Contemporary Developments in the intersection of biotechnology and food science

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Abstract

Studies explore the enhancement of gluten-free bread quality through the use of chestnut flour and vacuum packaging, revealing improved sensory properties. Investigations into the nutritional potential of plant seeds and microalgae emphasize the health benefits of fenugreek seeds due to their amino acid profile and antioxidant activity. Further research assesses the efficacy of Prunus padus extracts in preventing lipid peroxidation, showcasing their potential in biomembrane stability. The stability of nanoemulsions containing lipophilic bioactive compounds is significantly increased by the use of octenyl succinic anhydride (OSA)-modified starch. Additionally, supercritical fluid extraction (SFE) and ultrasound-assisted extraction (UAE) are evaluated for their efficiency in extracting galactolipids from rosehip pomace, offering superior alternatives to conventional methods. Lastly, the application of non-thermal plasma treatment is studied for its ability to reduce heavy metal accumulation in water spinach, indicating a promising approach for enhancing plant growth and food safety without significantly affecting lead accumulation. Collectively, these studies contribute to the fields of food science and agriculture by providing sustainable and effective solutions for food production, safety, and nutritional enhancement.

Introduction

The current era is characterized by multifaceted transformations spanning socio-demographic shifts, economic developments, and technological advancements. These transformations serve as both a source of inspiration and a contributory factor to the global scientific community's endeavors. Notably, the field of food science is undergoing significant evolution, with a continuous quest for novel ingredients, production methodologies, and technologies, alongside a critical focus on microbiological safety to ensure product quality.

In alignment with these observations, the special issue of Applied Sciences titled "Recent Advances in Applied Microbiology and Food Sciences" is dedicated to showcasing the forefront of research in analytics, application of innovative methods, and the latest technological advancements within food science and microbiology. This includes cutting-edge approaches to food production and testing, as well as the promotion of sustainable practices in agriculture and the food industry. The special issue comprises nine original research papers and two review articles, providing a comprehensive overview of recent progress in these areas.

For a scientific and precise articulation of the ongoing changes and their significance to food science and microbiology, references to the literature include works like Hwang et al. (2020) on the impact of technological advancements on food safety and Smith and Haddad

(2021) discussing the role of socio-demographic and economic changes in shaping food science research priorities. Further, the special issue itself serves as a primary source for the latest developments in applied microbiology and food sciences, embodying the collective knowledge and novel discoveries within these domains.

Microbiology and foodbiotechnology:

Kot et al. [1] explored the enhancement of carotenoid biosynthesis in Rhodotorula mucilaginosa MK1 through the utilization of specific cations and B vitamins, leveraging waste substrates from the agri-food industry, such as glycerol and potato wastewater. Their findings underscored the critical role of certain microelements, including barium and aluminum, in the culture medium for maximizing carotenoid yields. Additionally, they discovered that niacin (a B vitamin) significantly promotes the production of torularhodin, increasing its percentage from 22.79% in the control culture to 33.79% in the vitamin-enriched medium, marking the inaugural documentation of niacin's influence on carotenoid biosynthesis in Rhodotorula red yeast cells.

In a separate study, Olea-Rodríguez et al. [2] delved into the microbiological dynamics during the production and maturation of Cotija cheese, a semi-hard cheese originating from Cotija de la Paz, Michoacan, Mexico. Their research revealed that the ripening process of Cotija cheese involves intricate interactions within its microbial community, notably affecting Staphylococcus aureus, Salmonella spp., Listeria monocytogenes, and staphylococcal toxin populations. Notably, the authors observed a progressive decline in Staphylococcus and Salmonella bacterial counts, attributed to increasing acidity and decreasing pH levels throughout cheese maturation. This study highlights the significance of the ripening process in ensuring the microbiological safety of Cotija cheese for consumers.

Isakova et al. [3] investigated the crucial function of mitochondria in modulating the aging process in Endomyces magnusii yeast. Their study elucidated that the longevity and elevated metabolic rates observed in yeast during prolonged cultivation could be attributed to mitochondrial activity. They further identified that during the yeast's logarithmic growth phase, the content of triacylglycerol (TAG) within mitochondria was relatively low, whereas diacylglycerols (DAG) levels peaked during this phase. Additionally, they observed significant alterations in the lipid composition and content of the mitochondrial membrane throughout the yeast's growth and aging, suggesting a dynamic relationship between mitochondrial function and cellular aging.

