

EVALUATION OF THE PHB PRODUCTION USING MILK WHEY AS FEEDSTOCK



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ISWM - TINOS 2015

CONTENT

1. Introduction
2. Methodology
3. Results
4. Conclusions
5. References
6. Acknowledgements



1. INTRODUCTION

PLASTICS

Oil has been considered as an essential raw material in many industrial processes. However, one of its derivatives, specifically synthetic plastics or polymers, presents serious pollution problems hence the necessity to find suitable and more environmentally friendly substitutes.



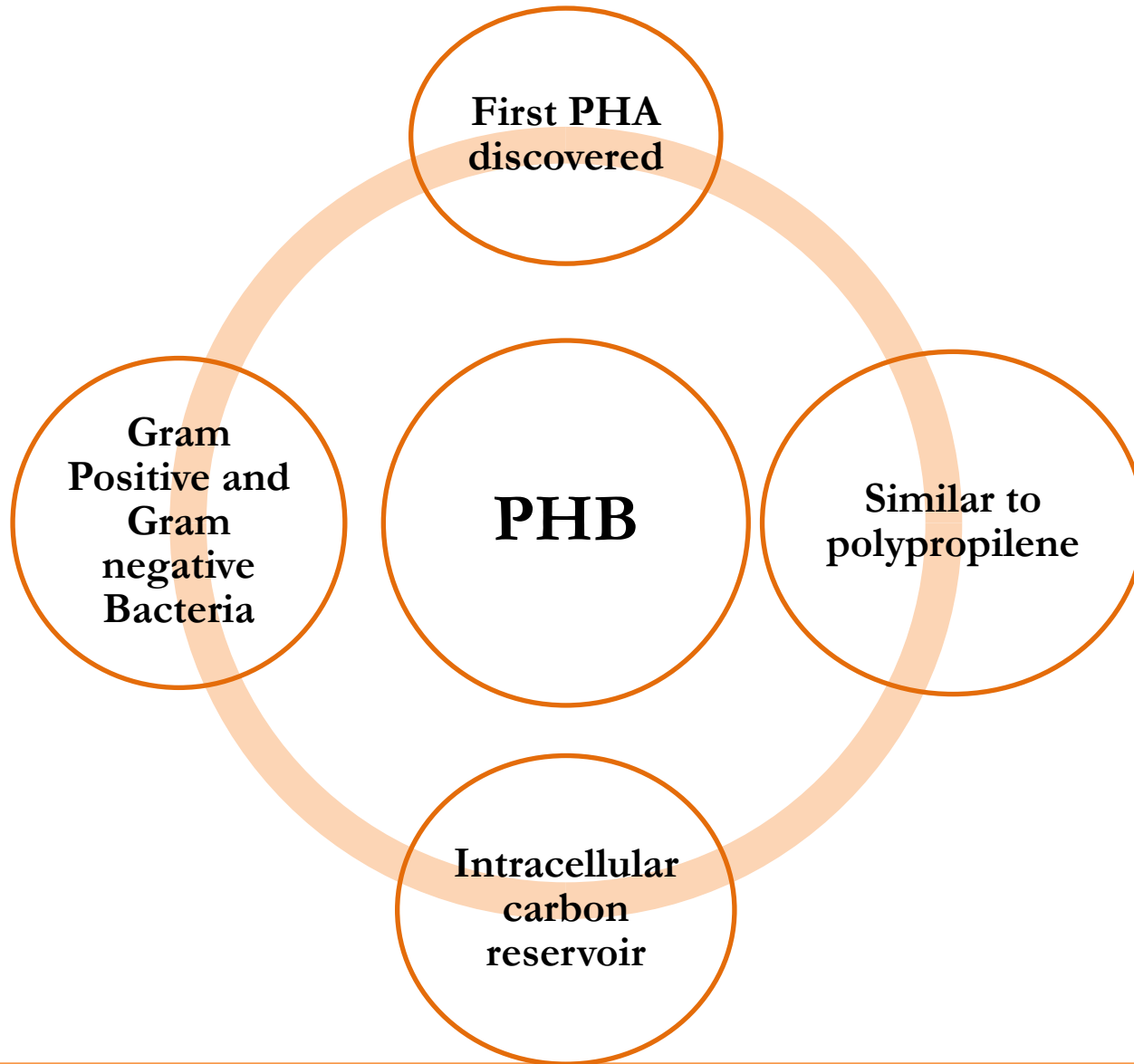
