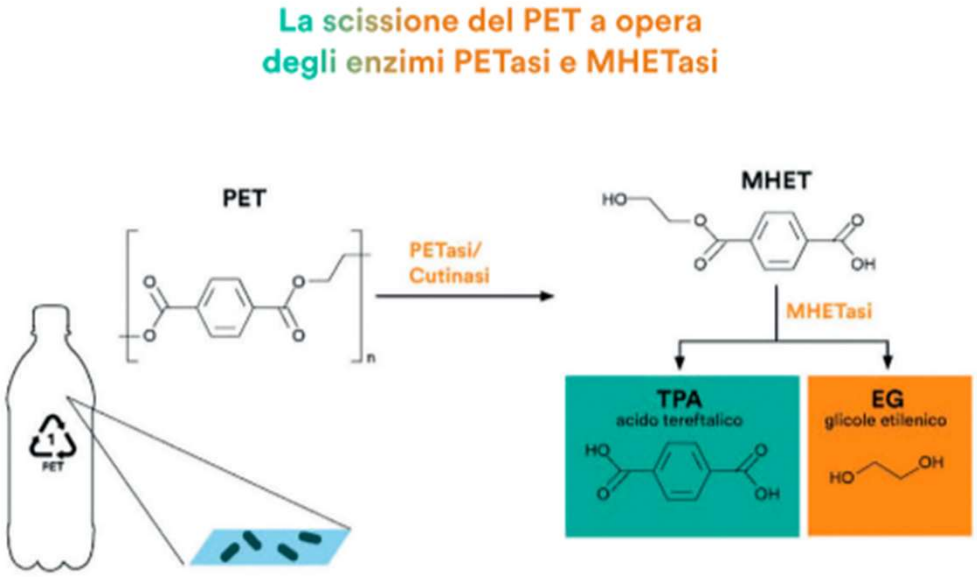
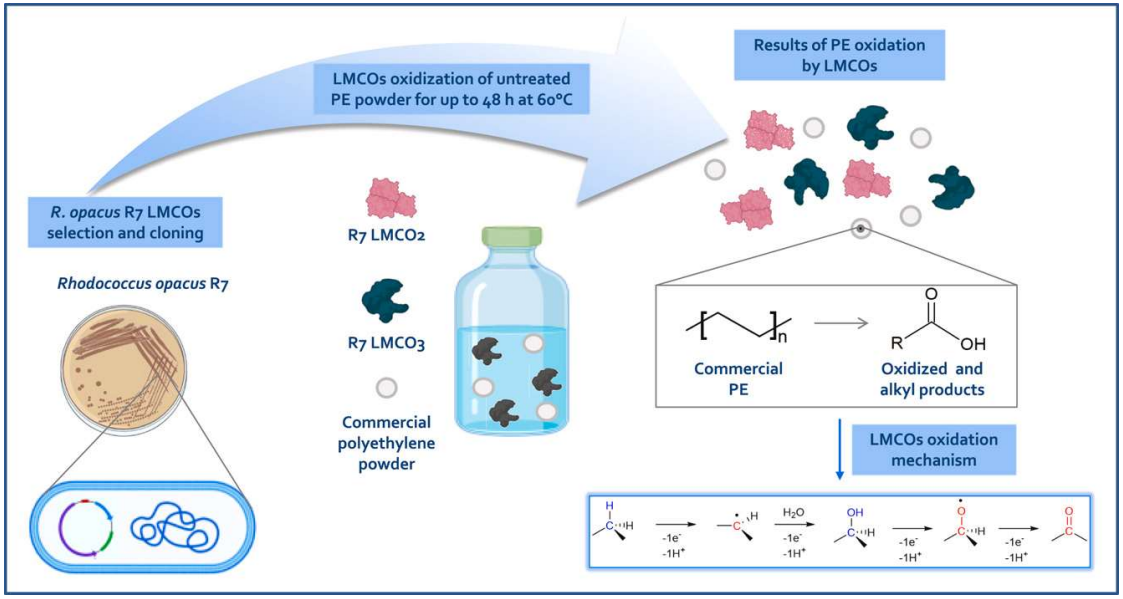