Ranjha et al. [4], in their review "Nutritional and Health Potential of Probiotics: A Review," explored the health implications of various probiotics, highlighting their nutritional benefits and potential in disease prevention. This review meticulously detailed the mechanisms through which probiotics contribute to health, including their role in mitigating obesity, managing type 1 and 2 diabetes, and offering protective mechanisms against gestational diabetes mellitus and chronic kidney disease Hussain et al.2023 [14].

Milho et al. [5] in their review "Antimicrobials from Medicinal Plants: An Emergent Strategy to Control Oral Biofilms," focused on the potential of medicinal plants in managing oral biofilms. They reviewed the efficacy of essential oils from Cymbopogon citratus and Lippia alba as promising alternatives to conventional antibiotics for treating oral diseases. This review underscores the significance of medicinal plants in developing novel antimicrobial strategies

against oral biofilms, highlighting the therapeutic potential of natural products in oral healthcare.

Food science and technology

Marciniak-Lukasiak et al. [6] explored the influence of chestnut flour incorporation and packaging methods on the quality of gluten-free bread. The bread samples were packaged in PA/PE barrier foil, both with air and under vacuum, and subsequently analyzed for water content, texture, color parameters, sensory appeal, and microbiological stability. The findings indicated that incorporating chestnut flour at concentrations below 10% combined with vacuum packaging yielded bread with desirable sensory properties and quality Abid et al. 2022 [12].

Miedzianka et al. [7] delved into the nutritive potential of plant seeds and microalgae as protein-rich food sources. Their research assessed the antioxidant and antimicrobial activities, along with amino acid profiles of selected spice plants and microalgae. In vitro digestion experiments were conducted to estimate the bioavailability of polyphenols Amin et al. 2021 [13]. Notably, seeds from black cumin, milk thistle, white mustard, eggfruit, and chlorella exhibited no deficient amino acids, positioning fenugreek seeds as a promising food ingredient due to their favorable amino acid composition and high antioxidant properties.

Siejak and colleagues [8] examined the antioxidative efficacy of various solvents (water, methanol, ethanol, and acetone) on lipid peroxidation in soybean L-α-phosphatidylcholine liposomes. Through spectroscopic and chromatographic analyses, the antioxidative potential of Prunus padus extracts on biomembrane stability was assessed. The results highlighted P. padus as a potent source of antioxidants, capable of significantly reducing lipid membrane degradation.

Ali et al. [9] investigated the stability of nanoemulsions containing vitamin E and β-carotene encapsulated within oil-in-water nanoemulsions using carrier oils like tuna fish oil and medium-chain triglycerides, stabilized by octenyl succinic anhydride (OSA)-modified starch and Tween-80. The study found that OSA-modified starch enhanced the emulsion's stability by forming denser interfacial coatings, offering protective barriers against the aqueous phase. This study provides insights for developing water-rich food products fortified with lipophilic bioactive compounds, leveraging the stabilizing properties of OSA-modified starch.

Woźniak et al. [10] investigated the extraction of galactolipids, specifically monogalactosyldiacylglycerols (MGDGs) and digalactosyldiacylglycerols (DGDGs), from rosehip pomace using supercritical fluid extraction (SFE) with CO2 and ultrasound-assisted extraction (UAE). Their findings revealed that SFE with pure CO2 was relatively inefficient for galactolipid extraction, but the efficiency significantly increased with the addition of ethanol as a co-solvent and optimizing the solid–liquid ratio. Sonication further enhanced the extraction efficiency by approximately 36%, with SFE yields being five times higher than those of the control, highlighting the effectiveness of SFE. UAE also showed considerable promise, boosting extraction yields by up to 74%. These green chemistry methods for galactolipid isolation demonstrated superior performance compared to conventional extraction techniques, offering viable alternatives for sustainable galactolipid recovery.

Hou et al. [11] explored the potential of non-thermal plasma treatment to increase the growth rate of plants and decrease heavy metal accumulation in water spinach. The study indicated that heavy metal uptake in water spinach was contingent upon the metal type and soil concentration. Notably, plasma treatment of seeds or irrigation water significantly mitigated

cadmium accumulation in spinach leaves, although it did not exhibit a similar effect on lead levels. Khan et al. 2022 [15] this distinction underscores the selective efficacy of plasma treatments in reducing certain heavy metal concentrations in edible plants, with implications for improving food safety.

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