# "PHYSICOCHEMICAL CHARACTERIZATION OF POLY-3-HYDROXYBUTYRATE PRODUCED *BY BULKHOLDERIA XENOVORANS* LB400"

Claudia Sanhueza Sanhueza

PhD student on Doctoral program in Science of Natural Resources

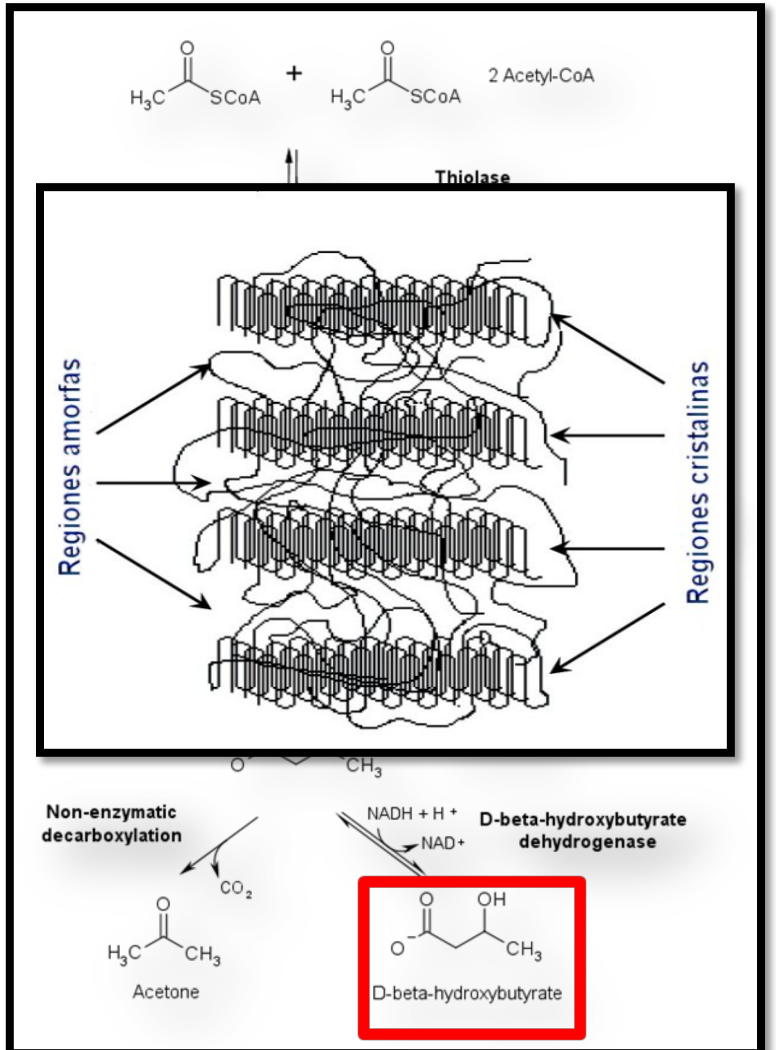
c.sanhueza07@ufromail.cl

Tutor: Francisca Acevedo

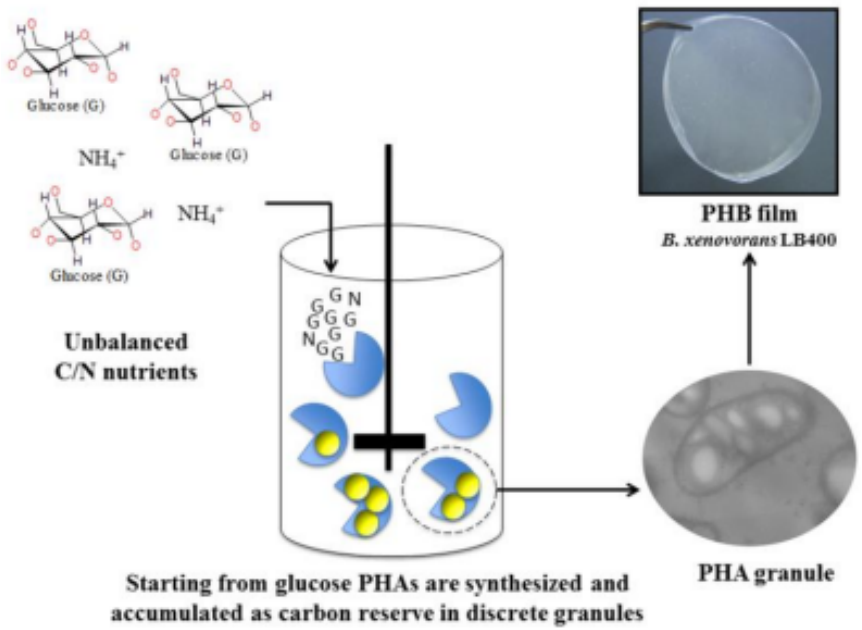