LMCO = laccase-like multicopper oxidases



Zampolli *et al.* (2023) - *Environmental Technology & Innovation*

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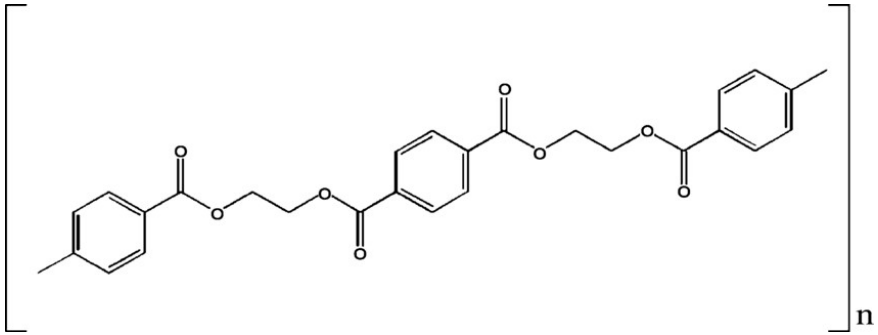

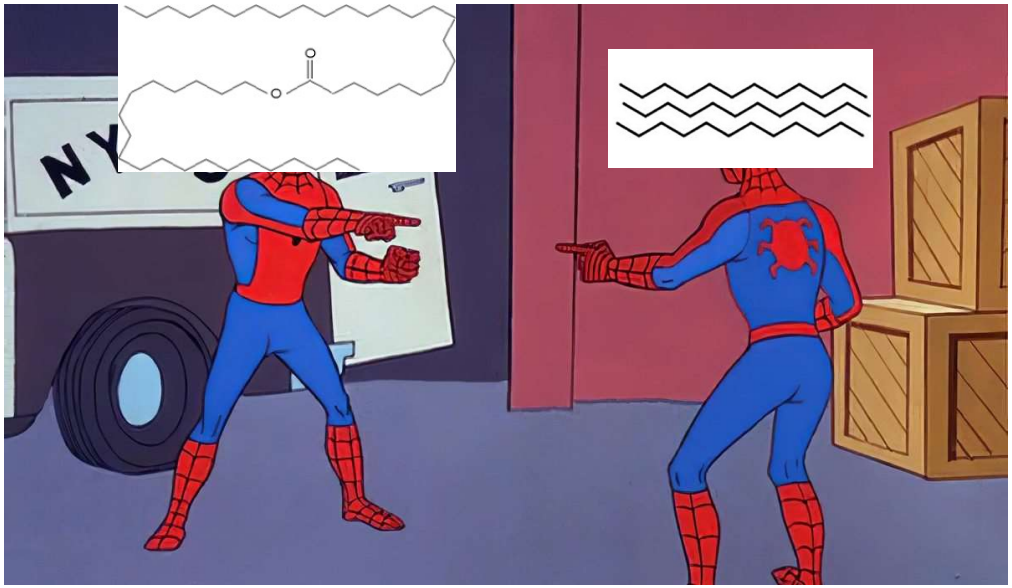