1. INTRODUCTION

BIOPOLYMERS

Biopolymers are presented as an attractive alternative, because of their similar properties to petroleum-based plastics, their biodegradability and ability to be obtained from renewable carbon sources.



1. INTRODUCTION



PHB intracellular inclusion

1. INTRODUCTION

MILK WHEY

Low costs

High sugar content

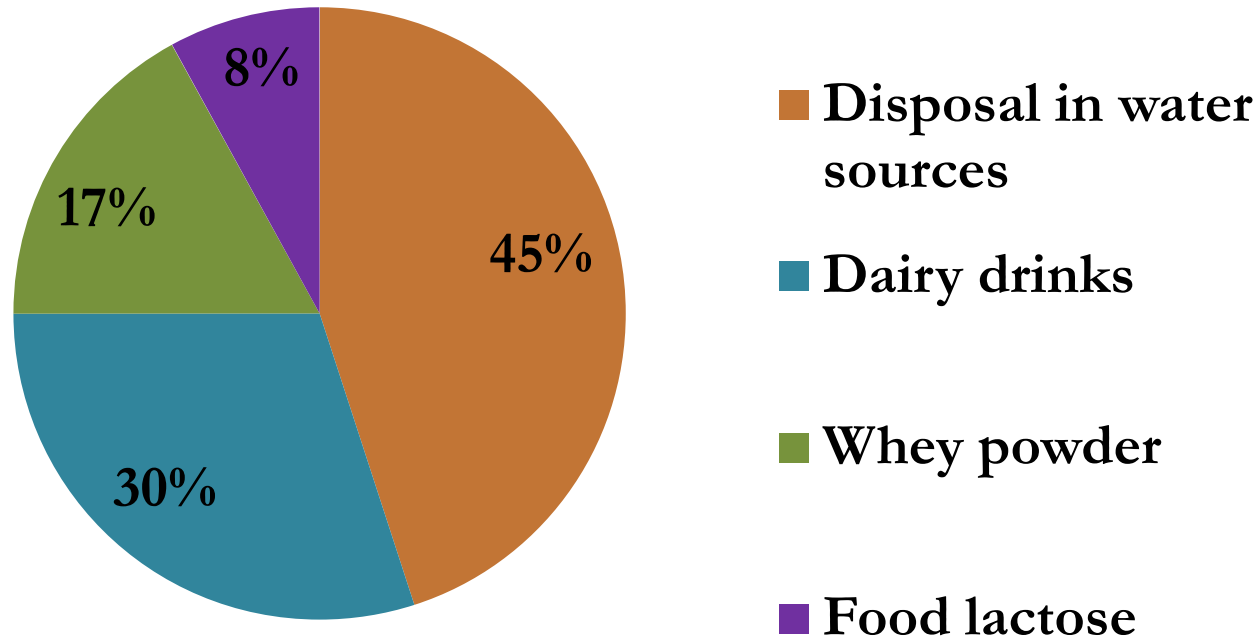
Bioremediation



Component	Concentration (g/l)
Total Solids	63,0 – 70,0
Lactose	44,0 – 46,0
Protein	6,0 – 8,0
Calcium	1,2 – 1,6
Phosphates	2,0 – 4,5
Lactate	6,4
Chlorides	1,1