# Introduction

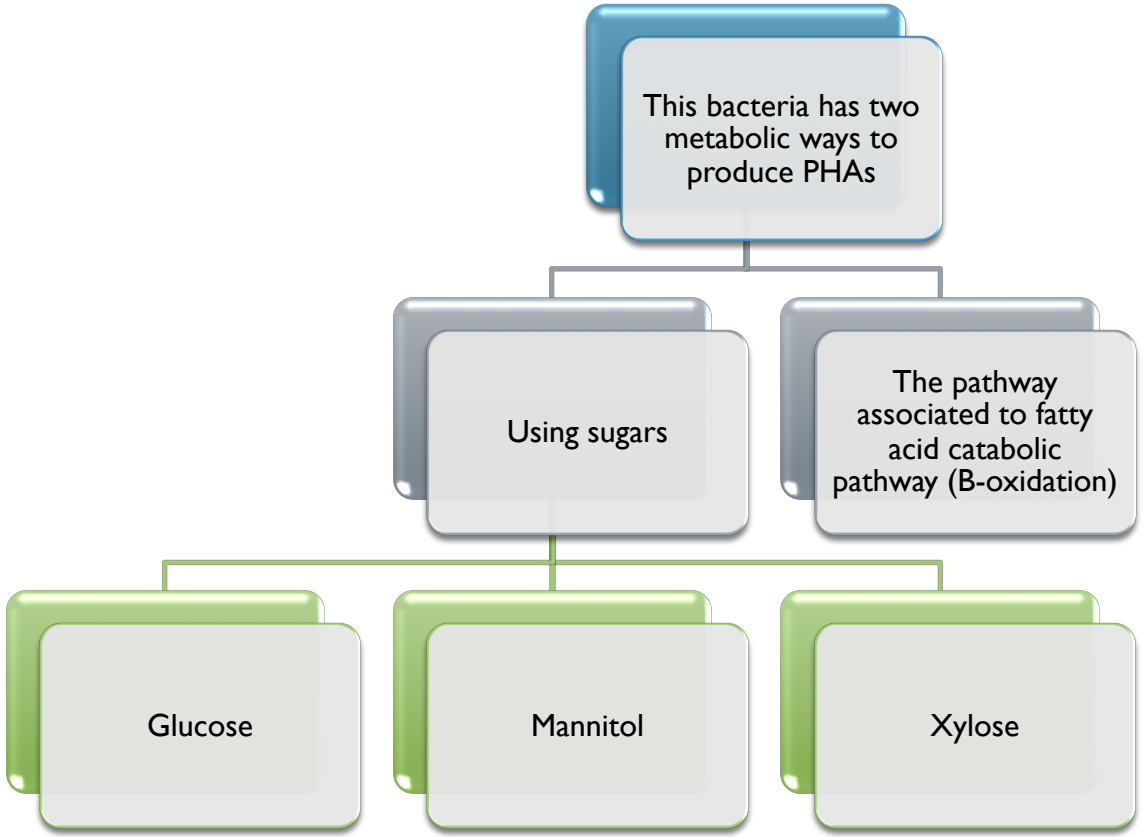
## *Poly-3-hydroxybutyrate*

- The PHB is a biopolymer produced by a wide variety of microorganisms
- It is a semicrystalline polymer
- It is Biodegradable, biocompatible and non-toxic
- Its monomer is commonly found in mammals as product of fatty acid catabolism
- It is approved by the U.S. Food & Drug administration



