

JOINT AEROBIC BIODEGRADABILITY OF POLYESTER AND COTTON MICROFIBERS AND LAUNDRY SURFACTANTS

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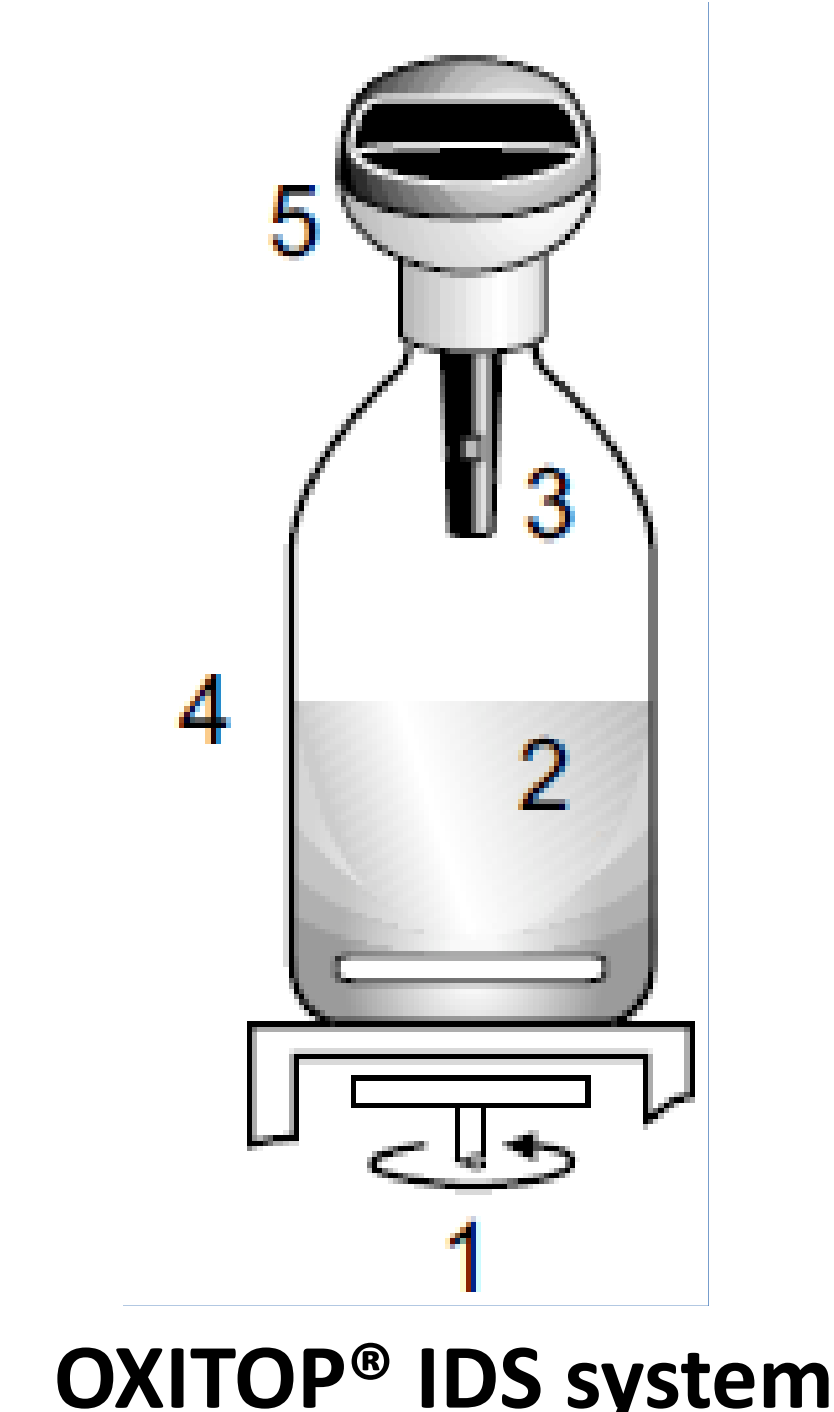
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Introduction

