María José Pérez Crespo, commited listener, México

In silico Screening of Microbial Genes for Microplastic Adhesion

(who has the tools to adhere?)

Identify microbial genes involved in adhesion to microplastics (form biofilm) using high-throughput computational analysis.

Short-term (computational)

Retrieve adhesion-related protein sequences (NCBI, UniProt – biofilm, Surface proteins, Adhesins...)
Filter genes from selected microbes (e.g. *Pseudomonas, Bacillus, Vibrio*...)
Classify proteins by function (adhesins, biofilm-related, Surface proteins...)

Medium-term (Development)

Analyze protein (one by function) properties (**hydrophobicity**, charge, size... with peptiverse) -
Perform sequence alignment & clustering (clustal omega?)
Identify patterns linked to plastic interaction

Long-term (Visionary)

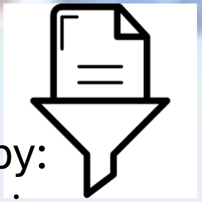
Useful to select top candidate genes
And suggest engineered proteins or microbial strains

Conclusion

Fully in silico
Predicts microbial genes/proteins involved in microplastic adhesión
Provides a data-driven foundation for future experimental or biotechnological applications

Database search

Sequence retrieval



Filtering by:
organism
function

Data analysis

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Computational Analysis of Microplastic–Protein Interactions
(Which tools stick to plastic type?)

Microplastics accumulate in the environment. Certain microbial proteins can adhere to plastic surfaces. This project predicts protein traits associated with microplastic adhesion using computational, high-throughput methods.

Short-term (Computational): Identify candidate adhesión proteins from microbial genomes

Retrieve protein structures (AlphaFold, PDB) related to adhesins, Biofil and Surface related proteins filtered by organism (Pseudomonas, Bacillus, Vibrio).
Simulate protein–plastic

Medium-term (Developmental): Analyze interaction patterns and protein features

Characterize physicochemical properties (hydrophobicity, charge)
Cluster proteins by predicted binding
Compare interactions across plastic types

Objective 3 – Long-term (visionary)

Identify top protein candidates
Suggest engineered proteins / strains
If posible, propose applications (bioremediation, coatings)

Conclusion

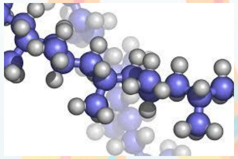
Fully **in silico, high-throughput** identification of adhesion proteins
Predicts **key traits** for microplastic interaction
Guides **future experimental validation and biotech applications**
Provides a **data-driven foundation** to tackle microplastic pollution

Search: Adhesion-related proteins

Filter: Focus on Pseudomonas, Bacillus, Vibrio

Generate Plastic surface

Simulate: Protein–plastic docking / interaction



Analyse and rank by adhesión potential

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Controlled Biodegradation of Microplastics in Sewage Sludge
Using Pseudomonas spp.

Aim 1 (Experimental):
Isolate and identify *Pseudomonas* from sludge
Test degradation of PET and PE

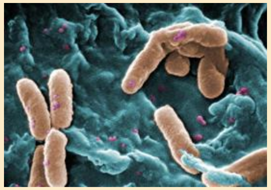
Aim 2 (Developmental):
Optimize conditions (pH, temperature, oxygen)
Test plastic pre-treatments

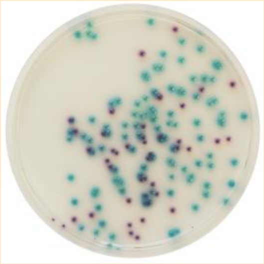
Aim 3 (Visionary):
Explore application in sludge treatment
Assess safety and scalability

Impact
- Reduce microplastics in biosolids
- Improve wastewater sustainability
- Enable bioremediation strategies

Concept
Controlled bacterial bioremediation of sludge


Sludge sampling


Isolation Pseudomona strand


Pure culture


Plastic exposure


Data analysis

María José Pérez Crespo, commited listener, México

Computational Identification and Simulation of Microbial Adhesion Proteins Interacting with Synthetic Polymers

Microplastics accumulate in the environment. Certain microbial proteins can adhere to plastic surfaces creating biofilm that behave as a vector for pathogenes and other bacterias. This project predicts protein traits associated with microplastic adhesion using computational, high-throughput methods.

Short-term – Computational

•Identify adhesion, biofilm, and surface proteins from microbial genomes (*Pseudomonas*, *Bacillus*, *Vibrio*) and evaluate their .
•Perform sequence alignment and clustering.
•Retrieve protein structures and model a synthetic polymer.
•Simulate protein–polymer interactions (docking).
Output: Candidate proteins predicted to bind polymer surfaces.

Medium-term – Development

•Analyze protein physicochemical properties (hydrophobicity, charge, structure).
•Compare interaction patterns across proteins and polymer types (Alphafold).
•Evaluate binding stability using molecular simulations.
Output: Identification of key features driving microbial adhesion to polymers.

Long-term – Visionary

•Select top protein candidates.
•Propose engineered proteins or microbial strains.
•Develop applications in bioremediation and biofunctional coatings.
Impact: Integration of synthetic biology and sustainable material design.

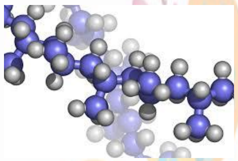
Conclusion

Fully **in silico, high-throughput** identification of adhesion proteins
Predicts **key traits** for microplastic interaction
Guides **future experimental validation and biotech applications**
Provides a **data-driven foundation** to tackle microplastic pollution

Search: Adhesion-related proteins

Filter by organism function: Focus on Pseudomonas, Bacillus, Vibrio

Generate Plastic Surface AND Simulate: Protein–plastic docking / interaction



Analyse and rank by adhesión potential

Analyze protein physicochemical properties AND interaction patterns across proteins and polymer types

Data analysis