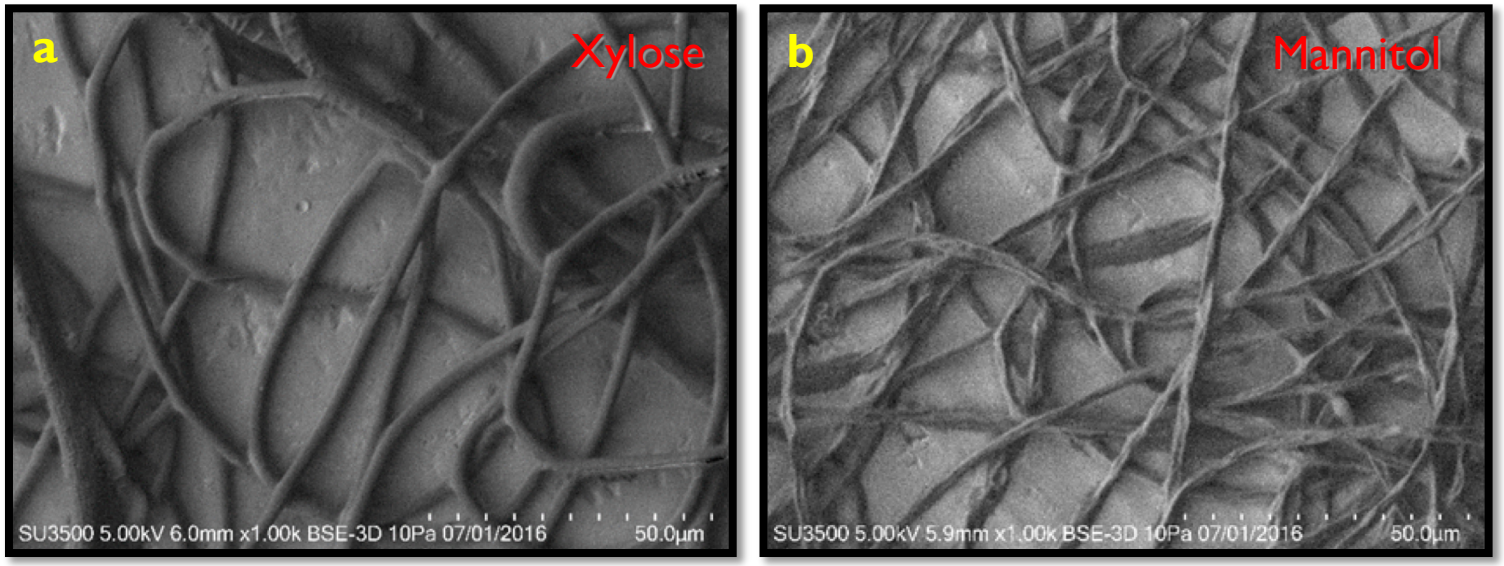
## *The PHB synthesis by Burkholderia xenovorans LB 400*




Urtuvia et al. 2014

## The *PHB synthesis by Burkholderia xenovorans LB 400*




SEM micrographs of electrospun microfibers produced from bacterial PHBs. a) PHB produced by strain LB 400 from xylose and b) PHB produced by strain LB 400 from mannitol (Acevedo et al. 2018)

