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PACKAGING SCIENCE

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Biosensori a base di aptameri per la determinazione analitica del Bisfenolo A negli alimenti.

Il bisfenolo A (BPA) è un composto sintetico utilizzato per produrre materie plastiche per materiali a contatto con gli alimenti (FCM) o resine per l'interno di contenitori per alimenti. E' stato riconosciuto come una sostanza chimica che altera il sistema endocrino (EDC). La dieta è considerata la principale fonte di esposizione per gli esseri umani al BPA. Finora, molte recensioni sono state pubblicate su biosensori e biosensori basati su aptameri, ma nessuno di loro si concentra sulle loro applicazioni nelle loro analisi dei bisfenoli nelle matrici alimentari. Dato che un nuovo valore di DGT è stato recentemente proposto dall'EFSA (0,04 ng/kg), la ricerca di nuovi strumenti sensibili per l'analisi quantitativa del BPA è più urgente che mai.

applied sciences

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Review

Aptamer-Based Biosensors for the Analytical Determination of Bisphenol A in Foodstuffs

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Featured Application: Surveys on BPA levels in specific groups of foodstuffs; design of aptasensors for BPA analogs.

Abstract: Bisphenol A (BPA) is a synthetic compound utilized to manufacture plastics for Food Contact Materials (FCMs) or resins for the inside of food containers. Since it was recognized as an Endocrine-Disrupting Chemical (EDC), its implications in pathologies, such as cancer, obesity, diabetes, immune system alterations, and developmental and mental disorders, have been widely documented. Diet is considered the main source of exposure for humans to BPA. Consequently, continuous monitoring of the levels of BPA in foods is necessary to assess the risk associated with its consumption in one's diet. So far, many reviews have been published on biosensors and aptamer-based biosensors, but none of them focus on their applications in their analyses of bisphenols in food matrices. With this review, the authors aim to fill this gap and to take a snapshot of the current state-of-the-art research on aptasensors designed to detect BPA in food matrices. Given that a new TDI value has recently been proposed by the EFSA (0.04 ng/kg), the search for new sensitive tools for the quantitative analysis of BPA is more topical and urgent than ever. From this perspective, aptasensors prove to be a good alternative to traditional analytical techniques for determining BPA levels in food.

Keywords: bisphenols; Endocrine-Disrupting Chemicals (EDCs); biosensors; aptasensors; food safety

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Citation: Schiano, M.E.; Abduvakhidov, A.; Varra, M.; Albrizio, S. Aptamer-Based Biosensors for the Analytical Determination of Bisphenol A in Foodstuffs. *Appl. Sci.* **2022**, *12*, 3752. https://doi.org/10.3390/app12083752

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Un approccio privo di solventi per rivestimenti polimerici idrofobici reticolati su carta utilizzando olio vegetale.

I rivestimenti idrofobici sono della massima importanza per molte applicazioni di materiali a base di carta. Tuttavia, ad oggi, la maggior parte dei metodi di rivestimento richiede grandi quantità di sostanze chimiche e solventi. Spesso vengono utilizzati materiali di rivestimento a base fossile e spesso sono necessarie molteplici reazioni di derivatizzazione per ottenere le prestazioni desiderate. In questo lavoro, presentiamo un processo di rivestimento della carta privo di solventi, in cui l'olio d'oliva come principale componente biogenico viene utilizzato per ottenere una barriera idrofobica su carta.

polymers

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Article

A Solvent-Free Approach to Crosslinked Hydrophobic Polymeric Coatings on Paper Using Vegetable Oil