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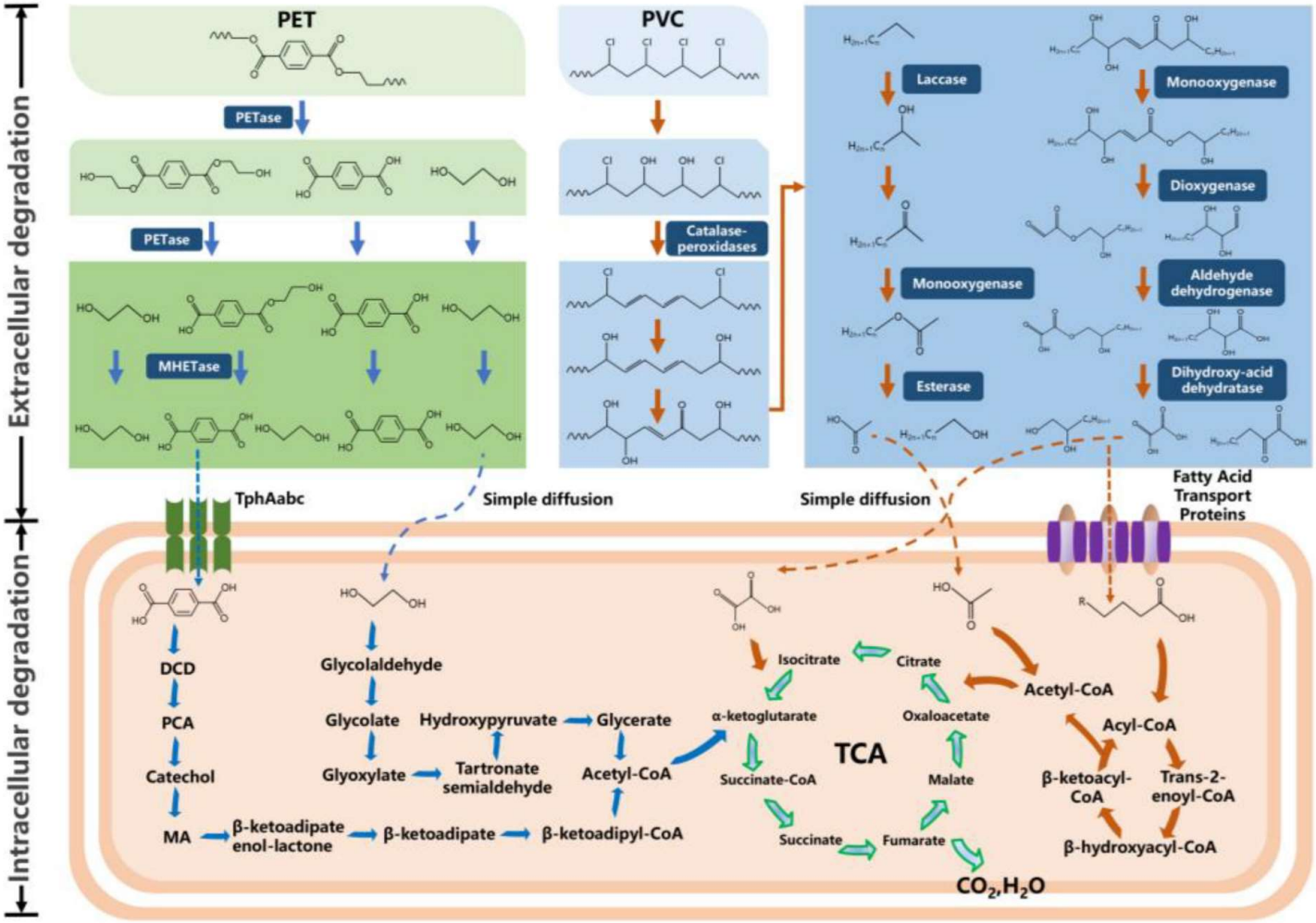
Gli enzimi «mangia-plastica»



Geo *et al.* (2024) - *Fermentation*

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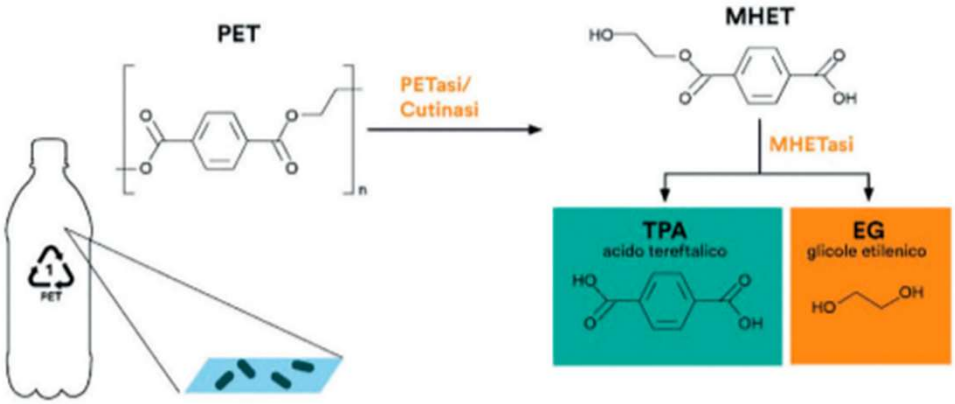
Downcycling