EX UMBRA IN SOLEM

# Polymers characterization

## 1.1 *FT-IR spectrum*

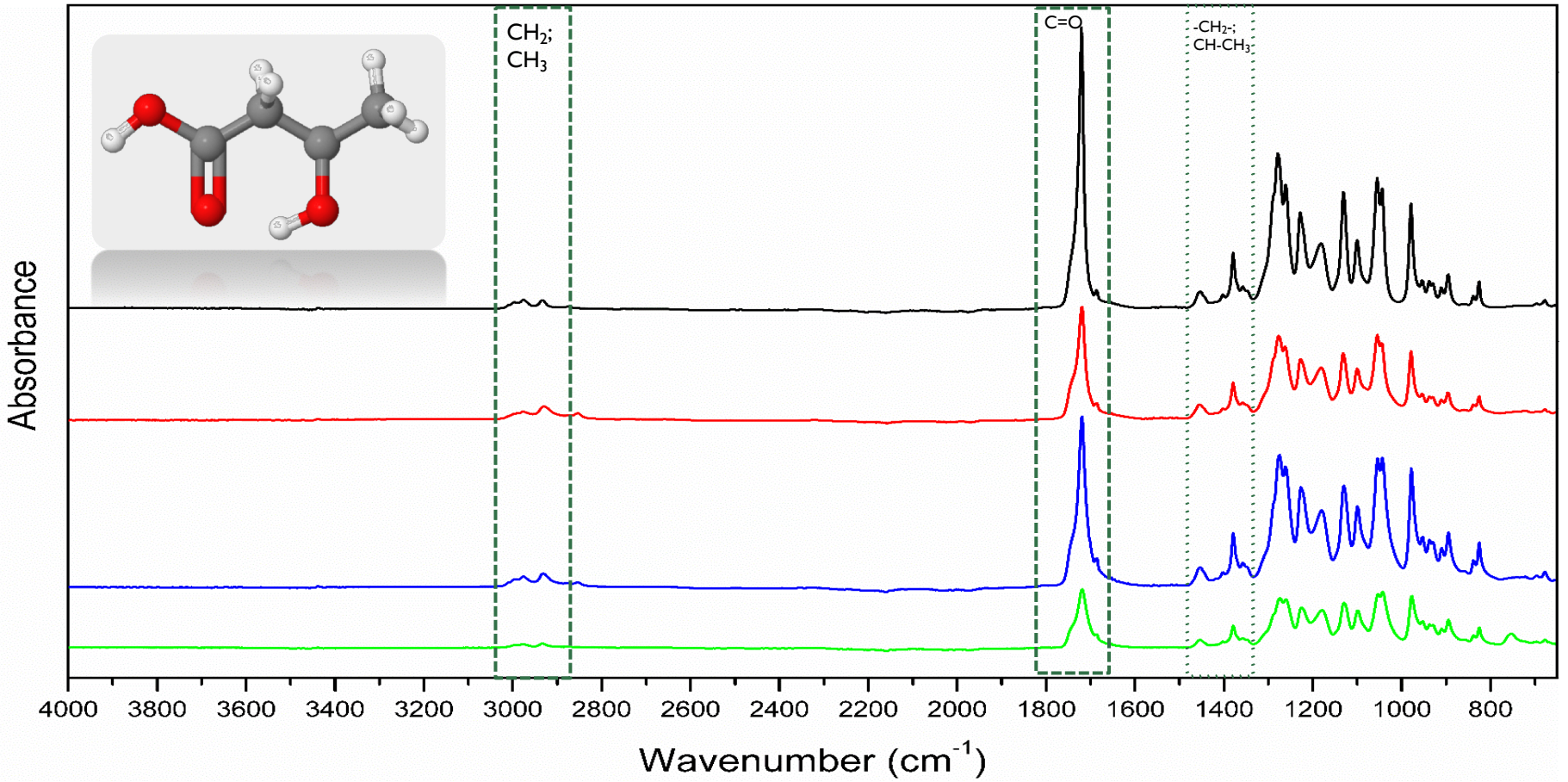



**Fig 1.** FT-IR spectrum of $PHB_c$ (Blue), $PHB_g$ (Black), $PHB_m$ (Green) and $PHB_x$ (Red).

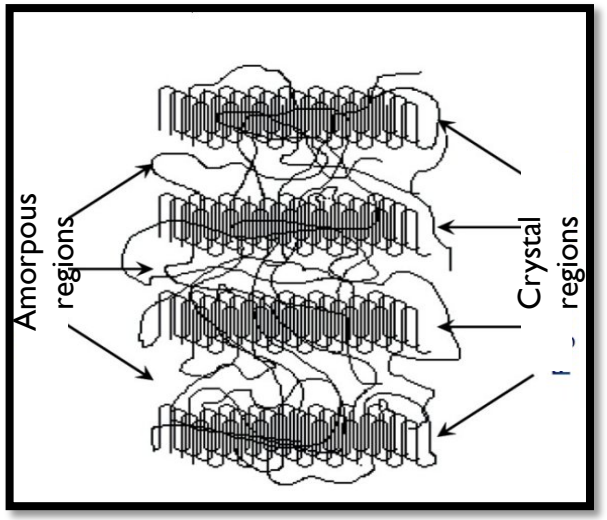



**Table 1.** Absorption indexes of different PHB calculated from the ratio of the absorbance at 1230 and 1453 $cm^{-1}$.

| | **Abs** 1230 | **Abs** 1453 | **AI** 1230/1453 |