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Abstract: Hydrophobic coatings are of utmost importance for many applications of paper-based materials. However, to date, most coating methods demand vast amounts of chemicals and solvents. Frequently, fossil-based coating materials are being used and multiple derivatization reactions are often required to obtain desired performances. In this work, we present a solvent-free paper-coating process, where olive oil as the main biogenic component is being used to obtain a hydrophobic barrier on paper. UV-induced thiol-ene photocrosslinking of olive oil was pursued in a solvent-free state at a wavelength of 254 nm without addition of photoinitiator. Optimum reaction conditions were determined in advance using oleic acid as a model compound. Paper coatings based on olive oil crosslinked by thiol-ene reaction reach water contact angles of up to 120°. By means of Fourier transform infrared spectroscopy and differential scanning calorimetry, a successful reaction and the formation of a polymer network within the coating can be proven. These results show that click-chemistry strategies can be used to achieve hydrophobic polymeric paper coatings while keeping the amount of non-biobased chemicals and reaction steps at a minimum.

Keywords: vegetable oil; coatings; paper; thiol-ene; hydrophobicity; barrier; food packaging

Citation: Loesch-Zhang, A.; Cordt, C.; Geissler, A.; Biesalski, M. A Solvent-Free Approach to Crosslinked Hydrophobic Polymeric Coatings on Paper Using Vegetable

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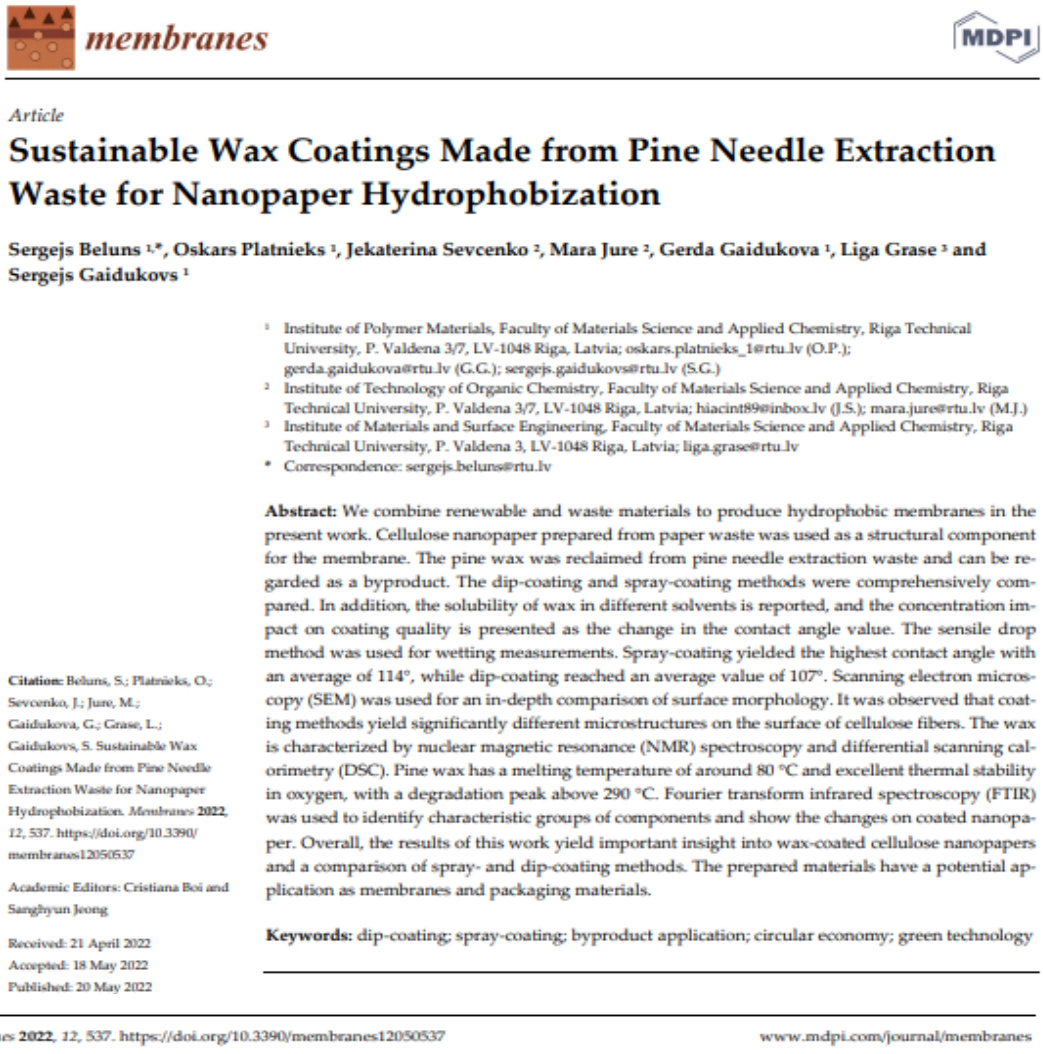
Rivestimenti in cera sostenibili realizzati con scarti di estrazione dell'ago di pino per l'idrofobizzazione della nanopaper