Milk whey composition

1. INTRODUCTION



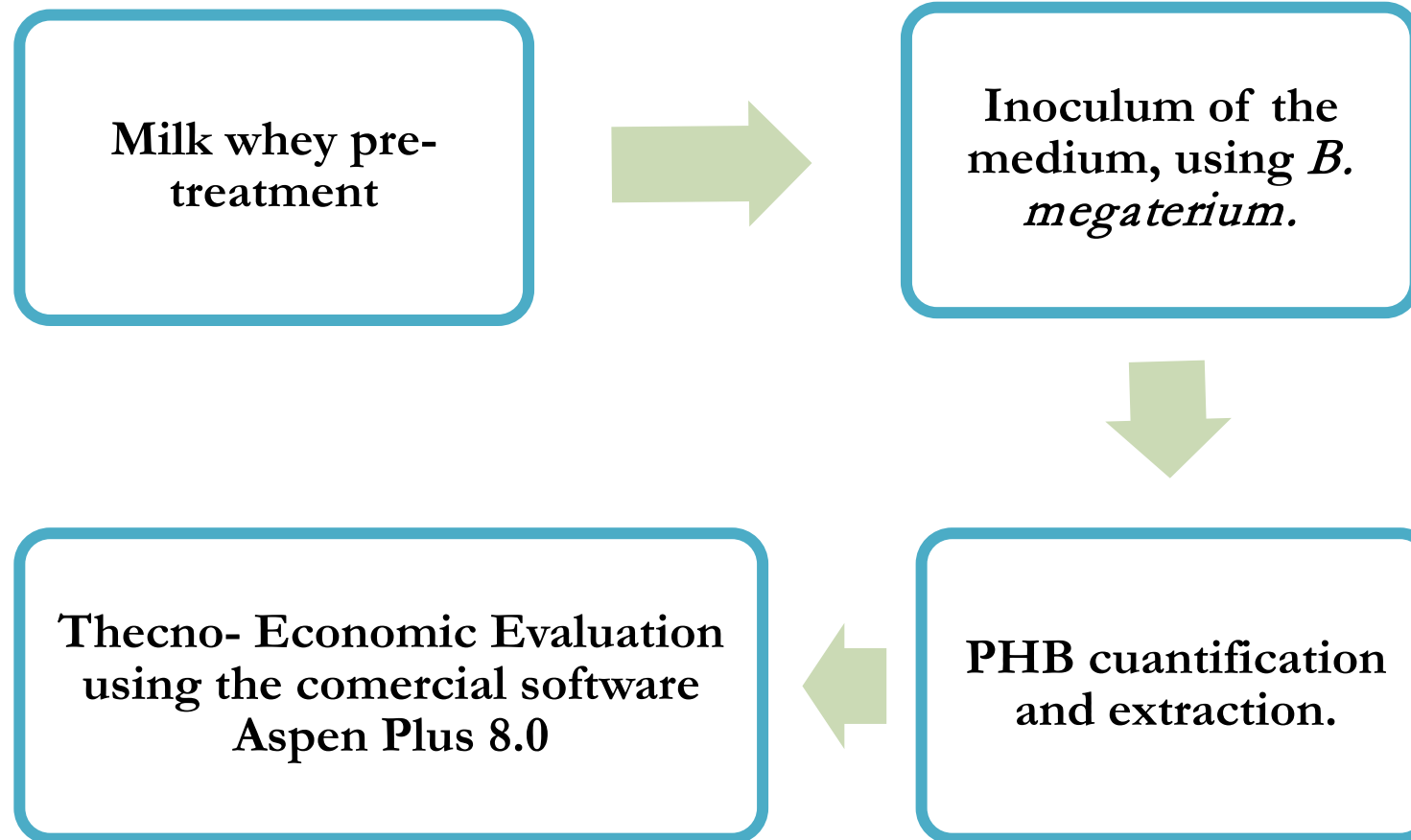
Colombia produces 3 600 tonnes of milk whey per year¹.