|---|---|---|---|
| **$PHB_c$** | 0.262 | 0.050 | 5.243 |
| **$PHB_g$** | 0.264 | 0.056 | 4.676 |
| **$PHB_m$** | 0.108 | 0.026 | 4.129 |
| **$PHB_x$** | 0.164 | 0.043 | 3.832 |

# Polymers characterization

## 1.3 Determination of PHB molecular weight

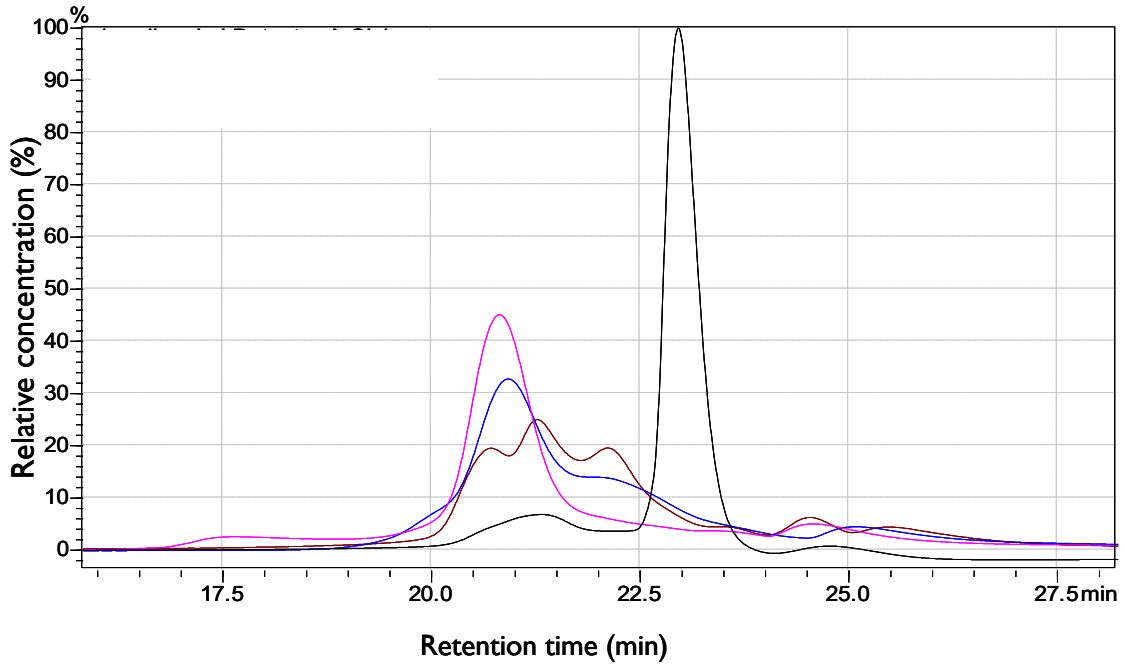



**Fig 3.** Chromatogram of PHBc (brown), and the polymers produced by *B. xenovorans* LB 400, PHBg (Blue), PHBm (pink), and PHBx (black).

