

# INDEX

---

<b>I. Introduction.....</b>	<b>1</b>
1. Food packaging materials.....	3
1.1. Current packaging status.....	3
1.2. Polymers used in packaging.....	4
1.3. Biopolymers as a new alternative.....	6
2. Polyhydroxyalkanoates for sustainable food packaging.....	8
2.1. Polyhydroxyalkanoates production through mixed microbial cultures using by-products.....	10
2.2. Circular Bioeconomy.....	13
3. High-oxygen-barrier materials.....	14
3.1. Poly(ethylene- <i>co</i> -vinyl alcohol) copolymers.....	16
3.2. Cellulose nanocrystals.....	18
4. Processing technologies in food packaging.....	21
4.1. Melt compounding.....	22
4.2. Electrospinning technology.....	23
5. Multilayer structures.....	27
6. References.....	29

<b>II. Objectives.....</b>	<b>51</b>
General and specific objectives.....	53
<b>III. Results.....</b>	<b>56</b>
<b>Block I: Development of interlayers based on polymeric fibers by electrospinning.....</b>	<b>62</b>
<b>Chapter I:</b> Preparation and characterization of electrospun food biopackaging films of poly(3-hydroxybutyrate- <i>co</i> -3-hydroxyvalerate) derived from fruit pulp biowaste.....	64
<b>Chapter II:</b> Valorization of municipal biowaste into electrospun poly(3-hydroxybutyrate- <i>co</i> -3-hydroxyvalerate) biopapers for food packaging applications.....	94
<b>Chapter III:</b> Development and characterization of electrospun biopapers of poly(3-hydroxybutyrate- <i>co</i> -3-hydroxyvalerate) derived from cheese whey with varying 3-hydroxyvalerate contents.....	125
<b>Chapter IV:</b> Electrospun antimicrobial films of poly(3-hydroxybutyrate- <i>co</i> -3-hydroxyvalerate) containing eugenol essential oil encapsulated in mesoporous silica nanoparticles.....	164
<b>Chapter V:</b> Development and characterization of electrospun fiber-based poly(ethylene- <i>co</i> -vinyl alcohol) films of application interest as high-gas-barrier interlayers in food packaging.....	195
<b>Block II: Development of PHA-based structural layers by melt compounding.....</b>	<b>234</b>
<b>Chapter VI:</b> Reactive melt mixing of poly(3-hydroxybutyrate)/rice husk flour composites with purified biosustainably produced poly(3-hydroxybutyrate- <i>co</i> -3-hydroxyvalerate).....	236
<b>Chapter VII:</b> Blends of poly(3-hydroxybutyrate- <i>co</i> -3-hydroxyvalerate) with fruit pulp biowaste derived poly(3-hydroxybutyrate- <i>co</i> -3-hydroxyvalerate- <i>co</i> -3-hydroxyhexanoate) for organic recycling food packaging.....	266

<b>Block III: Development of barrier multilayer systems based on PHA.....</b>	<b>295</b>
<b>Chapter VIII: Barrier biopaper multilayers obtained by impregnation of electrospun poly(3-hydroxybutyrate-<i>co</i>-3-hydroxyvalerate) with protein and polysaccharide hydrocolloids.....</b>	<b>297</b>
<b>Chapter IX: High-oxygen-barrier multilayer films based on polyhydroxyalkanoates and cellulose nanocrystals.....</b>	<b>320</b>
<b>IV. General discussion.....</b>	<b>342</b>
General discussion.....	344
References.....	350
Overall impact of research activities.....	351
<b>V. Conclusions.....</b>	<b>353</b>
<b>VI. Annexes.....</b>	<b>358</b>
Annex A: List of publications.....	360
Annex B: Additional works.....	369