FINAL DISPOSAL

[1] FEDEGAN, “Federación Nacional de Ganaderos,” *Estadísticas*, 2014. [Online]. Available: <http://portal.fedegan.org.co>. [Accessed: 03-Jan-2015].



2. METHODOLOGY



2. METHODOLOGY

Culture Conditions

- pH: 7
- Temperature: 32 °C
- Agitation: 200 rpm
- Aeration: 5 l/min

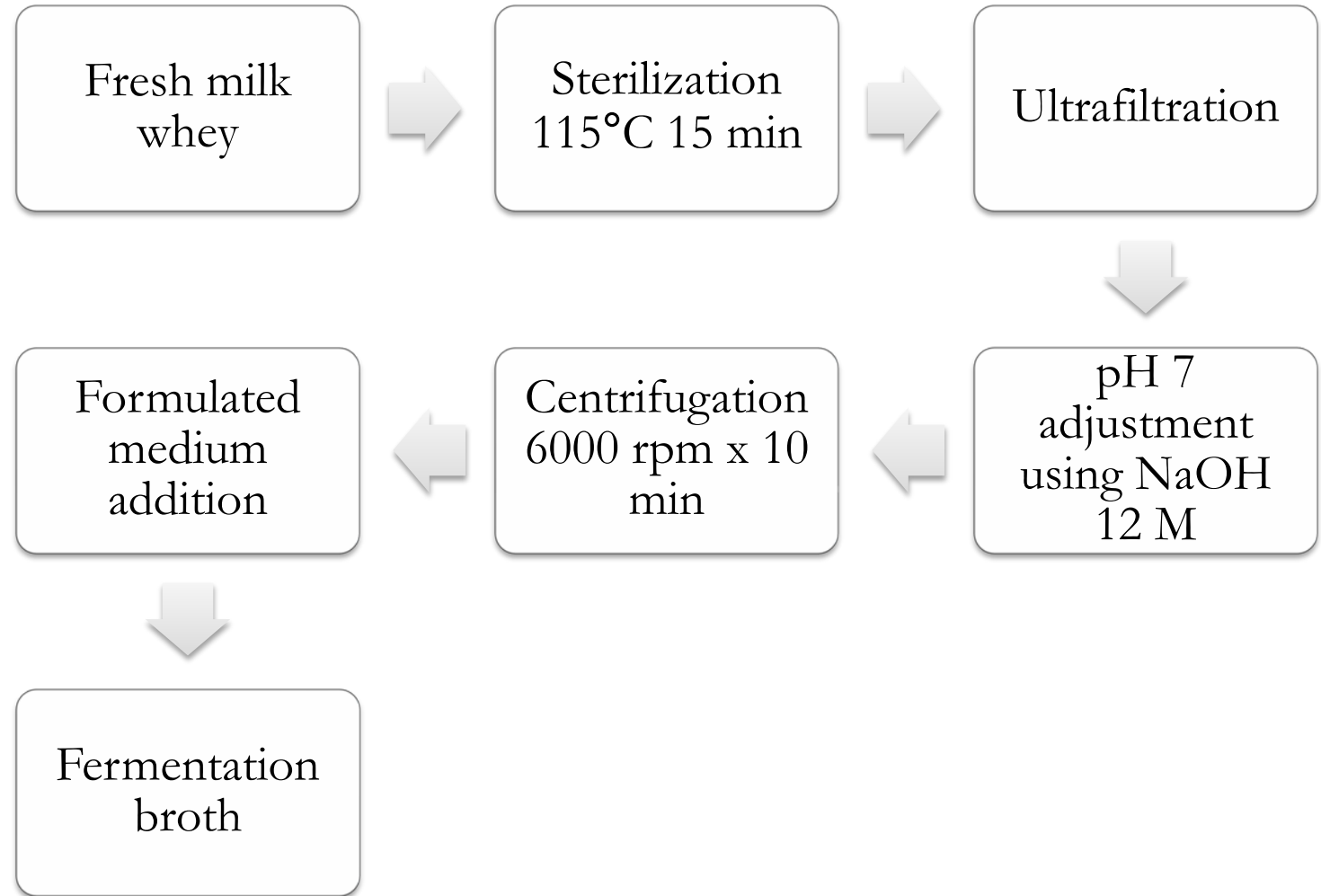


Compound	Formula
Ammonium Sulfate	$(\text{NO}_4)_2 \cdot \text{SO}_4$
Acid sodium phosphate	Na_2HPO_4
Magnesium sulfate heptahydrate	$\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$
Potassium dihydrogen phosphate	KH_2PO_4