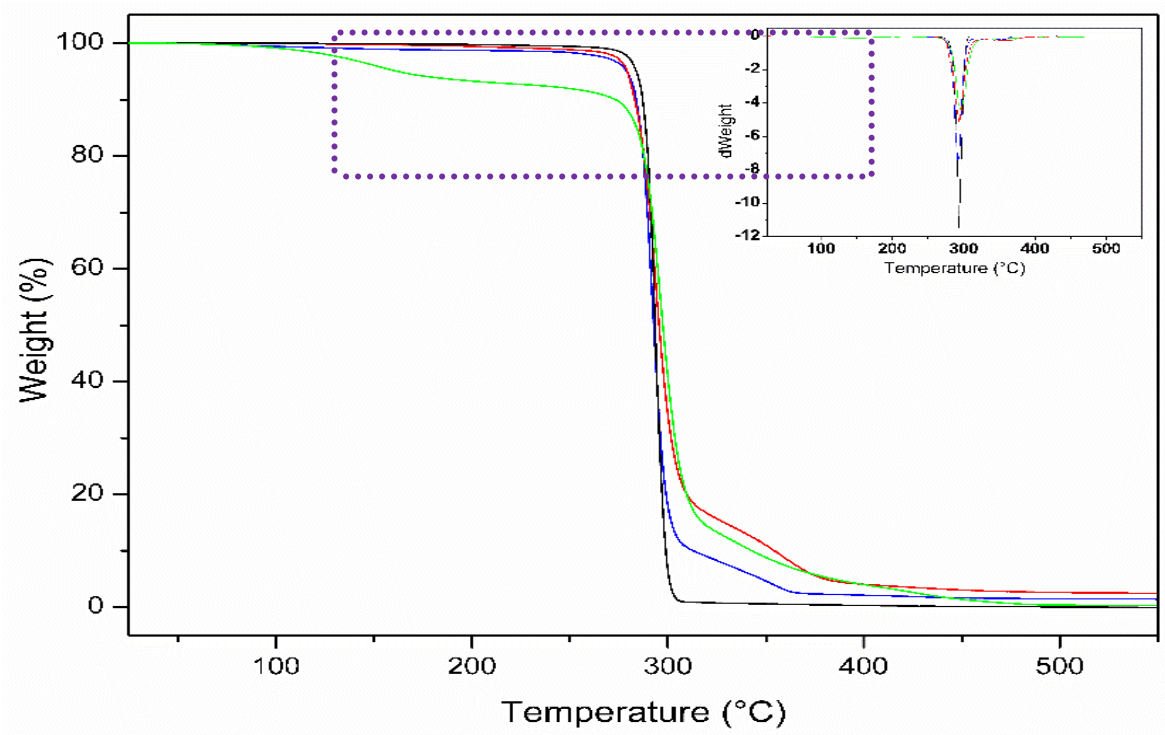
**Table 3.** Mean PHB molecular weight

| | Mw | Mw/Mn |
|---|---|---|
| **PHBc** | **694** | **715.89** |
| **PHBg** | **800** | **60.52** |
| **PHBm** | **1724** | **81.71** |
| **PHBx** | **262** | **3.03** |