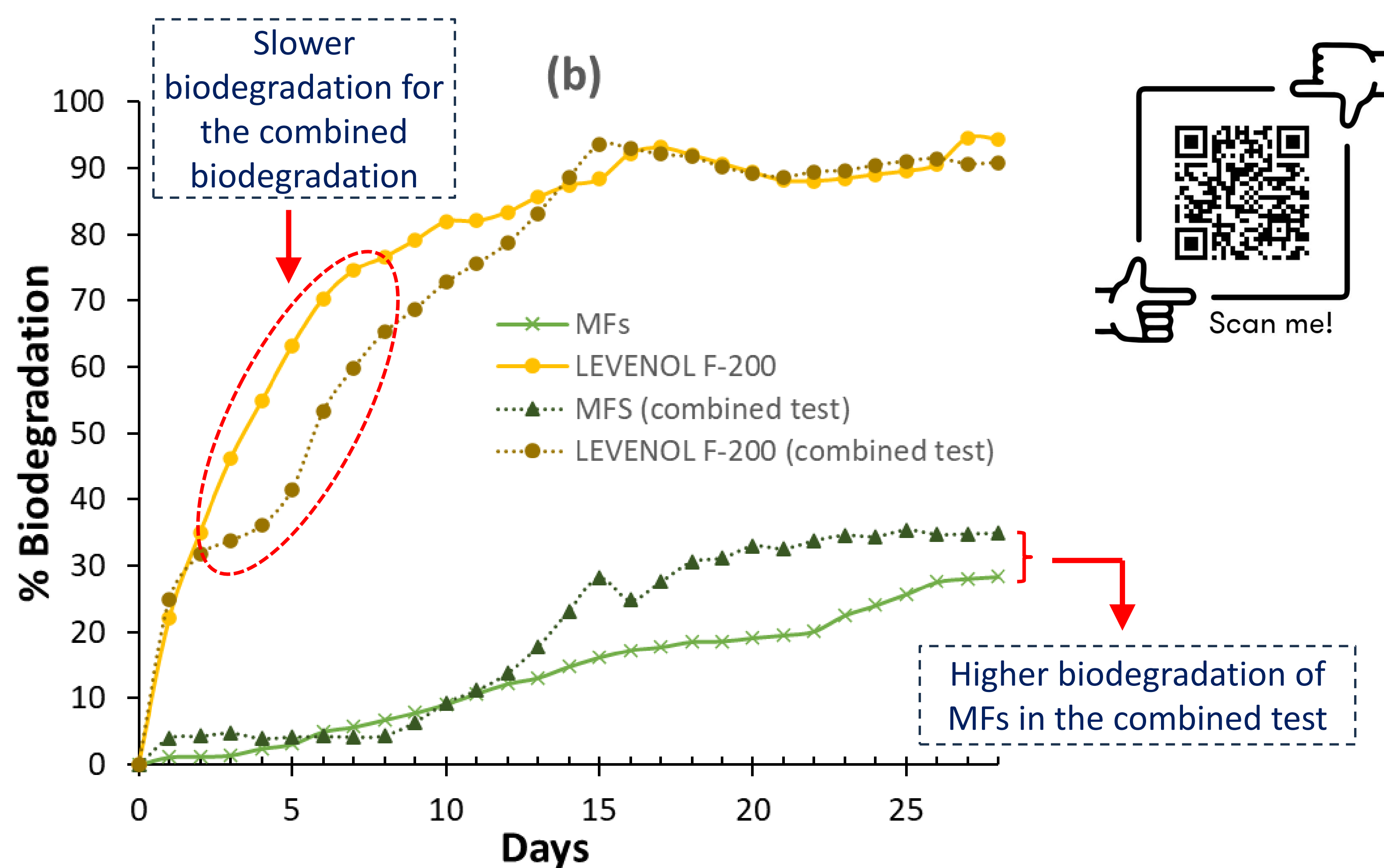
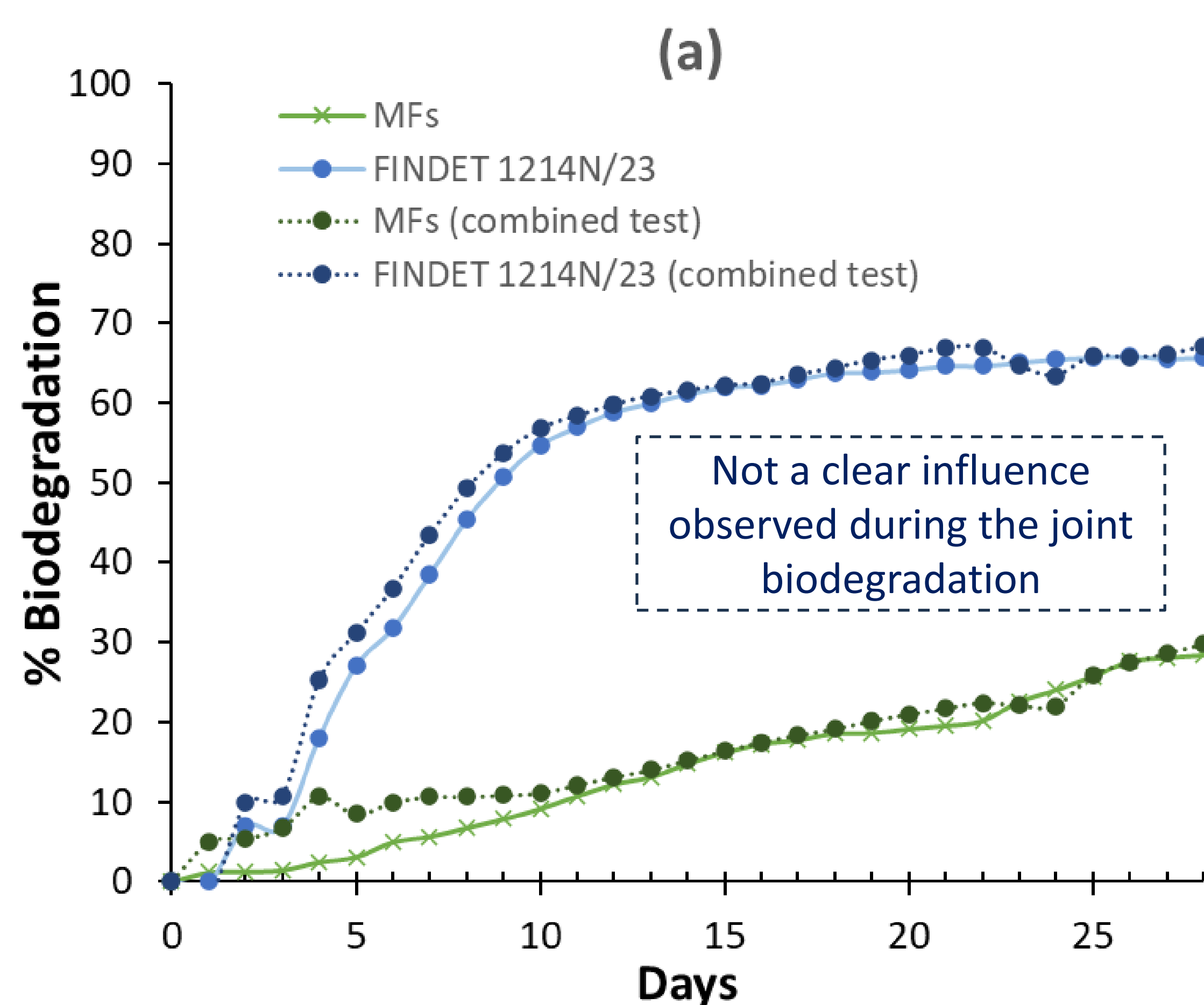
During each wash of clothes, millions of **natural and plastic microfibers (MFs)** are released due to friction generated during the washing. Up to 20% of these cannot be captured in WWTP and are released into aquatic environments. Several studies have remarked the environmental problems caused by MFs, which are **toxics** for some aquatic organisms and **persistent in the environment** [1]. Due to its larger surface area and hydrophobic properties they can adsorb toxic surface- compounds, while can be ingested by aquatic organisms becoming part of the trophic chain. MFs are mainly found in wastewater in combination with surfactants which pose a severe environmental threat to the ecosystems [2]. It is unclear how surfactants can affect to the biodegradability of MFs, or how MFs can affect the biodegradability of surfactants. In this **work we study the aerobic biodegradation of microfibers from polyester/cotton fabric in combination with non-ionic surfactants from laundry products.**