Nutrients added to the *Bacillus megaterium* growth medium

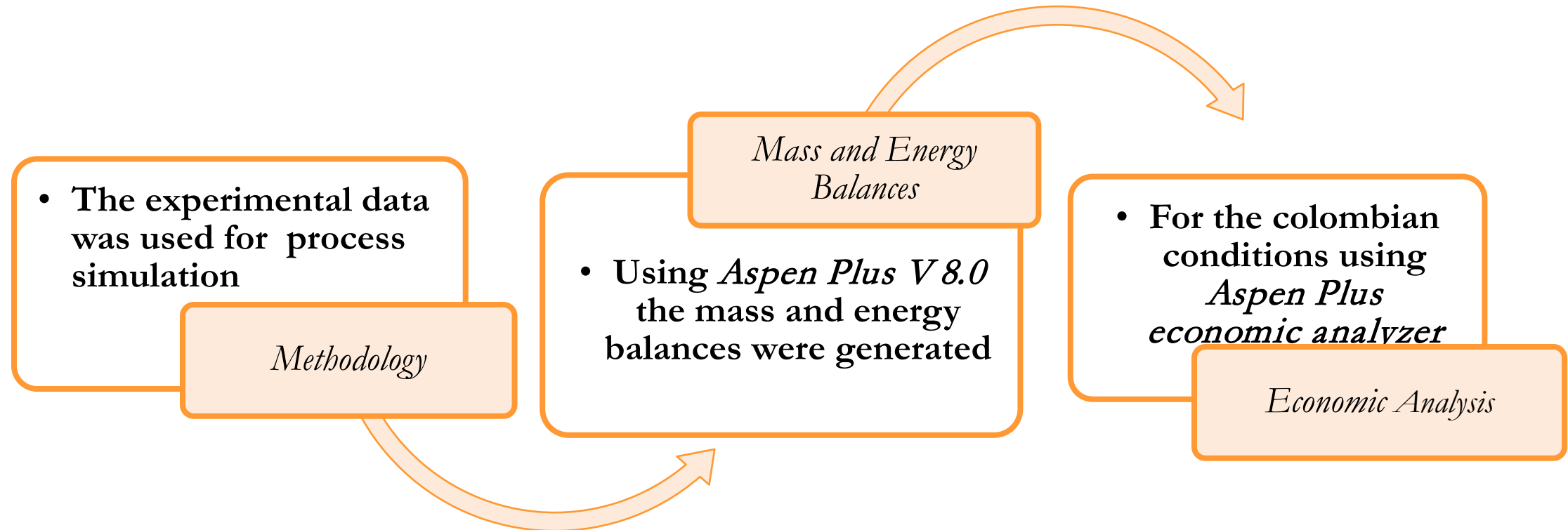
2. METHODOLOGY

ULTRAFILTRATION PRE-TREATMENT METHOD

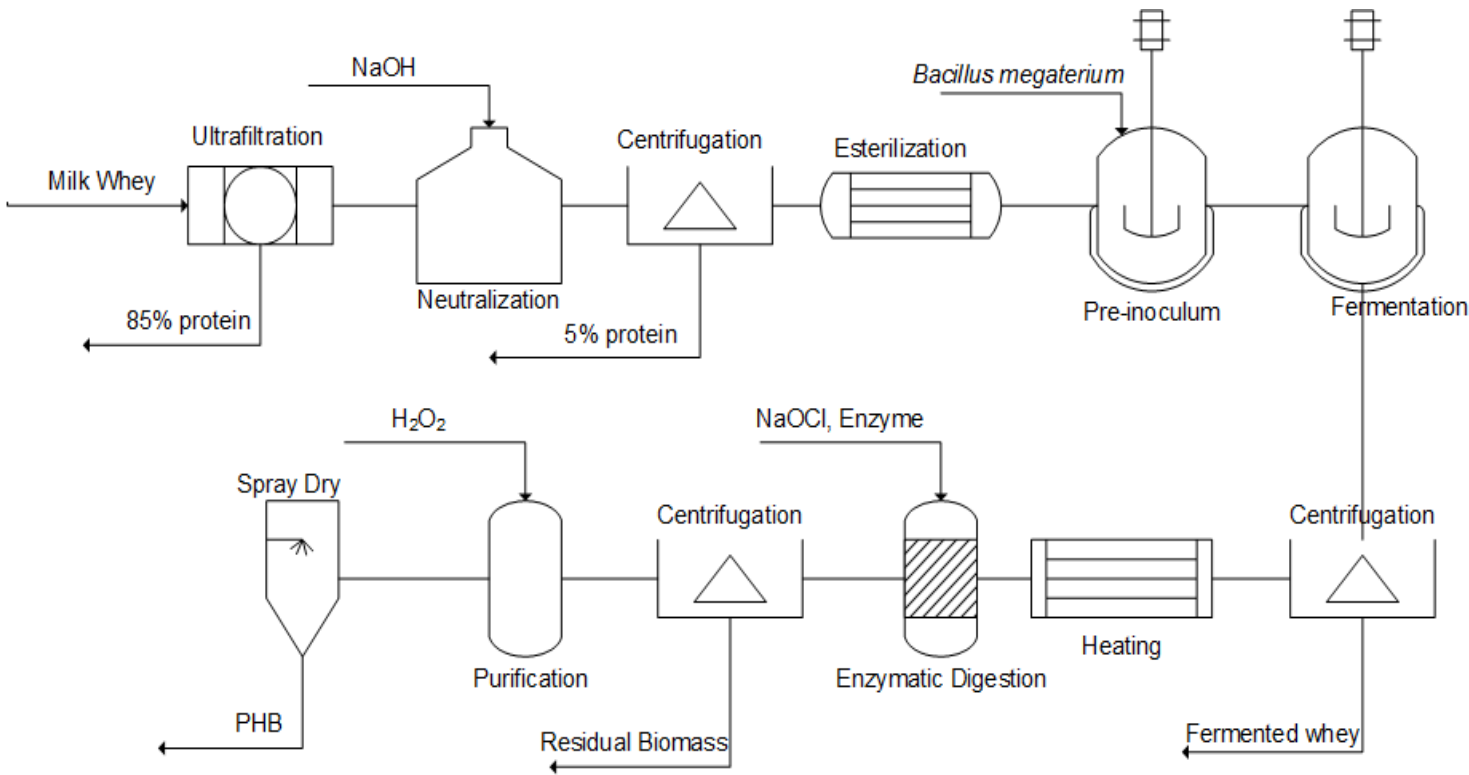


2. METHODOLOGY

SIMULATION



2. METHODOLOGY



PHB production process for the techno-economic evaluation.

Technologies and conditions used in the techno-economic assessment of PHB production (100kg/h milk whey).