Mw: Peso molecular g/mol; Mw/Mn: Índice de polidispersidad

# Polymers characterization

## 1.2 Differential scanning calorimetry (DSC)



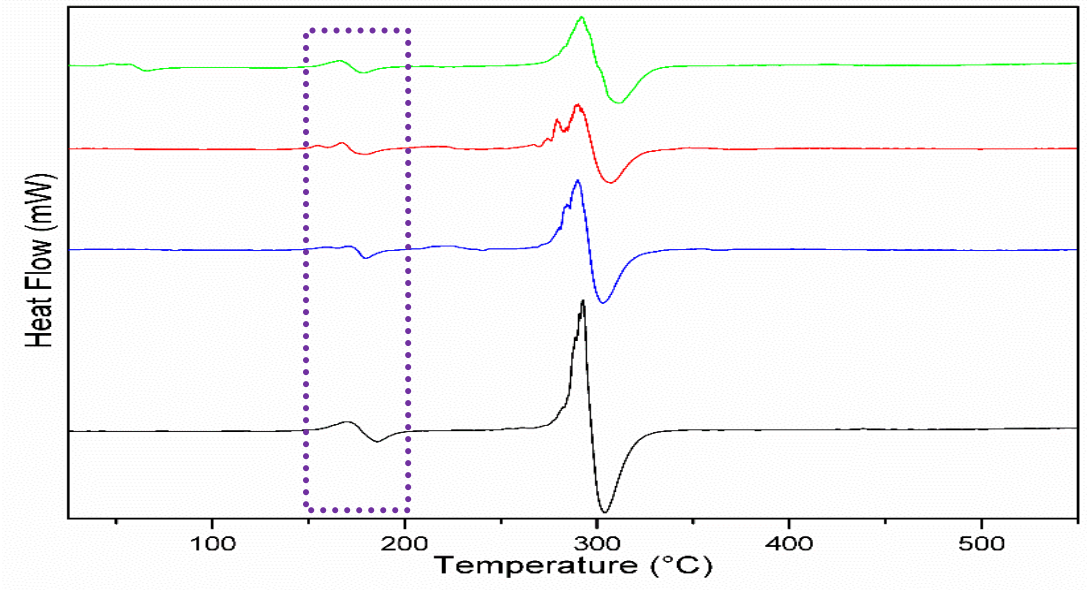




**Fig. 2 a** TGA and dTGA and **b** DSC of PHB produced by *B. xenovorans* LB 400 using; glucose (black); xylose (red) and mannitol (green). Commercial PHB was used as control (blue).

**Table 2.** PHB thermodynamic characterization produced by *B. xenovorans* LB 400

| | ΔCp Jg-1 deg | Tm °C | ΔHm Jg-1 | Td °C | Crystallinity % |
|---|---|---|---|---|---|
| **PHBC** | 0.284 | 174.18 | 50.369 | 305.53 | 34.5 |
| **PHBX** | 0.210 | 171.37 | 36.031 | 297.89 | 24.7 |
| **PHBM** | 0.132 | 179.82 | 56.271 | 297.17 | 38.5 |
| **PHBG** | 0.161 | 175.34 | 28.309 | 296.12 | 19.3 |

$\Delta C_p$: Heat capacity; $T_m$: Melting temperature; $\Delta H_m$: Melting enthalpy; Td: Degradation temperature

