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# Plastic-degrading microbial consortia: versatility study and design

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## Introduction

One of the most significant challenges we currently encounter is the impact of plastic accumulation on ecosystems. There are some alternative strategies to reduce contamination, such as biological degradation, which depends on the enzymatic characteristics of the microorganisms.
This work aims to demonstrate that microbial consortia are more effective for the degradation of plastics than their individual members, as well as to establish their best working dose. On top of that, another goal was to test the biodegradation in multiplastics.

## Experimental

The efficiency of the microorganisms to degrade 4 types of plastics was tested. The plastic included low-density polyethylene (LDPE), linear low-density polyethylene (LLDPE), polyethylene terephthalate (PET) and polystyrene (PS). For the determination of the plastic-degrading capacity, the bacterial growth using plastic as the sole carbon source was analyzed.
The first consortium, formed by *Pseudomonas* and *Bacillus*, were selected as suitable candidates for obtaining a plastic-degrading consortium. Their ability to degrade the plastics previously mentioned was determined, as well as the effect of inoculum dose. Additionally, the behavior of the consortium was compared to that of individual cultures.
Furthermore, several strains of *Pseudomonas* isolated from marine-environment plastics were used to select the ideal combination of three bacteria for degrading only LLDPE.
In all cases, a standardized inoculum was prepared ($10^5$ CFU/mL), except for when inoculum dose was analyzed ($10^3$,$10^5$ and $10^7$ CFU/mL), and added into a minimal medium with plastic 1% (w/v) as the sole carbon source. These cultures were carried out in a 48 well microplate. The incubation took place at 30ºC in a reciprocating shaker. Two samples were carried out at 15 and 30 days, and growth was quantified by counting viable cells on plates (Figure 1).

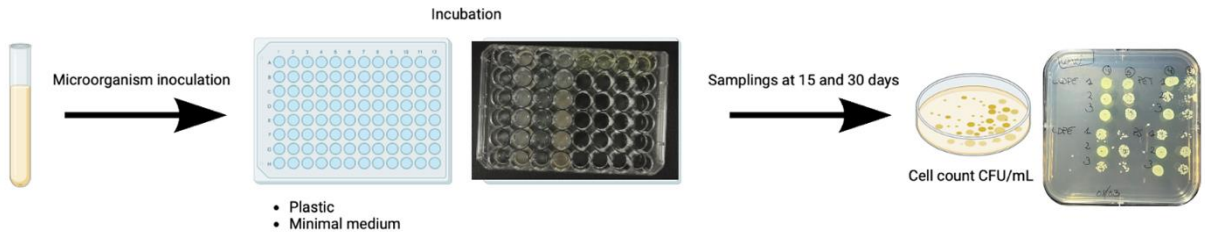


Figure 1. Experimental design workflow

**Results and Discussion**

The results showed that the *Bacillus-Pseudomonas* consortium grew better compared to the pure cultures. In addition, the best results were obtained when the consortium initial cellular concentration was very low. Results were not as positive in the attempt of obtaining a working consortium using the marine strains of *Pseudomonas*, since most of them lost viability with time.

**Conclusions**

This work confirms the effectiveness of using microbial consortia for the biodegradation of a wide range of plastics, in addition to prove the importance of the initial inoculum concentration. Lower initial inoculum concentrations improved the growth of the consortia on media with plastic as the sole carbon source. The consortium formed by *Bacillus* and *Pseudomonas* presents excellent qualities for the degradation of LLDPE, LDPE, PET and PS plastics.

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**Biography**

After obtaining her Bachelor's degree in Biotechnology, Silvia Cabello is currently pursuing a Master's degree in Industrial and Agro-food Biotechnology at the University of Almeria (UAL). Over the past two years, she has been collaborating in the research group of the Microbiology Area at UAL, gathering specialized knowledge in bioremediation.