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BOOK OF ABSTRACTS & PROCEEDINGS

EDITORS

Ayhan ORAL, Ph.D.
Oğuz GÜRSOY, Ph.D.
Arianit REKA, Ph.D.

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ISCMP 2022 – SCIENTIFIC PROGRAM

September 16, 2022 (Friday)

Session 3	**Chair: Yusuf Ziya Menceloğlu, Ph.D.**	
09:00-09:30	**Klaus Bente**, *Ph.D.*	Minerals (clay) for treatments of contaminated wastewater environmental protection ***(INVITED SPEAKER)***
09:30-09:50	Veprim Thaçi	A theoretical and experimental study of adsorbent dye removal from (2E, 5E)-2,5- bis[(4-dimethylamino) benzylidene] cyclopentanone using diatomaceous earth as an adsorbent
09:50-10:10	Vllaznim Mula	Development of a method for the detection and characterization of volatile organic compounds in the atmosphere using passive sampling
10:10-10:30	Ayhan Oral	Effect of phenyl ethyl alcohol on crystallinity and biodegradation of poly (lactic acid)
10:30-11:00	Coffee Break	
Session 4	**Chair: Ahmed Jashari, Ph.D.**	
11:00-11:30	**Jasmina Petreska Stanoeva**, *Ph.D.*	Risk assessment of natural toxic pyrrolizidine alkaloids in the food chain ***(INVITED SPEAKER)***
11:30-12:00	**Ilir Mazreku**, *Ph.D.*	In vivo evaluation of carboxylated graphene oxide's impact on oxidative stress and other biochemical markers in snail Helix locurum ***(INVITED SPEAKER)***
12:00-12:20	Seda Çetintaş	Evaluation of the effect of glucose fatty acid esters on thermal degradation of vegetable-based oils
12:30-14:30	Lunch	
Session 5	**Chair: Klaus Bente, Ph.D.**	
14:30-15:00	**Valentin Mirceski**, *Ph.D.*	Advanced pulse-voltammetric techniques ***(INVITED SPEAKER)***
15:00-15:20	Yusuf Dilgin	Fabrication of a novel colorimetric glucose biosensor using copper(II)-neocuproine as chromogenic oxidant and glucose dehydrogenase immobilized magnetite nanoparticles
15:20-15:40	Mustafa Akın	Determination of antimicrobial, DPPH scavenging, and tyrosinase inhibitory activities of *Thymus vulgaris*, *Helichrysum arenarium*, and *Rosa damascene* Mill. ethanol extracts
15:40-16:10	**Halil İbrahim Çiftçi,** *Ph.D.*	Development of novel strategies for eradication of HIV-1 using structural and computational analysis ***(INVITED SPEAKER)***
16:10-16:30	Coffee Break	
09:00-18:00	***POSTER SESSION***	

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Effect of Phenyl Ethyl Alcohol on Crystallinity and Biodegradation of Poly (Lactic acid)

Mert Akgün
Mr.
Science Technology Application and Research Center, Canakkale Onsekiz Mart University, Turkey

Yalçın Coşkun
Assoc. Prof.
Department of Organic Farming, Lapseki Vocational School, Canakkale Onsekiz Mart University, Turkey

Ayhan Oral*
Prof.
Department of Chemistry,
Canakkale Onsekiz Mart University, Turkey

The increasing interest in biopolymers has progressively increased the interest in the development and utilization of more environmentally friendly polymeric materials. Consequently, applications of biopolymers, especially Poly (Lactic acid) (PLA) have increased in recent years. The crystallinity of the polymer matrices is one of the most important parameters that could be able to affect some properties such as degradation and mechanical performance. PLA is one of the most promising bio-based, compostable polymers able to be an alternative to petro-derived polymers both in single-use applications and also for durable equipment with sufficient technical properties. Hydrolytic biodegradation describes usage areas for this kind of polymers. Manipulating this hydrolytic degradation process also affects the usage potential of polymeric materials. Crystallinity is one of the parameters that affect the degradation process on polymer matrices. In order to control the crystallinity and biodegradation of the PLA matrix, the natural product Phenyl ethyl alcohol (PEA) was inserted into the polymeric matrices at different percentages. An increase in the crystallinity was observed depending on the PEA percentage. The biodegradation was also affected thanks to the PEA insertion into the matrix. Consequently, the insertion of PEA into the PLA matrices resulted to increase in crystallinity and biodegradation.

