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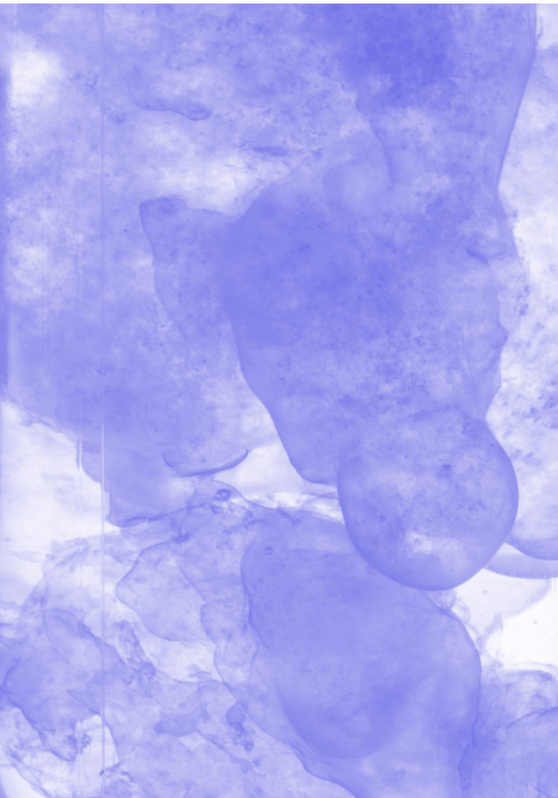

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Message from the Editor-in-Chief

As the world of science becomes ever more specialized, researchers may lose themselves in the deep forest of the ever increasing number of subfields being created. This open access journal *Applied Sciences* has been started to link these subfields, so researchers can cut through the forest and see the surrounding, or quite distant fields and subfields to help develop his/her own research even further with the aid of this multi-dimensional network.

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Prof. Dr. Alejandro Pérez-Rodríguez

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Selected Papers

Tannin Extraction from Chestnut Wood Waste: From Lab Scale to Semi-Industrial Plant

Authors: Lidia María Belmonte, Rafael Morales and Antonio Fernández-Caballero

Abstract: The chestnut tree (*Castanea sativa*, Mill.) is a widespread plant in Europe whose fruits and wood has a relevant economic impact. Chestnut wood (CW) is rich in high-value compounds that exhibit various biological activities, such as antioxidant as well as anticarcinogenic and antimicrobial properties. These metabolites can be mainly divided into monomeric polyphenols and tannins. In this piece of work, we investigated a sustainable protocol to isolate enriched fractions of the above-mentioned compounds from CW residues. Specifically, a sequential extraction protocol, using subcritical water, was used as a pre-fractionation step, recovering approximately 88% of tannins and 40% of monomeric polyphenols in the first and second steps, respectively. The optimized protocol was also tested at pre-industrial levels, treating up to 13.5 kg CW and 160 L of solution with encouraging results. Ultra- and nanofiltrations were used to further enrich the recovered fractions, achieving more than 98% of the tannin content in the heavy fraction, whilst the removed permeate achieved up to 752.71 mg GAE/g_{ext} after the concentration (75.3%). Samples were characterized by means of total phenolic content (TPC), antioxidant activity (DPPH· and ABTS·), and tannin composition (hydrolysable and condensed). In addition, LC-MS-DAD was used for semiqualitative purposes to detect vescalagin/castalagin and vescalin/castalin, as well as gallic acid and ellagic acid. The developed valorization protocol allows the efficient fractionation and recovery of the major polyphenolic components of CW with a sustainable approach that also evaluates pre-industrial scaling-up.

https://doi.org/10.3390/app13042494

Smart Materials for Green(er) Cities, a Short Review

Authors: Pascal Nicolay, Sandra Schlögl, Stephan Mark Thaler, Claude Humbert and Bernd Filipitsch

Abstract: The transition to sustainable or green(er) cities requires the development and implementation of many innovative technologies. It is vital to ensure that these technologies are themselves as sustainable and green as possible. In this context, smart materials offer excellent prospects for application. They are capable of performing a number of tasks (e.g., repair, opening/closing, temperature measurement, storage and release of thermal energy) without embedded electronics or power supplies. In this short review paper, we present some of the most promising smart material-based technologies for sustainable or green(er) cities. We will briefly present the state-of-the-art in smart concrete for the structural health monitoring and self-healing of civil engineering structures, phase-change materials (PCM) for passive air-conditioning, shape-memory materials (SMA) for various green applications, and meta-surfaces for green acoustics.