Technology

Ultrafiltration

Cellulose- acetate membrane removing 96% of protein

Fermentation

Using *Bacillus megaterium* without genetic modification

Enzymatic

Enzymatic treatment using 2% w/w of *Burkholderia sp*

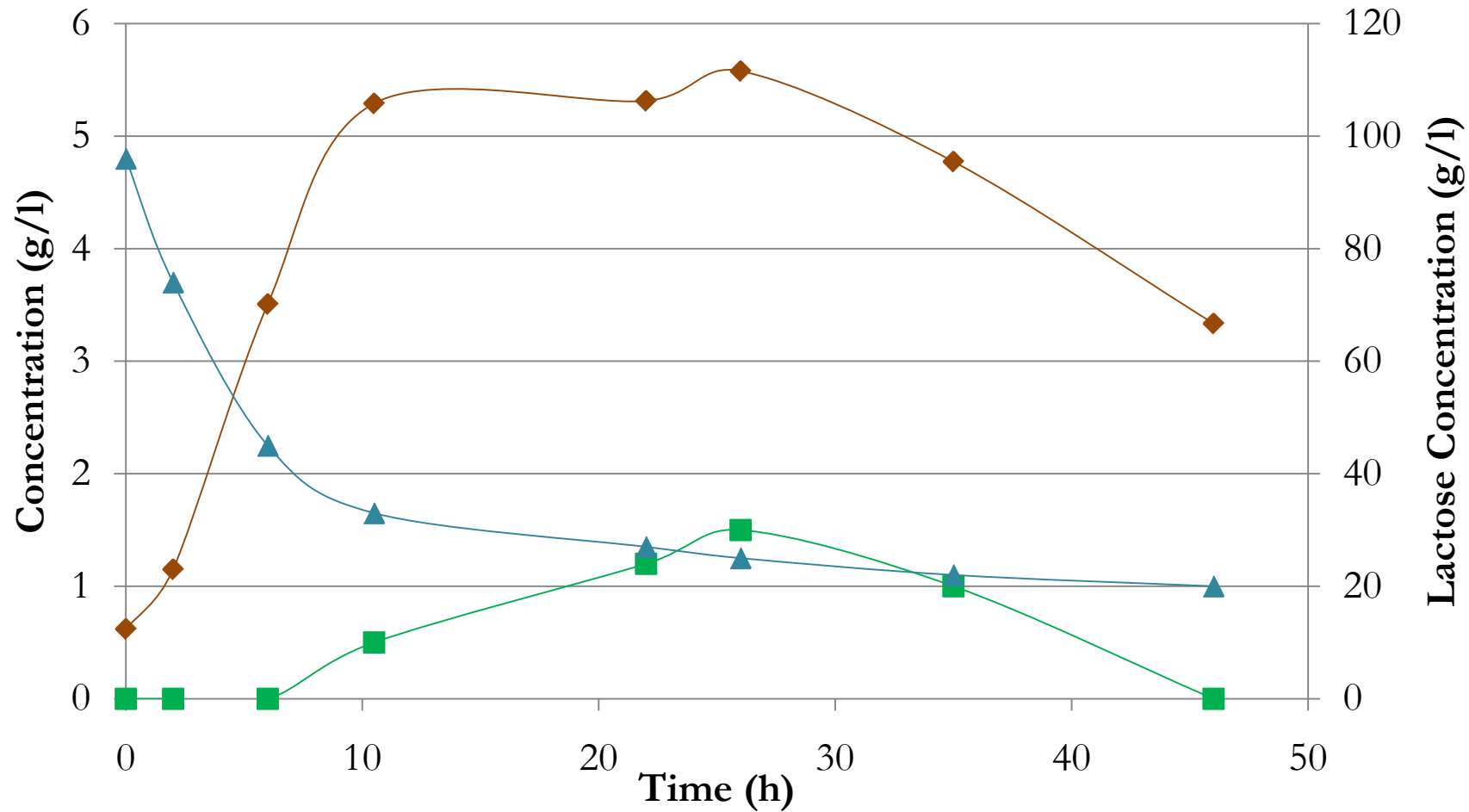
Digestion

PTV

Purification

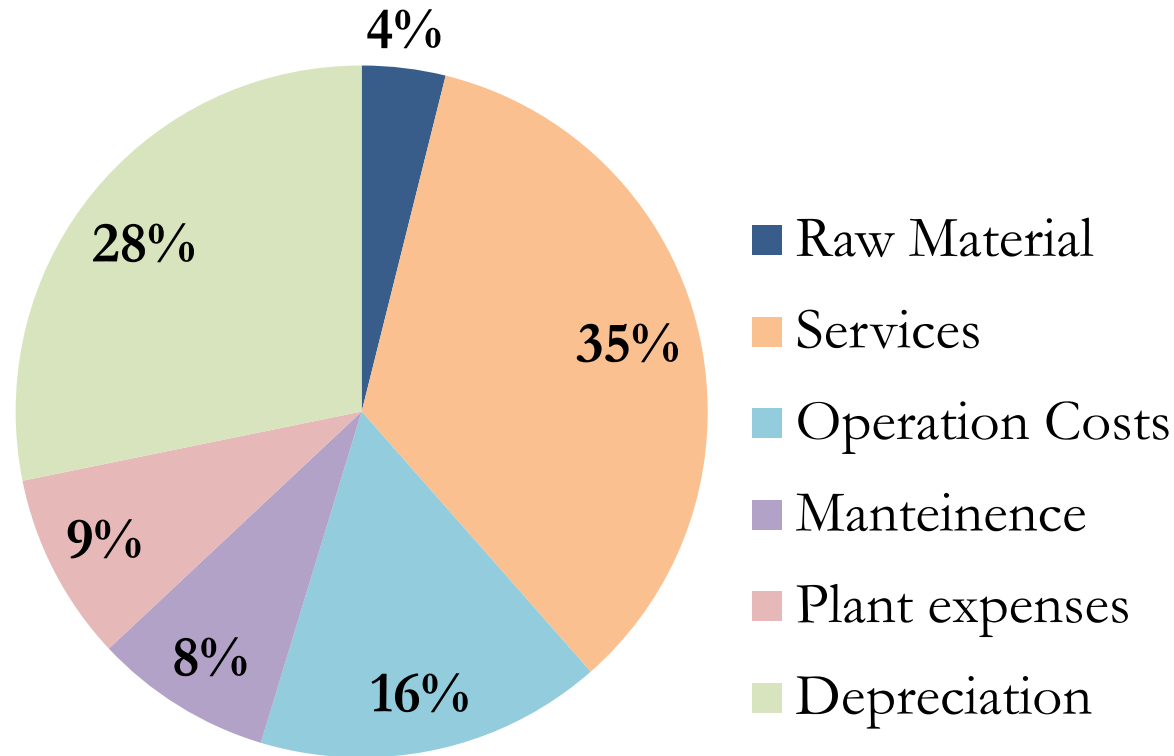
Using H₂O₂ 1,2% v/v

3. RESULTS



Growth curve of *B. megaterium* using milk whey as substrate. Total Biomass, PHB concentration, Lactose concentration.

3. RESULTS



PHB PRODUCTION COST
4 USD/kg

PHB MARKET PRICE
3 USD/kg

4. CONCLUSION

It is possible to use different bio-residues to obtain PHB as an alternative to synthetic polymers (low cost and high pollution load).

The production of PHB using milk whey as raw material was demonstrated. Nevertheless, it is necessary to invest in new technologies for cheaper pre-treatment methods that would reduce the high production costs associated with this step and achieve a competitive level for this product.

PHB production could be assessed within a biorefinery scheme where other products are obtained, thereby reducing production costs and reaching similar values to synthetic polymers.



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6. ACKNOWLEDGMENTS

Universidad Nacional de Colombia at Manizales

Research group in Chemical, Catalytic and Biotechnological Processes
(PQCB)

Biotechnological and Agribusiness Institute (IBA)

Faculty of Engineering and Architecture



THANK YOU FOR YOUR ATTENTION

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