Keywords: Phenyl Ethyl alcohol, Poly (Lactic acid), Crystallinity, Biodegradation

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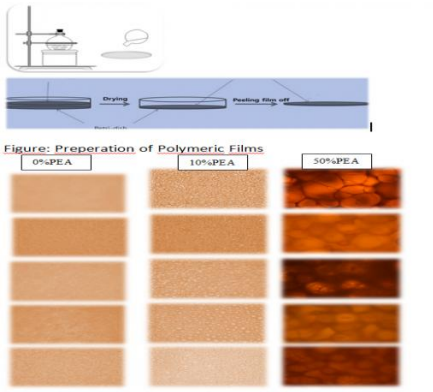


Figure 2. Microscope photographs of PLA / PEA films containing different rates of PEA (after 7 days).

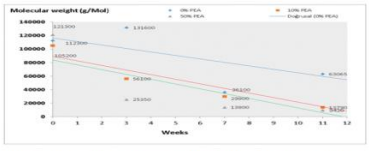


Figure. PLA / PEA films with pure PLA, 10% PEA and 50% PEA.

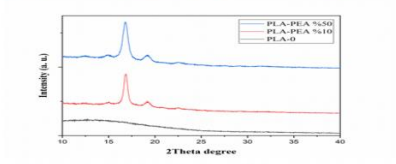


Figure. XRD Diagrams of PLA / PEA Films.

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1.Introduction

Lately, biodegradable and biocompatible polymers have become a major concern of research studies and sectoral stakeholders, especially from an ecological perspective. Recently bio-based or biodegradable polymers have been getting more importance in the polymer industry because of environmental concerns as well as their various applicability for different aims especially, biomedical products . Mechanical, thermal, and biodegradation properties of polymeric materials designate usage areas . Poly (lactic acid) (PLA) is a commercially available bio-based polymer used in a variety of applications because of its high strength, modulus, compostability, biodegradability, semicrystalline, and thermoplastic properties. PLA has rapidly evolved into a competitive commodity material over the last decade, because of these properties. A considerable number of scientists have been carrying out studies to proliferate application areas of PLA. The control of crystallinity is among the ways to increase the number of application areas . The crystallization kinetic is affected by several factors, such as nucleating agents, temperature, molecular weight, etc. It is important to control the crystallinity grade in PLA and for this purpose different kinds of nucleating agents, such as organic and inorganic chemicals, were used . Phenylethyl alcohol (PEA) is a natural volatile oil which is isolated from a rose. In the present study, the effects of temperature on the crystallinity of PLA - PEA were investigated. The polymer films were prepared by the solution casting method. PLA - PEA films, containing 0% of PEA, 10% of PEA, and 50% of PEA (w/w), were placed in tubes containing 10 ml of Phosphate buffer (pH 7.4) and incubated at 37 0C. The changes in crystallinity were investigated.

