

# Anaerobic digestion of bioplastics: potential recovery of methane from bio-shopper

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## Introduction

The excessive amount of conventional plastic polymers put on the market and their use in numerous commercial applications represents an issue of global concern (Y. Tokiwa, 2009). To date, bioplastics represent a valid alternative to conventional polymers.

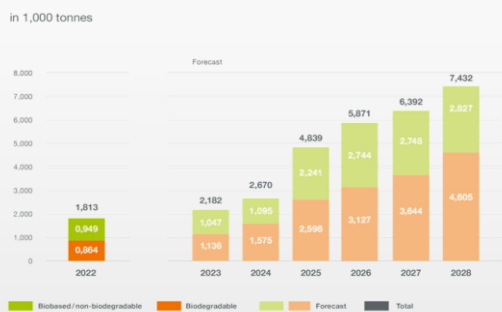


Figure 1. Global production capacities of bioplastics (Source: <https://www.european-bioplastics.org/>).

These materials have had a rapid spread on the global market since 2019, the year in which the European Parliament voted in favor of a directive to limit the use of single-use plastics (Directive EU 904, 2019).

## Materials & Method

The aim of the experimental study is the analysis of the behavior of bio-shoppers in the anaerobic digestion of Organic Fraction of Municipal Solid Waste, by the biochemical methane potential test (BMP).

This technology consists of a batch experiment (each reactor having a volume of 500 ml), aimed at determining the maximum methane potential of an organic substrate.

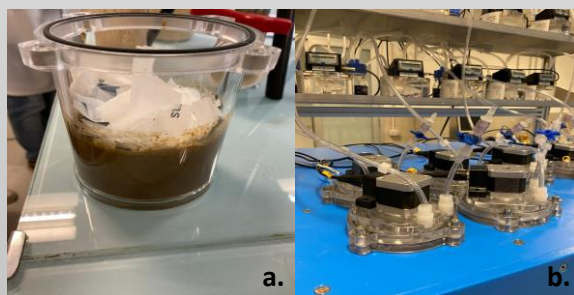


Figure 2. a) Reactor with inoculum and substrate; b) BMP instrumentation.

The substrates, certified as compostable (UNI EN 13432:2002 standard), were mixed with a culture of anaerobic bacteria, from an anaerobic digestion plant and compared with cellulose (positive control), according to an Inoculum/substrate=3, referring to volatile solids (VS).

## Future perspectives

- Subsequent experiments will involve the use of different bioplastic matrices.
- New BMP tests are planned under thermophilic conditions (55-57 °C) and with lower particle sizes.
- It will be replicated in a semi-continuous reactor, at laboratory scale, a typical anaerobic biodegradation process that takes place on an industrial scale, by analyzing the degree of biodegradation of bioplastics.

Table 1. Quantity of input to the BMP process

n. reactor	Inoculum [g]	Cellulose [g]	Substrate [g]
R1	400	-	-
R2	400	-	-
R3	400	14	-
R4	400	14	-
R5	300	-	7,5
R6	300	-	7,5
R7	300	-	7,5

## Results

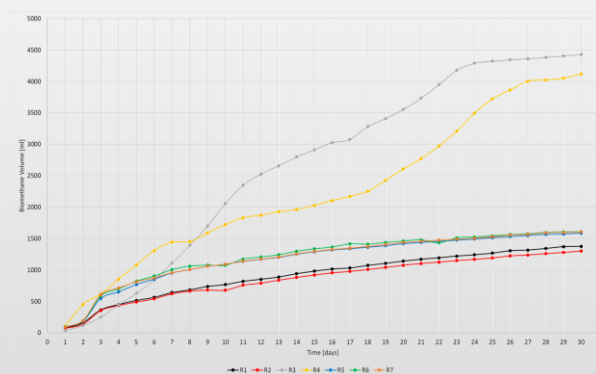


Figure 3. Curves of cumulative production of Bio-methane.

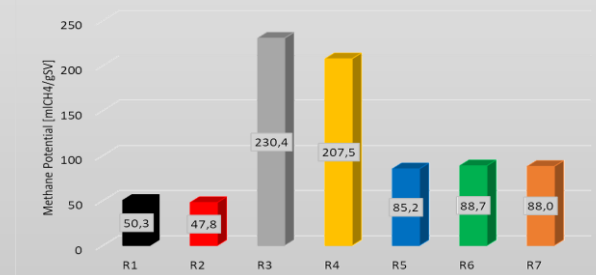


Figure 4. Methagenic potential diagram for each reactor

- The biomethane production curves, in particular of the R5, R6, R7, had an increasing trend throughout the test.
- The methane potential of reactors with inoculum and substrate is around 90 mlCH<sub>4</sub>/gVS, a value that is around 65%–70% compared to the contribution of cellulose alone.
- The BMP values of reactor with bioplastic substrate tends to increase with a longer test period.

References.

- Y. Tokiwa, (2009). Biodegradability of Plastics. *International Journal of Molecular Sciences*.
- European Bioplastic, 2021. (2022).
- Norma UNI EN 13432. (2002).