https://doi.org/10.3390/app13169289

Advancing Plastic Waste Classification and Recycling Efficiency: Integrating Image Sensors and Deep Learning Algorithms

Authors: Janghee Choi, Byeongju Lim and Youngjun Yoo

Abstract: Plastics, with their versatility and cost-effectiveness, have become indispensable materials across various industries. However, the improper disposal and mismanagement of plastic waste have led to significant environmental issues, including pollution, habitat destruction, and threats to wildlife. To address these challenges, numerous methods for plastic waste sorting and recycling have been developed. While conventional techniques like near-infrared spectroscopy (NIRS) have been effective to some extent, they face difficulties in accurately classifying chemically similar samples, such as polyethylene terephthalate (PET) and PET-glycol (PET-G), which have similar chemical compositions but distinct physical characteristics. This paper introduces an approach that adapts image sensors and deep learning object detection algorithms; specifically, the You Only Look Once (YOLO) model, to enhance plastic waste classification based on the shape of the waste. Unlike conventional methods that rely solely on spectral analysis, our methodology aims to significantly improve the accuracy and efficiency of classifying plastics, especially when dealing with materials having similar chemical compositions but differing physical attributes. The system developed using image sensors and the YOLO model proves to be not only effective but also scalable and adaptable for various industrial and environmental applications. In our experiments, the results are strikingly effective. We achieved a classification accuracy rate exceeding 91.7% mean Average Precision (mAP) in distinguishing between PET and PET-G, surpassing conventional techniques by a considerable margin. The implications of this research extend far and wide. By enhancing the accuracy of plastic waste sorting and reducing misclassification rates, we can significantly boost recycling efficiency. The proposed approach contributes to a more sustainable and efficient plastic waste management system, alleviating the strain on landfills and mitigating the environmental impact of plastic waste, contributing to a cleaner and more sustainable environment.

https://doi.org/10.3390/app131810224

Optimization of Process Variables for the Sustainable Extraction of Phenolic Compounds from Chicory and Fennel By-Products

Authors: Antonietta Baiano, Roberto Romaniello, Ferruccio Giametta and Anna Fiore

Abstract: The production of minimally processed vegetables generates large amounts of by-products whose concentrations in bioactive compounds is comparable to those of the edible part. The aim of this work was the optimization of sustainable processes for the extraction of phenolic compounds from chicory and fennel by-products using water as solvent. The results were compared with those obtained through a conventional extraction performed with a 70% ethanol aqueous solution as extraction solvent. The ultrasound-assisted extraction (UAE) and microwave-assisted extractions (MAE) were established by developing two Box–Behnken designs, respectively, a four-factor, three-level design and a three-factor, three-level design. A quadratic polynomial model was useful in optimizing both the ultrasonic (R^2 0.8473 for chicory and R^2 0.9208 for fennel) and microwave (R^2 0.9145 for chicory and R^2 0.7836 for fennel) extraction of bioactive compounds as well as the antioxidant activity of extract (R^2 0.8638 for chicory and R^2 0.9238 for fennel treated with ultrasounds; R^2 0.9796 for chicory and R^2 0.7486 for fennel submitted to MAE). The UAE conditions able to maximize the total phenolic concentrations were: 10 g/100 mL, 55 °C, t: 60 min, 72 W for chicory (9.07 mg gallic acid/g dm) and 15 g/100 mL, 45 °C, t: 40 min, 120 W for fennel (6.64 mg gallic acid/g dm). Concerning MAE, the highest phenolic concentrations were obtained applying 7.5 g/100 mL; 2 min; 350 W for chicory (8.23 mg gallic acid/g dm); 7.5 g/100 mL; 3 min; 160 W for fennel (6.73 mg gallic acid/g dm). Compared to conventional solvent extraction, UAE and MAE allowed the obtainment of (a) chicory extracts richer in phenolic compounds (+48% and +34%, respectively), in less time (4-fold and 90-fold reduction, respectively) and (b) fennel, extracts with slightly lower amount of phenolics (–11.7% and –10.5%, respectively) but halving the extraction time (UAE) or reducing it to 60-fold (MAE).

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