Nel presente lavoro sono stati combinati materiali rinnovabili e di scarto per produrre membrane idrofobiche. La nanopaper di cellulosa preparata dai rifiuti di carta è stata utilizzata come componente strutturale per la membrana. La cera di pino è stata recuperata dai rifiuti di estrazione dell'ago di pino e può essere considerata un sottoprodotto. La spettroscopia infrarossa a trasformata di Fourier (FTIR) è stata utilizzata per identificare gruppi caratteristici di componenti e mostrare i cambiamenti sulla nanopaper rivestita. Nel complesso, i risultati di questo lavoro forniscono importanti informazioni sui nanopaper di cellulosa rivestiti di cera e un confronto dei metodi di rivestimento a spruzzo e a immersione. I materiali preparati hanno una potenziale applicazione come membrane e materiali di imballaggio.



membranes

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Article

Sustainable Wax Coatings Made from Pine Needle Extraction Waste for Nanopaper Hydrophobization

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Abstract: We combine renewable and waste materials to produce hydrophobic membranes in the present work. Cellulose nanopaper prepared from paper waste was used as a structural component for the membrane. The pine wax was reclaimed from pine needle extraction waste and can be regarded as a byproduct. The dip-coating and spray-coating methods were comprehensively compared. In addition, the solubility of wax in different solvents is reported, and the concentration impact on coating quality is presented as the change in the contact angle value. The sensile drop method was used for wetting measurements. Spray-coating yielded the highest contact angle with an average of 114°, while dip-coating reached an average value of 107°. Scanning electron microscopy (SEM) was used for an in-depth comparison of surface morphology. It was observed that coating methods yield significantly different microstructures on the surface of cellulose fibers. The wax is characterized by nuclear magnetic resonance (NMR) spectroscopy and differential scanning calorimetry (DSC). Pine wax has a melting temperature of around 80 °C and excellent thermal stability in oxygen, with a degradation peak above 290 °C. Fourier transform infrared spectroscopy (FTIR) was used to identify characteristic groups of components and show the changes on coated nanopaper. Overall, the results of this work yield important insight into wax-coated cellulose nanopapers and a comparison of spray- and dip-coating methods. The prepared materials have a potential application as membranes and packaging materials.

Keywords: dip-coating; spray-coating; byproduct application; circular economy; green technology

Citation: Beluns, S.; Platnieks, O.; Sevcenko, J.; Jure, M.; Gaidukova, G.; Grase, L.; Gaidukovs, S. Sustainable Wax Coatings Made from Pine Needle Extraction Waste for Nanopaper Hydrophobization. *Membranes* **2022**, *12*, 537. https://doi.org/10.3390/membranes12050537

