the year 2019 was 837,122 tones. From this amount 34,405 tones or 4.1 % was plastic, 29,572 tones or 3.5 % was paper and cardboard, 16.060 tones or 1.3% glass, and 13,153 tones or 1.5 % metals (including aluminum and tin). The recovery and management of food packaging materials in Albania are regulated based on laws and regulations and the food packaging can be considered as the main contributor with more than 50 percent of the waste by volume. The main objective of the current study is to analyze actual legislation related to food packaging waste management, comparing with EU directives and regulations in order to improve actual Albanian legislations and waste management from the food industry. Some laws, regulations and strategies are approved by the Albanian government in order to manage direct or indirect packaging and food packaging materials. Thus, the packaging and food packaging material is mainly regulated by the Law No.9863 "Food Law", date 28.1.2008; the Law No. 10431,"On the environmental protection", date 9.06.2011 and the Law No. 10463, "On the integrated waste management". Further, are approved the Decisions of the Council of Ministers "On materials and plastic materials intended to come in contact with food" and"Packaging and waste packaging". These laws and decisions are partly harmonized with EU directives and regulations, thus the improvement of actual legislation. Another observed issue on the management of food packaging was the separation in source of the waste. Furthermore, this study highlights a lack of collaboration between the central government and several municipalities. Therefore, besides improvement of Albanian legislation, it is required to raise awareness and collaboration between central and local governments on food packaging management.

Keywords: Food legislation, food packaging materials, waste management, plastic waste, raising awareness.

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BIO-BASED PLATELET-SHAPED BIOCHARS AS REINFORCEMENTS IN BIOPOLYMERS FOR FOOD PACKAGING APPLICATIONS

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In this work, we have successfully extracted platelet-shaped biochars (PCNC) with widths/lengths up to 100 μm and thicknesses down to 100-150 nm from pyrolyzed nematic structures of cellulose nanocrystals. The PCNC showed 87% carbon content and mostly amorphous nature. The performance of PCNC as a reinforcing agent for food packaging applications was evaluated by comparing to the reinforcing capabilities of graphene oxide (GO) in a 6,14 biopolyamide (PA) and a cellulose nanofibers (CNF) matrix. For both cases, PCNC was found to be a better reinforcement than GO. PA/PCNC composites showed improved thermomechanical properties compared to PA/GO (PA/PCNC 5% showed a storage modulus at 100°C of 545 MPa while PA/GO 5% 392 MPa). Additionally, PA/PCNC composites showed reduced water diffusivity than PA/GO composites (PA/PCNC 1% showed a water diffusivity of 1.3 * 10-7 cm2/s, PA/Go 1% 1.8 * 10-7 cm2/s). Besides, filaments made with PA/PCNC also showed a better surface finish than PA/GO. In CNF composites, the incorporation of 5% of PCNC reduced the moisture-induced swelling by 31% (from 0% RH to 90% RH at 35 °C), increased the CNF´s young modulus and stress at the break by 34% and 22%, respectively. Besides, unlike GO, the incorporation of PCNC increased the electrical conductivity of CNF up to 10-3 S/m. To summarize, PCNC was a better reinforcement than GO, for both PA and CNF, in several aspects.

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NATURAL PECTIN-BASED EDIBLE COMPOSITE COATINGS WITH ANTIFUNGAL PROPERTIES TO CONTROL POSTHARVEST DECAY AND REDUCE LOSSES OF 'VALENCIA' ORANGES

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The potential of essential oils (EOs) and natural plant extracts to inhibit Penicillium digitatum (PD), Penicillium italicum (PI), and Geotrichum citri-aurantii (GC), the most economically important pathogens causing postharvest diseases of citrus fruits, was evaluated in in vitro studies. Selected antifungal agents and concentrations were incorporated into a pectin-based edible coating. In vitro mycelial growth inhibition was evaluated in PDA Petri dishes by exposure to the volatile compounds of EOs in the vapor phase or by direct contact of the natural extracts using the agar dilution method after 7-14 days of incubation at 25°C. Commercial EOs and volatile compounds evaluated were cinnamon (CN), lemongrass (LG), Satureja montana (SM) and myrrh (MI) EOs, eugenol (EU) and geraniol (GE). Dry extracts included green tea (GT), propolis (PRO) and vanillin (VA). Among these agents, CN, SM, EU and GE (at a dose of 20 µl) inhibited the radial growth of all the pathogens by 90-100%; whereas, VA, PRO and MI extracts were effective at concentrations of 0.125-0.5% (w/w). The effective

