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THE IMPACT AND INTERACTION OF UNICELLULAR GREEN ALGAE WITH BIO-BASED PLASTICS

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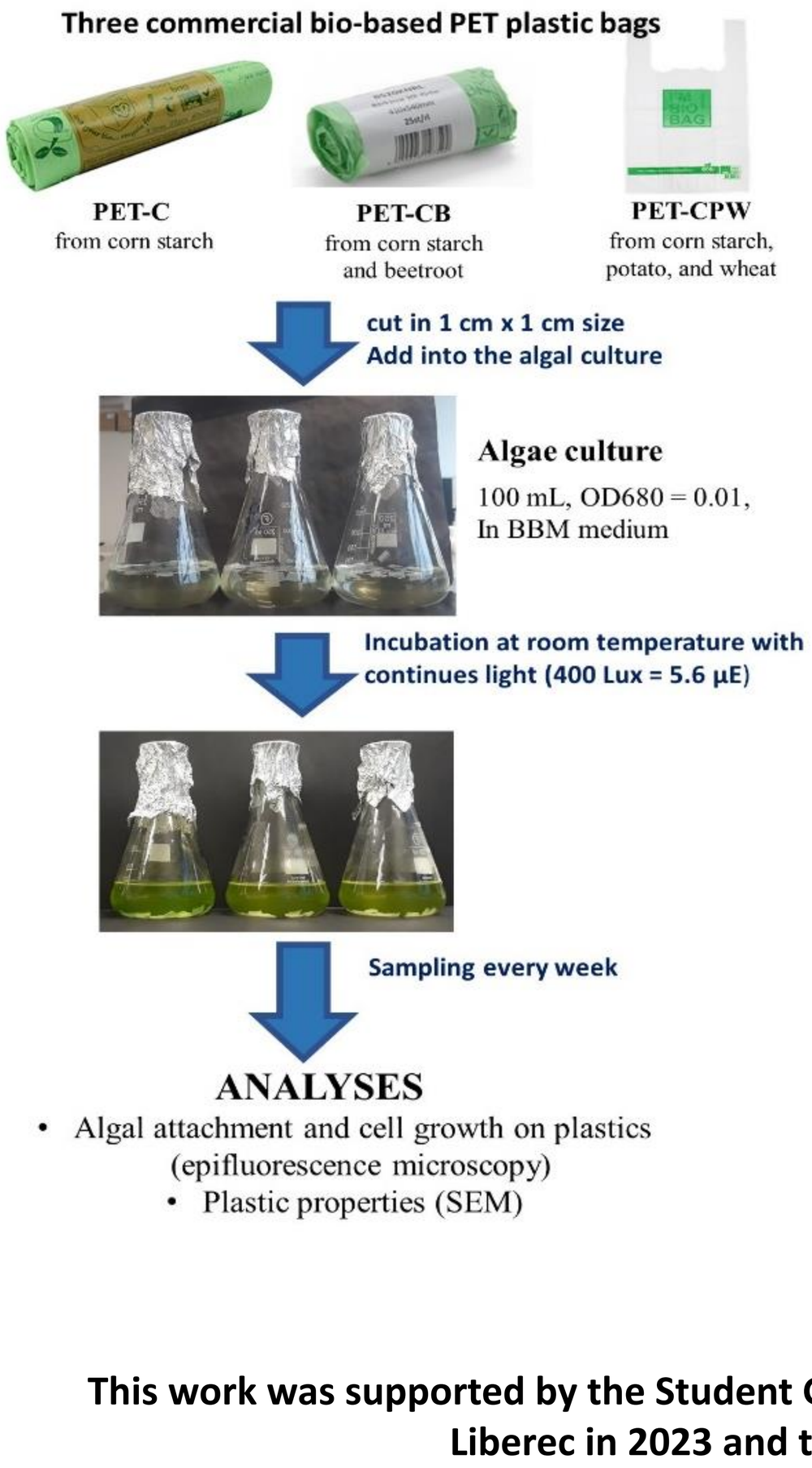
ABSTRACT

In this experiment, the attachment of two strains of freshwater unicellular green algae, *Chlamydomonas reinhardtii* and *Raphidocelis subcapitata* on three types of starch-based polyethylene terephthalate (PET) plastic bags PET-C made from corn starch, PET-CB (made from corn starch and beetroot), and PET-CPW made from corn starch, potato and wheat, was studied as the initial phase of plastic degradation.

INTRODUCTION

Following the growing concern about fossil-based plastics pollution, the fast growth of bio-based plastics as its alternativ is also rising. The bio-based plastics derived from renewable biological sources, are believed to be more environmentally friendly. However, their biodegradation and fate in the environment are not fully understood. Therefore, the aim of this study was to investigate the impact and interaction of natural microbes, unicellular green algae, with bio-based plastics.