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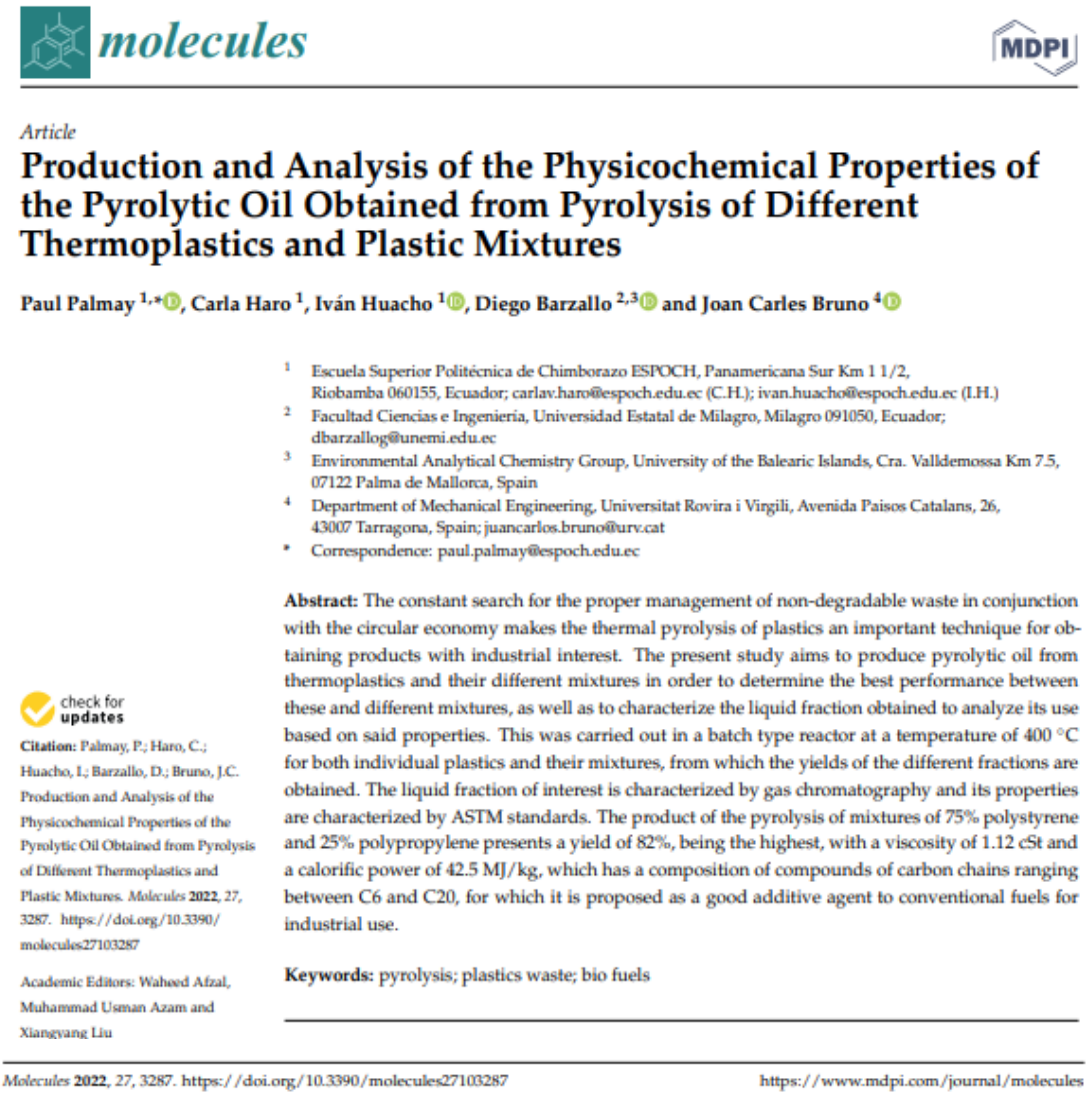
Produzione e analisi delle proprietà fisico-chimiche dell'olio pirolitico ottenuto dalla pirolisi di diversi materiali termoplastici e miscele plastiche.