Materials and Methods

- **Microfibers:** A commercial fabric composed by 65:35 polyester/cotton was ground using cryogenic milling (Freezer Mill 6870) to obtain microfibers with an average length of 400 μm and 10 μm width.
- **Surfactants:** two commercial non-ionic surfactants supplied by Kao Corporation (Tokyo, Japan) were tested. The fatty alcohol ethoxylated, FINDET®1214N/23 (a) and the polyoxyethylene glycerol ester LEVENOL® F-200 (b).
- **Aerobic Biodegradation test:** conducted following the OECD 301F method and using the OXITOP®-IDS system. Activated sludge from the local WWTP served as the source of microorganisms. Substances were tested in duplicate at 50 mgThOD/L during 28 days at 22°C in the dark.



Results



The surfactants FINDET 1214N/23 and LEVENOL F-200 are aerobically biodegradable, as they surpass the 60% threshold described by the OECD 301F method. The MFs from the polyester-cotton fabric (65:35) are not aerobically biodegradable, reaching only a percentage close to 30%, which correlates with the cotton content in the MFs.

Conclusions

- MFs from the cotton-polyester fabric are not biodegradable, and the biodegradation percentage can be attributed solely to the cotton fraction.
- The presence of MFs can affect the biodegradation course of LEVENOL F-200, while this surfactant also promotes the mineralization of the biodegradable part of the MFs.

References

- [1] Zambrano, M.C., Pawlak, J.P., Daystar, J., Ankeny, M., Cheng, J.J., Venditti, R.A. Microfibers generated from the laundering of cotton, rayon and polyester based fabrics and their aquatic biodegradation. (2019), Marine Pollution Bulletin, 142, 394-407.
- [2] Ríos, F., Lobato-Guarnido, I., Fernández-Serrano, M. Antagonistic toxic effects of surfactants mixtures to bacteria *Pseudomonas putida* and marine microalgae *Phaeodactylum tricornutum*. (2023), Toxics, 11, 344.