METHODOLOGY



RESULTS AND DISCUSSION

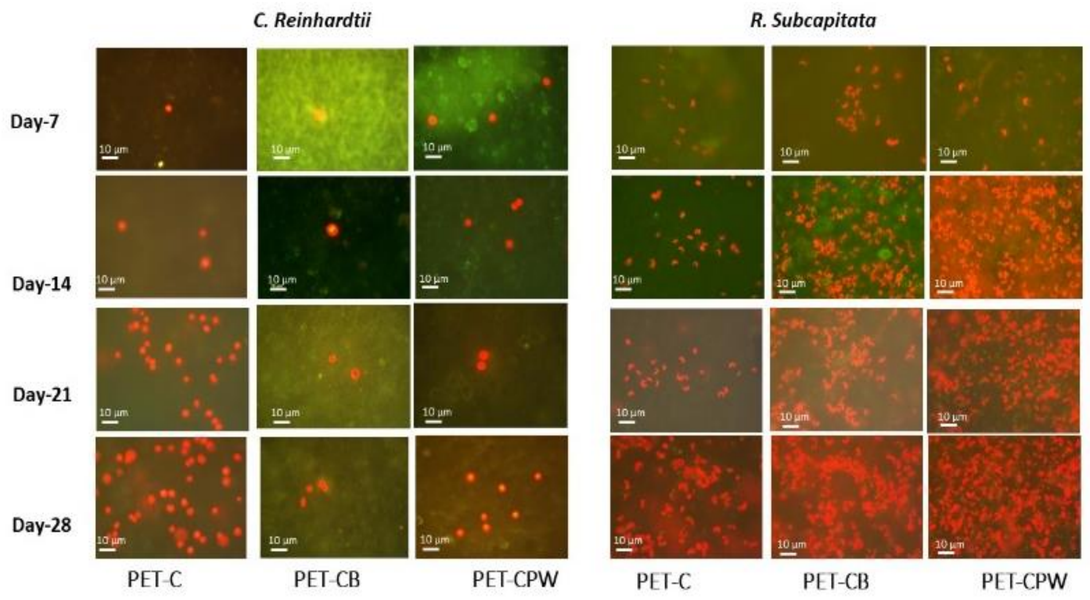


Fig 1: Algal attachment on the surface of bio-based plastics

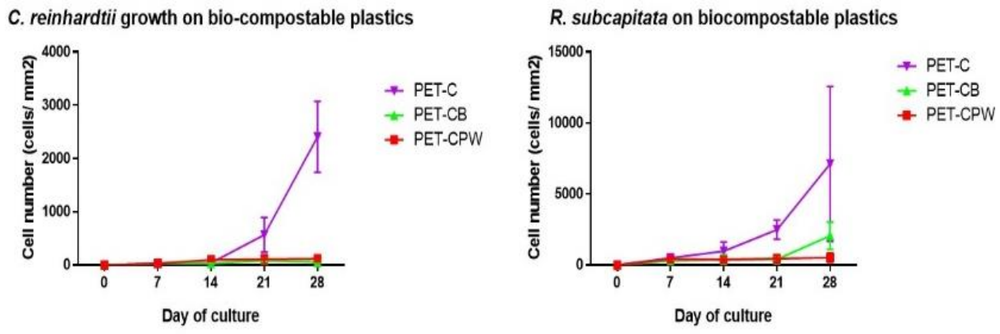


Fig 2: Algal growth on the surface of bio-based plastics

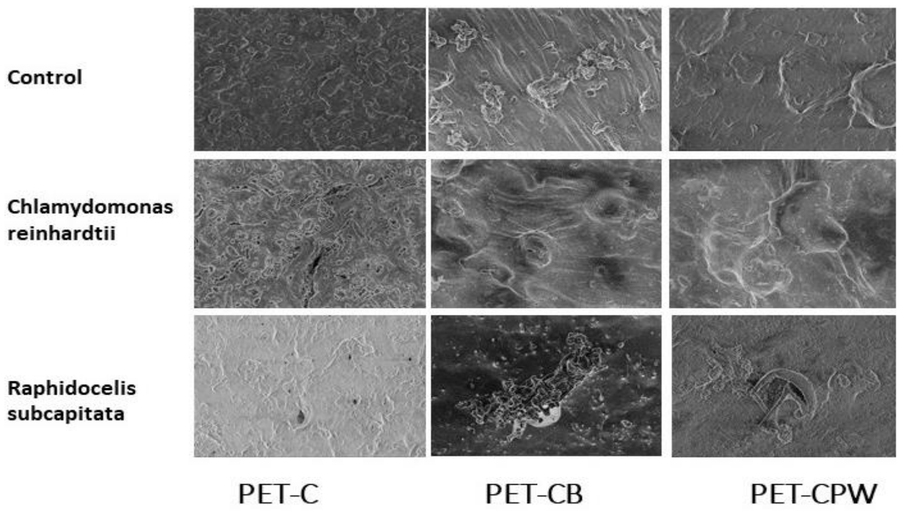


Fig 3: Morphology of the surface of bio-based plastic surface at day-72

Unicellular green algae, *Chlamydomonas reinhardtii* and *Raphidocelis subcapitata*, able to attach and colonized PET bio-based plastics, especially PET-C made from corn starch. The process of algal attachment involved two steps, initial adhesion to the surface of material and the thickening of biofilm formed by algae. Non-axenic culture produced high biofilm and extra polymeric substrated (EPS) that support stronger attachment and colonization on the membrane surface (Tong et al., 2022).

Study by Kumar et al., (2017) in Amobonye etall., (2021) showed that algae including *Scenedesmus dimorphus*, *Anabaena spiroides* and *Navicula pupula* are able to degrade high density and low-density PE. The SEM results showed that Chlamydomonas reinhardtii able to change the morphology of the bio-based plastic surface at day-72 (Figure 3.). Further study must be conducted to investigate the mechanisms of algae to involve in plastic bio-degradation.

REFERENCES

1. Amobonye, A., Bhagwat, P., Singh, S., and Pillai S., 2021, Plastic biodegrdation: Frontlline microbes and their enzymes, Science of the Total Environment, DOI: 10.1016/j.scitotenv.2020.143536
2. Tong, C. Y., Lew, J. K., Derek, C. J. C., 2022. Algal extracellular organic matter pre-treatment enhances microalgal biofilm adhesion onto microporous substrate, Chemosphere 307:135740

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