La costante ricerca della corretta gestione dei rifiuti non degradabili in concomitanza con l'economia circolare rende la pirolisi termica delle materie plastiche una tecnica importante per ottenere prodotti di interesse industriale. Il presente studio mira a produrre olio pirolitico da termoplastici e dalle loro diverse miscele al fine di determinare le migliori prestazioni tra queste e diverse miscele, nonché di caratterizzare la frazione liquida ottenuta per analizzarne l'uso in base a tali proprietà. Ciò è stato effettuato in un reattore di tipo batch ad una temperatura di 400 °C sia per le singole materie plastiche che per le loro miscele, da cui si ottengono le rese delle diverse frazioni.



molecules

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Article

Production and Analysis of the Physicochemical Properties of the Pyrolytic Oil Obtained from Pyrolysis of Different Thermoplastics and Plastic Mixtures

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Abstract: The constant search for the proper management of non-degradable waste in conjunction with the circular economy makes the thermal pyrolysis of plastics an important technique for obtaining products with industrial interest. The present study aims to produce pyrolytic oil from thermoplastics and their different mixtures in order to determine the best performance between these and different mixtures, as well as to characterize the liquid fraction obtained to analyze its use based on said properties. This was carried out in a batch type reactor at a temperature of 400 °C for both individual plastics and their mixtures, from which the yields of the different fractions are obtained. The liquid fraction of interest is characterized by gas chromatography and its properties are characterized by ASTM standards. The product of the pyrolysis of mixtures of 75% polystyrene and 25% polypropylene presents a yield of 82%, being the highest, with a viscosity of 1.12 cSt and a calorific power of 42.5 MJ/kg, which has a composition of compounds of carbon chains ranging between C6 and C20, for which it is proposed as a good additive agent to conventional fuels for industrial use.

Keywords: pyrolysis; plastics waste; bio fuels

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Citation: Palmay, P.; Haro, C.; Huacho, I.; Barzallo, D.; Bruno, J.C. Production and Analysis of the Physicochemical Properties of the Pyrolytic Oil Obtained from Pyrolysis of Different Thermoplastics and Plastic Mixtures. *Molecules* **2022**, *27*, 3287. https://doi.org/10.3390/molecules27103287

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Valorizzazione del residuo di bauxite in paste ceramiche.

Il residuo di bauxite o fango rosso (RM) è un rifiuto industriale pericoloso generato dalla produzione di allumina utilizzando il processo Bayer. Attualmente, è uno dei rifiuti industriali più abbondanti. Attualmente, 300 milioni di tonnellate di RM vengono generate all'anno in tutto il mondo, e già ci sono circa 3 miliardi di tonnellate immagazzinate in stagni o tumuli secchi. Di conseguenza, è della massima importanza affrontare questo problema e cambiare questo paradigma. Questo lavoro mira a valorizzare il fango rosso utilizzandolo come colorante nelle paste ceramiche in gres. A tale scopo, RM in diverse proporzioni (0-10 wt.%) è stato aggiunto alla pasta ceramica. RM è stato prima essiccato (a 120 °C) e, successivamente, utilizzato come ricevuto e calcinato a 600 °C, per una velocità di riscaldamento di 10 °C/min e un tempo di permanenza di 30 min. Pertanto, questo lavoro fornisce una valida alternativa per la gestione di questi rifiuti e riduce i problemi ambientali associati allo smaltimento delle materie prime e all'impronta di carbonio associata al processo di produzione della ceramica. Inoltre, questi risultati dimostrano che il residuo di bauxite, un rifiuto pericoloso, può essere valorizzato nei prodotti in gres come colorante, promuovendo il concetto di economia circolare.

materials proceedings

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Abstract

Valorization of Bauxite Residue in Ceramic Pastes †

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† Presented at the Materiais 2022, Marinha Grande, Portugal, 10–13 April 2022.