2.Materials and Methods

2.1. Materials Poly (Lactic acid) (PLA 4043-D, Natureworks LLC), Phenethyl alcohol (Merk), Dichloromethane (DCM, Merck), Tetrahydrofuron (THF, Merck), Ethyl alcohol (Merk), PO4 Buffer solution, NaOH (Merck) were used. Radwag brand AS 2020 / C / 2 Model ± 0.001 g was used for weighing chemicals. In order to prepare a suitable medium for samples, Incubator and pH meter (Hanna) were used for pH adjustment of the solution medium. 2.2. Methods Polymeric films were prepared by the solution casting method with Ika brand magnetic heater mixer. Prepared films were dried at room temperature and after this step, whole samples were kept in a vacuum oven to remove the solvent. PLA films were prepared with different weight percent content Phenyl ethyl alcohol (PEA) (w / w), as 0% PEA, 10% PEA and, 50% PEA depending on the PLA. After the, 1g of PLA and the required amount of PEA were dissolved in dichloromethane (20 ml), it was poured into the Petri dish and left to dry for 24 hours at room temperature (24-26 ºC). The films were peeled off from Petri dishes. 2.3. Hydrolytic Degradation: The films were cut into 6 mm diameter discs and placed in two test tubes in each test tube and weighed on a sensitive scale to determine the starting weight. 10 ml of Phosphate buffer (pH 7.4) was added to the tubes and placed in the incubator at 37 0C. Thus, the hydrolytic biodegradability study was initiated. The tubes were taken from the incubator at certain time intervals and films were taken out of them. After washing with ethyl alcohol and drying, it was weighed and then analyzed. 2.4. Optical Microscopy Imaging: The prepared PLA and PLA / PEA films were initially imaged with an optical microscope and their photos were recorded to determine the morphological properties of the matrix. Leica EP model Polarized Optical Microscope device and camera were used for imaging of the films. 2.5. Molecular Weight Analyses: Gel Permeation chromatography (GPC), Waters styragel column (HR series 2, 3, 5E) Tetrahydrofuran (THF) solvent at 1 mL/min injection rate and Waters 410 differential refractometer detector (UK), was used for molecular weights analysis. 2.6. X-ray diffraction Analysis: X-ray diffraction analyses were performed by using PANalytical Empyrean (Netherlands) with Cu K K? radiation (? = 1.5406 A°). The current and voltage were adjusted to 40 mA and 45 kV.

3.Result and Discussion

3.1. Optical Microscopy Imaging Samples (0% PEA, 10% PEA and, 50% PEA) were removed from the tubes, cleaned and dried. The dried samples were imagined by using optical microscopy. The increasing dimensions of divided areas in polymer matrices could be seen in the figure. Diameters of divided areas increased depending on PEA contents as proportional. PLA and porosity of the polymer films were observed depending on PEA content. 3.2. Molecular weight It is seen from the GPC graph that the molar mass of all samples decreased depending on both time and PEA content. This reduction is more common in films containing more PEA. Molecular weights of 0%PEA, 10% PEA and 50% PEA containing PLA films decreased from initial weights to 63065, 13790 and 9420 respectively, at the end of 11 weeks. PEA content affected the degradation. 3.3. XRD analyses PLA has both crystalline and amorphous areas. It can be seen from the figure that neat PLA has reflections which belong to amorphous structures. The incorporation of 10%PEA resulted in the shifting of some of the reflections. In the case of increasing PEA content to 50%, the intensities of these reflections increased. As it was expected, the diffractograms of the films showed characteristic peaks. The peaks at 12.4°, 14.9°, 16.8°, 19.3°, 22.5°and, 24.6° belong to PLA . The PLA exhibits strong reflection at 16.8° because of the diffraction from (200) and/or(110) planes and another reflection peak at 19.3° arising from (203) plane . The small diffraction peaks at 2? = 12.4?, 14.9?, 20.8? and, 24.6°represent (004)/(103), (204), (115), (016), and (206) planes of ?-crystals. And more, a reflection at 2? = 24.6?, which is characteristic of ??crystals, can be seen. These results suggest that both ? and ?? crystals exist in the polymer matrix. Insertion of PEA increased the crystal structures in the PLA matrix and the amount of PEA affects these crystal structures.

4.Conclusion

The main purpose of the research is to investigate the effect of PEA on crystallinity and hydrolytic biodegradation on PLA. Pheniletyl alcohol, natural essential oil in different proportions, was added to PLA, a biodegradable polymer. It is concluded that this added natural component increased crystallinity and accelerated the biodegradability of PLA. It was found that this acceleration increased in direct proportion to the amount of natural component added. The natural essential oil PEA affected the crystallinity and biodegradability of PLA as a biodegradable polymer. The crystallinity and biodegradation of PLA could be controlled by using PEA as a natural material. Acknowledgements This work was funded by Çanakkale Onsekiz Mart Univesity, Unit of Scientific Research Projects as project number FBA-2018-1368.

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