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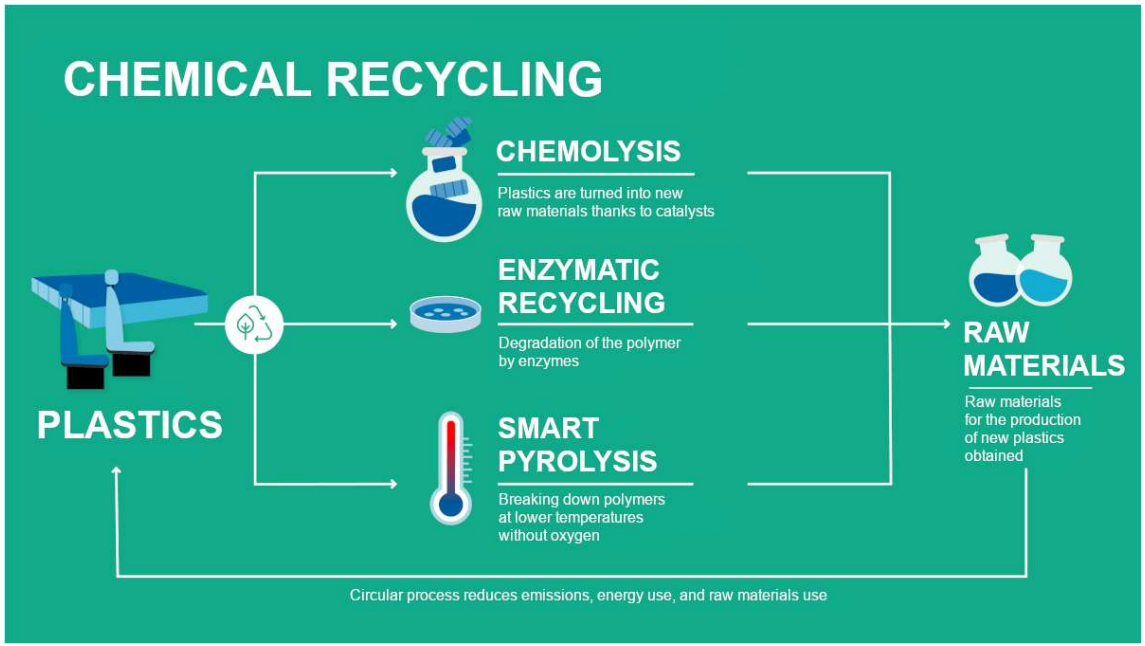