Keywords: red mud valorization; circular economy; life cycle assessment

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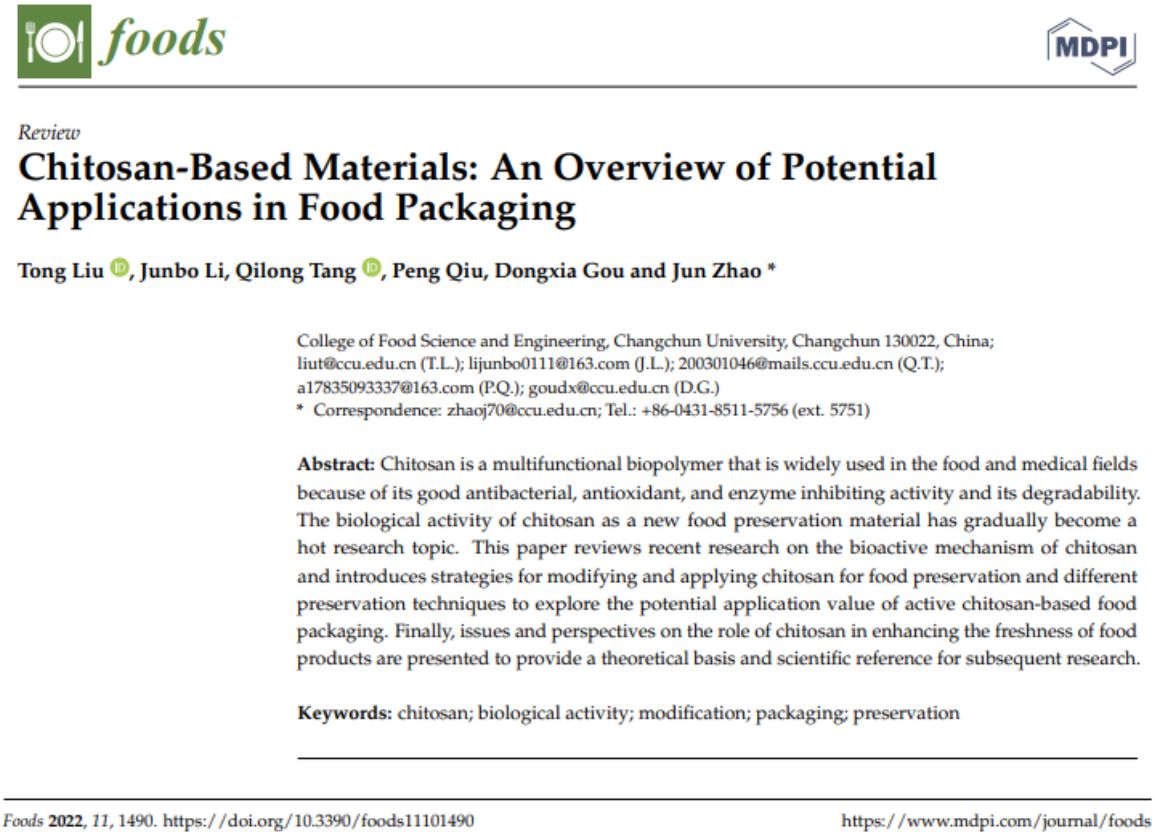
Materiali a base di chitosano: una panoramica delle potenziali applicazioni nel packaging alimentare

Il chitosano è un biopolimero multifunzionale ampiamente utilizzato in campo alimentare e medico per la sua buona attività antibatterica, antiossidante e inibente gli enzimi e la sua degradabilità. L'attività biologica del chitosano come nuovo materiale per la conservazione degli alimenti è diventata gradualmente un argomento di ricerca caldo. Questo articolo esamina le recenti ricerche sul meccanismo bioattivo del chitosano e introduce strategie per modificare e applicare il chitosano per la conservazione degli alimenti e diverse tecniche di conservazione per esplorare il potenziale valore applicativo dell'imballaggio alimentare attivo a base di chitosano. Infine, vengono presentate questioni e prospettive sul ruolo del chitosano nel migliorare la freschezza dei prodotti alimentari per fornire una base teorica e un riferimento scientifico per la ricerca futura.



