A TREASURED RECYCLING TECHNIQUE FOR WASTE TETRA PAK PACKAGING MATERIALS

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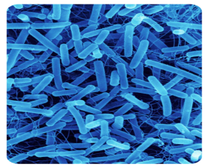
BACKGROUND

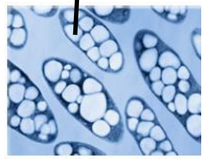
- **Tetra Pak (TP)** is a type of packaging widely used for aseptically packaging billions of litres of liquid food items, such as milk and juice.
- Due to their inability to be biodegraded and fully recycled, waste Tetra Pak packages accumulate in landfills, consequently leading to several environmental pollution.
- L**ow density polyethylene** (LDPE); a synthetic plastic component within the packaging material causes negative toxic effects on human and animal health.
- With the high yearly generation of 188 billion tonnes of waste Tetra Pak, there is the need to seek alternative ways of recycling waste tetra pak to yield end products that are economical and environmentally safe
- To reduce the environmental impact of waste tetra pak, this study proposes a **novel recycling technique of using the LDPE component in tetra pak wastes as a source of feed for the production of bioplastics (polyhydroxyalkanoates - PHA) by *Cupriavidus necator*;** a bacterial strain.
- **PHAs** are **biodegradable bioplastics** that can be synthesized from a wide range of carbon sources by many bacteria strains; having the potential of replacing and minimizing the hazardous impact caused by synthetic plastic waste.

Tetra pak packages



Cupriavidus necator

Intracellular PHA granules

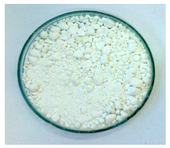


Bioplastics from PHA

METHODOLOGY

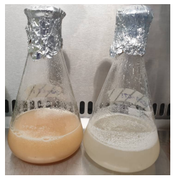
Tetra pak

Tetra Pak was pre-treated to obtain LDPE using solvent separation techniques



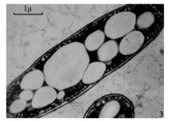
LDPE

0.50 g of LDPE was added into the fermentation flaks



Fermentation

fermentation flasks containing *C.necator* and LDPE in either Tryptone soy broth (TSB) or Basal salt medium (BSM) was incubated for 48 h at 30°C

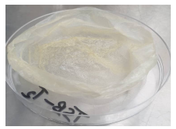


PHA in *C.necator*

PHA in *C.necator* was extracted using chloroform for 48 h

Extraction and purification of PHA

Extracted PHA was purified using rotatory evaporation and hexane precipitation



Purified PHA bioplastic

RESULTS AND DISCUSSION

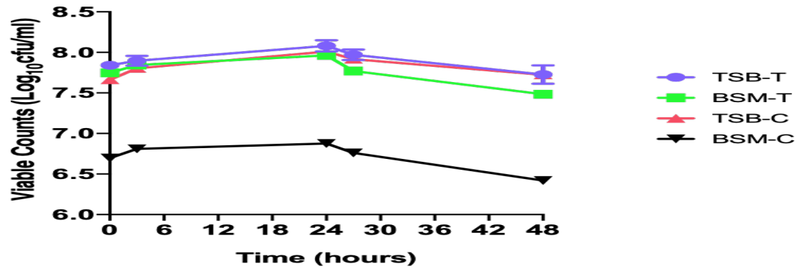


Figure 2:Growth observation of *C. necator* with 0.5 g of TP in either TSB or BSM medium after 48 hours of incubation at 30°C.

- Highest growth was observed in TSB culture supplemented with TP (TSB-T) showing that the addition of TP to TSB stimulated the growth of *C.necator* in TSB compared to TSB only (TSB-C).

Fermentation medium	Average cell dry weight (g/L)	Average PHA (g/L)	PHA (%w/w)
TSB only (TSB-C)	0.865	0.013	1.5%
BSM only (BSM-C)	0.073	ND	ND
TSB with TP (TSB-T)	0.820	0.33	40%
BSM with TP (BSM-T)	0.087	ND	ND

Table 1:PHA yield obtained from each fermentation study.

- Highest PHA yield (40%) was observed when TSB was supplemented with TP (TSB-T) showing that the addition of TP not only increased the growth of *C.necator* but also stimulated the production of PHA when compared to TSB only (1.5%)

CONCLUSION

This study shows that Tetra Pak waste containing polyethylene is a suitable and cheap carbon source for the production of bioplastic (polyhydroxyalkanoate) by *Cupriavidus necator.*