## Fibers characterization

### *PHB microfibers FT-IR spectrum*

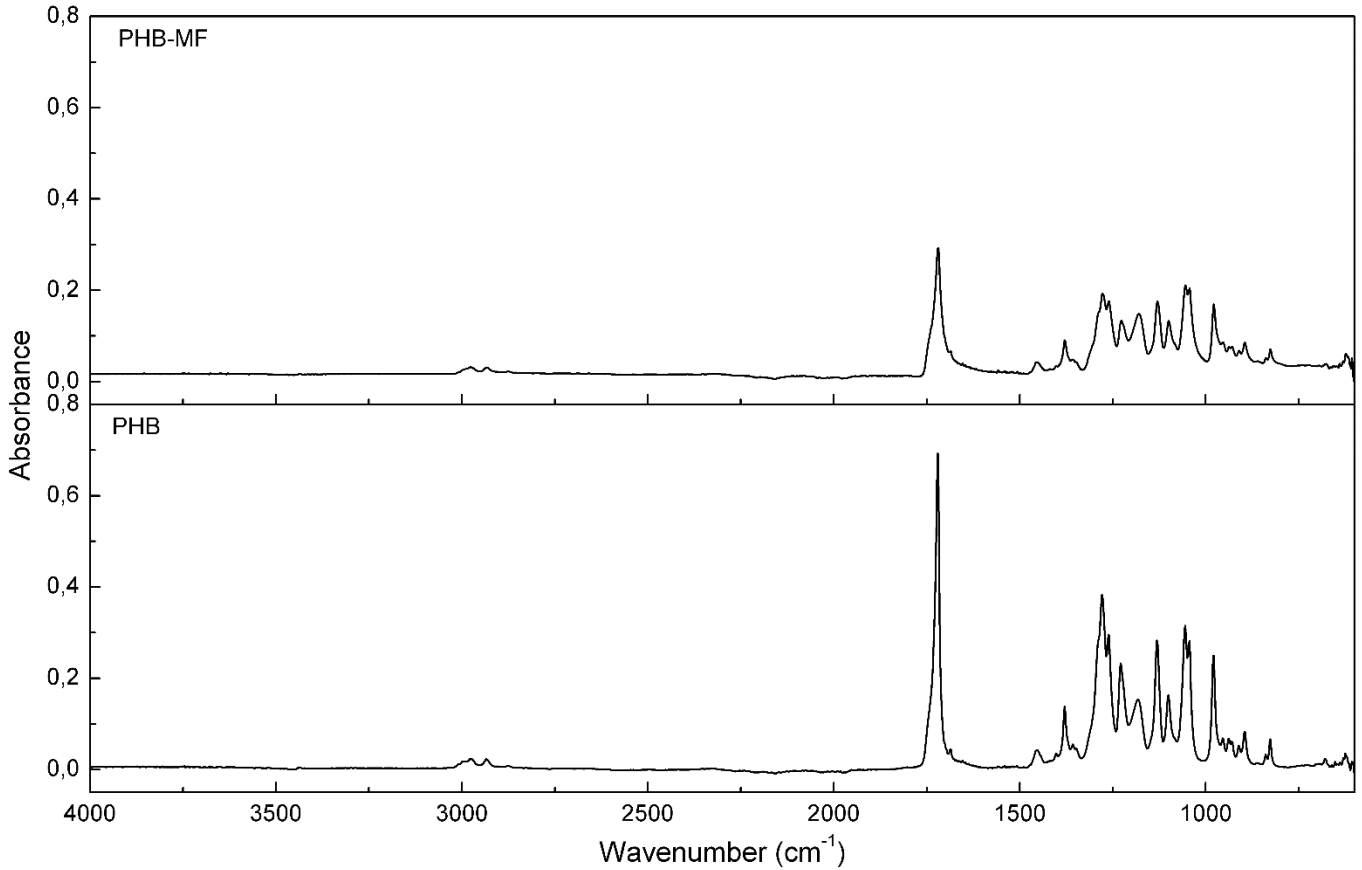



**Fig 4.** FT-IR spectrum of PHB and PHB microfibers.

**Table 4.** Effect of electrospinning on CI of PHB.

| | CI 1228/1453 |
|---|---|
| PHBc | 5.234 |
| PHB-MF | 2.980 |

CI: Cristallinity index

# CONCLUSIONS

- It was possible to observe that the PHB produced by the strain LB 400 supplied with different carbon sources possess a similar profile to the PHB obtained commercially, according with FT-IR spectrum results and thermogravimetrical characterization. The crystallinity degree was different between the polymers, which is associated to the extraction, drying and stored conditions.
- Additionally, the carbon source showed to affect in the molecular weight of PHB. The PHB obtained by supplying with xylose as sole carbon source was the PHB with lower molecular weight.

# ACKNOWLEDGEMENTS


- Universidad de La Frontera
- Universidad Técnica Federico Santa María
- GAMBIO proyecto anillo N° ACT1721288
- Conicyt scholarship N° 21160515
- Laboratorio de Tecnología y Procesos
- BIOREN
- CEMT-BIOREN

# "PHYSICOCHEMICAL CHARACTERIZATION OF POLY-3-HYDROXYBUTYRATE PRODUCED *BY BULKHOLDERIA XENOVORANS* LB400"

Claudia Sanhueza Sanhueza

PhD student on Doctoral program in Science of Natural Resources

c.sanhueza07@ufromail.cl

Tutor: Francisca Acevedo