foods

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Review

Chitosan-Based Materials: An Overview of Potential Applications in Food Packaging

Tong Liu, Junbo Li, Qilong Tang, Peng Qiu, Dongxia Gou and Jun Zhao *

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Abstract: Chitosan is a multifunctional biopolymer that is widely used in the food and medical fields because of its good antibacterial, antioxidant, and enzyme inhibiting activity and its degradability. The biological activity of chitosan as a new food preservation material has gradually become a hot research topic. This paper reviews recent research on the bioactive mechanism of chitosan and introduces strategies for modifying and applying chitosan for food preservation and different preservation techniques to explore the potential application value of active chitosan-based food packaging. Finally, issues and perspectives on the role of chitosan in enhancing the freshness of food products are presented to provide a theoretical basis and scientific reference for subsequent research.

Keywords: chitosan; biological activity; modification; packaging; preservation

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Applicazioni dei biopolimeri di amido per un'agricoltura moderna sostenibile

La coltivazione protetta nell'agricoltura moderna si basa ampiamente su pellicole di pacciamatura di origine plastica, reti, imballaggi, tubazioni, insilati e varie applicazioni. Le poliolefine sintetizzate dalle vie petrolchimiche sono ampiamente consumate nella plastica, in cui PP e PE sono le materie plastiche dominanti. Imponendo impatti sostanziali sulla nostra geosfera e sull'umanità, la plastica nel suolo minaccia la sicurezza alimentare, la salute e l'ambiente. Le plastiche mal gestite non sono biodegradabili in condizioni naturali e generano inquinanti emergenti problematici come le nano-microplastiche. L'amido è uno dei biopolimeri biodegradabili più abbondanti da fonti rinnovabili; contiene anche proprietà termoplastiche regolabili adatte a diverse applicazioni in agricoltura.

sustainability MDPI

Review

Applications of Starch Biopolymers for a Sustainable Modern Agriculture

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Citation: Gamage, A.; Liyanapathiranage, A.; Manamperi, A.; Gunathilake, C.; Mani, S.; Merah, O.; Madhujith, T. Applications of Starch Biopolymers for a Sustainable Modern Agriculture. *Sustainability* **2022**, *14*, 6085. https://doi.org/10.3390/su14106085

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Abstract: Protected cultivation in modern agriculture relies extensively on plastic-originated mulch films, nets, packaging, piping, silage, and various applications. Polyolefins synthesized from petrochemical routes are vastly consumed in plasticulture, wherein PP and PE are the dominant commodity plastics. Imposing substantial impacts on our geosphere and humankind, plastics in soil threaten food security, health, and the environment. Mismanaged plastics are not biodegradable under natural conditions and generate problematic emerging pollutants such as nano-micro plastics. Post-consumed petrochemical plastics from agriculture face many challenges in recycling and reusing due to soil contamination in fulfilling the zero waste hierarchy. Hence, biodegradable polymers from renewable sources for agricultural applications are pragmatic as mitigation. Starch is one of the most abundant biodegradable biopolymers from renewable sources; it also contains tunable thermoplastic properties suitable for diverse applications in agriculture. Functional performances of starch such as physicomechanical, barrier, and surface chemistry may be altered for extended agricultural applications. Furthermore, starch can be a multidimensional additive for plasticulture that can function as a filler, a metaphase component in blends/composites, a plasticizer, an efficient carrier for active delivery of biocides, etc. A substantial fraction of food and agricultural wastes and surpluses of starch sources are underutilized, without harnessing useful resources for agriscience. Hence, this review proposes reliable solutions from starch toward timely implementation of sustainable practices, circular economy, waste remediation, and green chemistry for plasticulture in agriscience

Keywords: biodegradable polymers; starch; mulch films; composites

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