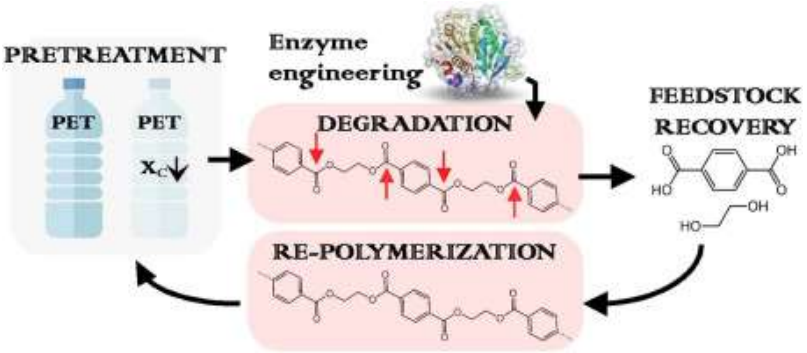

CARBIOS
Enzymes powering the Circular Economy

Chen *et al.* (2023) - *Current Opinion in Green and Sustainable Chemistry*

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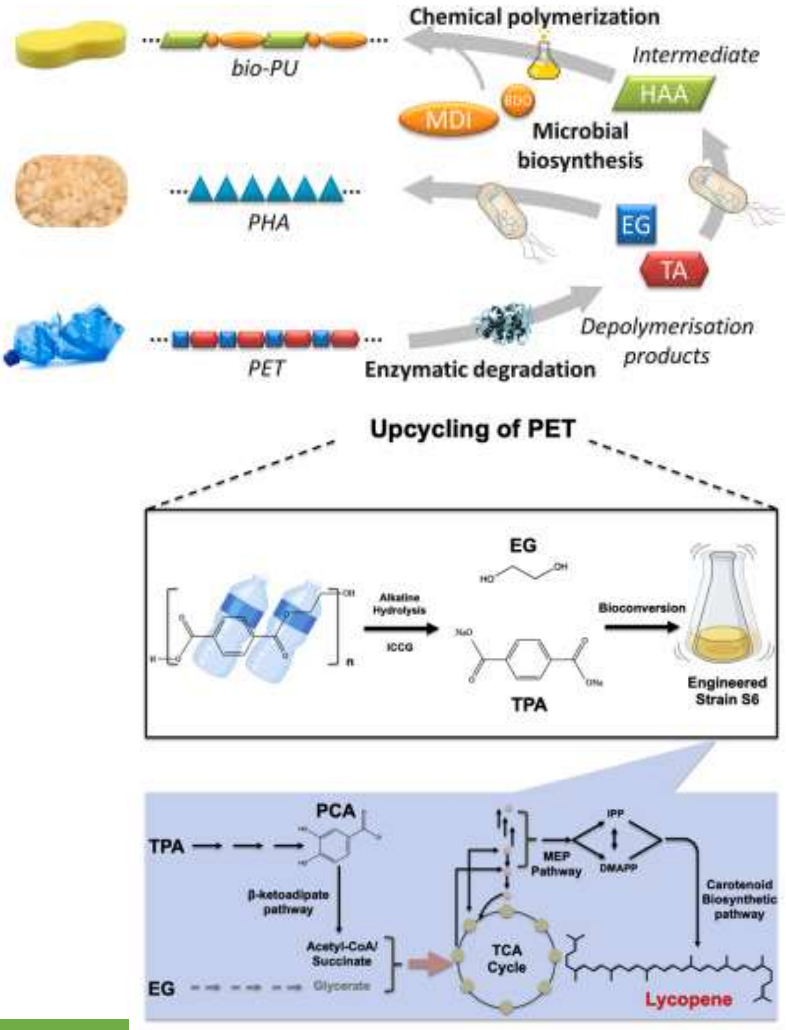
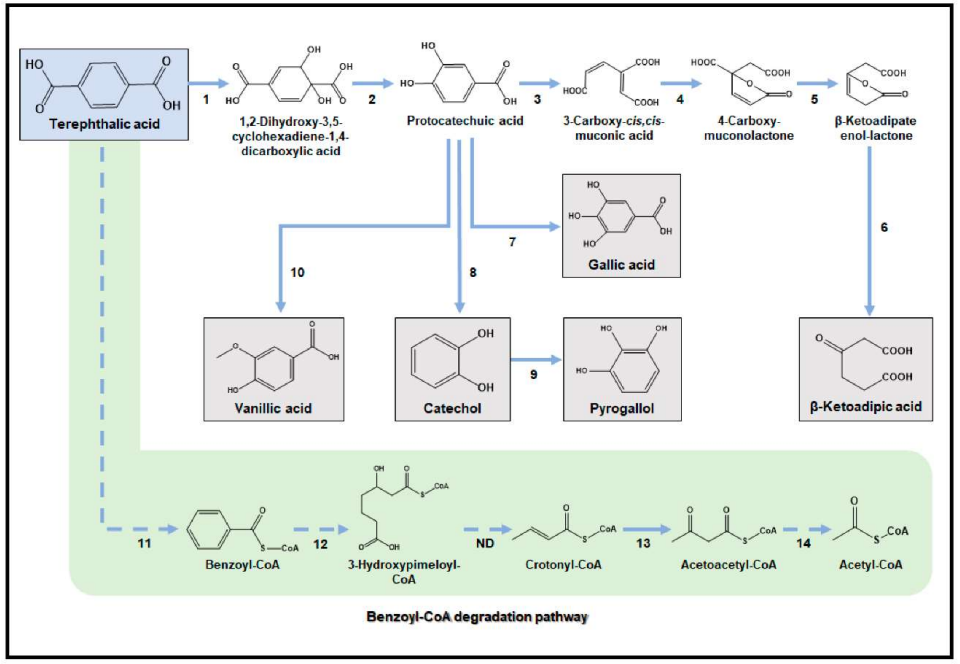
Upcycling