agents were tested as ingredients of pectin-beeswax edible coatings at different concentrations (0.2-2%w/w) to control green mold and sour rot on 'Valencia' oranges artificially inoculated with PD and GC, respectively. Disease incidence (%) and severity (lesion diameter, mm) were measured during 14-20 days of incubation at 20°C. Coatings containing 0.2% GE, 0.8% EU or 1.5% MI EOs reduced green mold incidence after 8 days by more than 40%, while the highest reduction in disease severity was observed with 0.8% CN. In the case of sour rot, the most effective coatings were those amended with EU (0.2-0.4%w/w), with 100% reduction of both disease incidence and severity. These results suggest the potential of these antifungal coatings to reduce citrus losses. Further studies should focus on the evaluation of the quality of coated citrus fruit during cold storage.

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DEVELOPMENT OF BACTERIAL NANOCELLULOSE POLY (3-HYDROXYBUTYRATE-CO HYDROXYVALERATE) COMPOSITE FOR FOOD PACKAGING

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Food packaging is increasingly demanding for advanced and eco-friendly sustainable materials that comply with food packaging requirements. Currently used materials are synthetic and non-degradable, raising environmental issues derived from the accumulation of plastics in landfills/waterways. Therefore, in this work, we intended to develop a sustainable and biodegradable food packaging based on bacterial nanocellulose (BNC) and polyhydroxyalkanoates. BNC is a biopolymer produced by Komagaebacter xylinus as a 3D nanofibrillar network, with interesting properties such as high porosity, biocompatibility and biodegradability. Applications such as biomedical, pulp & paper, composites, foods and many others, can benefit from these properties. Concerning food packaging, BNC has been demonstrated to offer interesting mechanical properties and the ability to support substances that play an active role in, for instance antimicrobial. However, the water vapour permeability is too high for packaging applications. While attempting to control the water vapour permeability, composites of BNC with poly-3-hydroxybutyrate-co-3-hydroxyvalerate (with a hydroxy valerate content of 18%) (PHBV) were produced. PHBV is a known polymer produced by bacteria with high degree of hydrophobicity and biodegradability. BNC membranes produced by static culture were plasticized either with glycerol (BNCgly) or polyethylene glycol (MW600) (BNCPEG), by impregnation for 24 h in 1% m/v solutions, followed by air-drying. The BNC was then coated with PHBV (20%m/v) dissolved in formic acid (60 ºC; 2 h), and oven-dried. The morphology, water vapour permeability, degree of hydrophobicity and mechanical properties were then assessed. Overall, PHBV coating on plasticized BNC reduced significantly the water vapour permeability (down to 0.032 g.um/ (m2.day.Pa) under 50% relative humidity), and enhanced the degree of hydrophobicity (Contact angle within 80-90º), compromising the high stiffness (from 3.1GPa to 1.3GPa) of BNC. However, the obtained properties were acceptable for packaging applications. Concerning the plasticizer used, better adhesion of PHBV was observed with glycerol, resulting in enhanced coating performance and barrier properties.

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LIGNIN/PLA BASED SUSTAINABLE COMPOSITES FOR FOOD PACKAGING APPLICATIONS

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Globally, 42% of total polymer consumption goes for packaging applications. Among the polymers used in food packaging, polylactic acid (PLA) is widely used in plastic films, bottles and biodegradable medical devices. However, PLA exhibits some limitations such as slow crystallization, poor thermal stability and high cost which makes it unsuitable for food storage applications. We suggest that these limitations can be overcome through incorporation of biopolymers like lignin. Lignin can be obtained as a byproduct from agricultural and forest biorefineries and contains several different functional groups (hydroxyl, carbonyl, and carboxyl groups). However, lignin has some compatibility issues with PLA due to the polar functional groups present. Modification of these polar groups within lignin can significantly minimize compatibility issues with the PLA matrix and enhance the properties. The present work proposes oxypropylation and benzylation reactions of lignin hydroxyl groups to boost the hydrophobicity and followed by the production of modified lignin/PLA composites. This work will also focus on producing modified lignin nanoparticle (LNP)-based PLA composites due to its strong potential for several applications. However, the hydrophilic nature of the LNP still results in compatibility issues, and therefore