Tiso *et al.* (2021) - *Metabolic Engineering*



Diao *et al.* (2023) – *Cell Reports*



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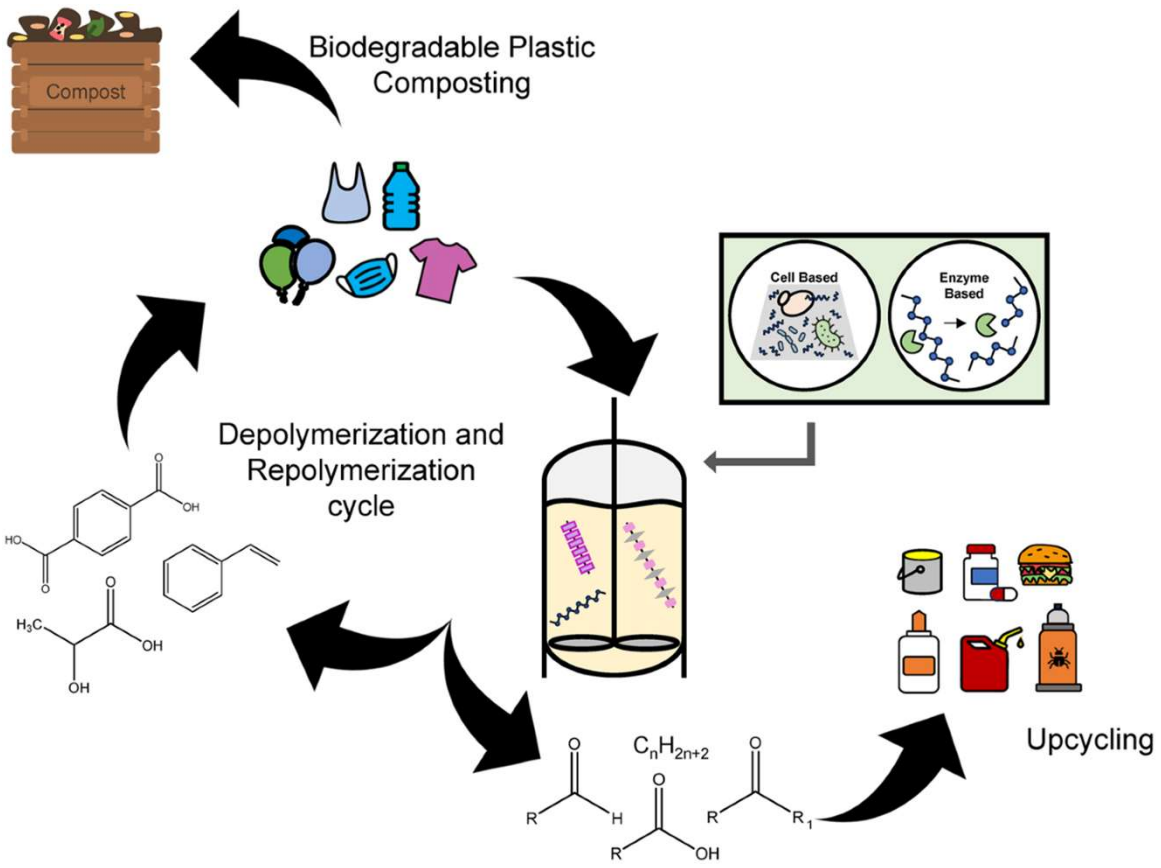

Bergeson *et al.* (2024) – *Nature Communications*

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