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Editorial

Special Issue "Advances in Postharvest Process Systems"

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The world population is predicted to increase from the present 7.7 billion to 9.7 billion in 2050, demanding a significant increase in food supply and production. However, around 25–30% of food is wasted worldwide every year due to poor postharvest supply chain design and management in different stages of the food supply chain, including postharvest handling, processing, and storage systems.

This special issue presents state-of-the-art information on the important innovations and research in the agricultural and food industry. Different novel technologies and their implementation to optimize postharvest processes and reduce losses are reviewed and explored. In particular, it examines a range of recently developed and improved technologies and systems to help the industry and growers to manage and minimize postharvest losses, enhance reliability and sustainability in the postharvest food value chain, and generate high-quality products that are both healthy and appealing to consumers.

This special issue consists of three sections, focusing on food storage and preservation technologies [1–4], food processing technologies [5–8], and the applications of advanced mathematical modeling and computer simulations [9–11]. We wish to acknowledge the expert contributions of all authors here. We also wish to acknowledge and thank MDPI staff for their professional assistance in editing the published articles. We sincerely hope that this special issue will assist all readers and stakeholders working in or are associated with the fields of agriculture, agri-food chain, and technology development and promotion. After all, efficient postharvest technology is an essential and key factor underlying future global food security, and ultimately human survival and development.

1. Food Storage and Preservation Technologies

There are many ways to store and preserve food, each with its benefits and limitations. Different food and crops also need to be stored and preserved in particular ways to maintain their quality best. Onwude et al. [1] reviews the recent advances in technologies to reduce the quality loss of fresh agricultural produce in the supply chain, including the applications of imaging technology, spectroscopy, multi-sensors, electronic nose, radio frequency identification, printed sensors, acoustic impulse response, and mathematical models. The Internet of Things (IoT) and virtual representation models of a particular fresh produce (digital twins) are particularly identified as emerging technologies that can help monitor and control the quality during postharvest.

Ndukwu et al. [2] investigates the effectiveness of different household storage strategies and also the plant-based preservatives for dehulled and sun-dried breadfruit seeds. The obtained results revealed the high potential of alligator pepper (*Zingiberaceaeaframomum melegueta*) as a botanical insecticide in preventing insect infestation and mold growth. An aluminum silo bin with alligator pepper powder is subsequently recommended to store dried and dehulled breadfruit seeds as a baseline for other tropical crops.

Tomlins et al. [3] evaluates the various factors contributing to the storage shelf-life of fresh Cassava roots. In this study, three different types of bag materials were tested. Microclimate related to temperature, humidity, and carbon dioxide (CO_2) was monitored. The results showed that fresh cassava roots could be stored for 8 days, with minimal postharvest physiological deterioration and starch loss. It was also shown that carbon dioxide concentration in the stores was significantly correlated with the starch loss in fresh cassava roots and is therefore proposed as a possible method for continuously and remotely monitoring starch loss in large-scale commercial operations and reducing postharvest losses.

Esua et al. [4] reviews the applications of ultraviolet-C radiation and ultrasound technology for postharvest preservation and handling of fruits and vegetables. It was identified that scale-up and optimization of the process would provide considerable opportunities for industry-led collaborations and chart effective commercialization paths.

2. Food Processing Technologies

Food processing technologies include the applications of different physical, chemical, or microbiological methods and techniques to enhance the food quality and also to ensure more diversity for the increasing demand of different consumers. Raut et al. [5] discusses the impact of process parameters and bulk properties on the quality of dried hops. The results showed that it is important to define and consider optimum bulk and process parameters in order to optimize the hop drying process to improve the process efficiency as well the product quality.

Gurdil et al. [6] evaluates the postharvest processing of hazelnut kernel oil extraction using uniaxial pressure and organic solvent. It was found that the increased speed caused a serration effect on the force–deformation curve, resulting in lower oil yield. Lower and upper oil point forces were also observed to be useful for predicting the pressure for maximum output oil. It was further found that the peroxide value and free fatty acid content of kernel oil decreased with increasing temperature. In designing new presses, it is suggested that there is a need to consider compression and relaxation processes to reduce the residual kernel cake oil.

Tan et al. [7] explores the physicochemical changes, microbiological properties, and storage shelf life of cow and goat milk from industrial high-pressure processing (HPP). No significant changes were found in the physicochemical properties of the treated milk except for pH. HPP-treated cow and goat milk both achieved microbial shelf life of 22 days at 8 °C storage temperature.

Kwofie et al. [8] investigates the relationship between the classification and force deformation characteristics of common beans and the influence of bean softeners on cooking time. This work classified ten bean cultivars as either easy-to-cook (ETC) or hard-to-cook (HTC) based on a traditional subjective finger pressing test and a scientific objective hardness test. The results showed that a modified three-parameter non-linear regression model could accurately predict the rate of bean softening. The influence of bean softeners, such as potassium carbonate (K_2CO_3) and sodium chloride (NaCl), to reduce cooking time was also investigated in this paper.

3. Application of Mathematical Modeling and Computer Simulations in Postharvest Technology

With increased computing power, it is now very attractive to investigate the applications of mathematical modeling and computer simulations in the postharvest processes. Many models have now been successfully developed and employed in food and crop monitoring, grading, and classification, predicting and modeling quality properties, and forecasting chemical, physical, and nutrient characteristics during processing and postharvest storage. Khaled et al. [9] demonstrates the application of computational intelligence in describing the drying kinetics of persimmon fruit during vacuum and hot air-drying processes. Kinetic models were developed using selected thin layer models and computational intelligence methods, including multi-layer feed-forward artificial neural network (ANN), support vector machine (SVM), and k-nearest neighbors (kNN). The validation results indicated good agreement could be obtained from the computational intelligence methods between the predicted values and the experimental data.

Azman et al. [10] studies the physical properties and mass modeling of pepper berries at different maturity levels. It was found that the quadratic model was best fitted for mass prediction at all mass maturity levels (immature, mature, and ripe). The results showed that mass modeling based on the actual volume of pepper berries was more applicable compared to other properties. The findings would be potentially useful in developing improved grading, handling, and packaging systems.

Due to the numerous side effects of synthetic pesticides, including environmental pollution, threats to human health, harmful effects on non-target organisms, and pest resistance, the use of alternative healthy, available, and efficient agents in pest management strategies is attracting increased attention. Ebadollahi et al. [11] examines the optimization and modeling of susceptibility of Tribolium castaneum (Coleoptera: Tenebrionidae) to the fumigation of two essential Satureja oils. The insecticidal properties of the essential oils were modeled and optimized using response surface methodology. It was suggested that the essential oils of S. hortensis and S. intermedia could be offered as promising pesticidal agents against Tribolium castaneum in the management of such pests instead of detrimental synthetic pesticides.

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References

1. Onwude, D.I.; Chen, G.; Eke-Emezie, N.; Kabutey, A.; Khaled, A.Y.; Sturm, B. Recent advances in reducing food losses in the supply chain of fresh agricultural produce. *Processes* **2020**, *8*, 1431. [CrossRef]
2. Ndukwu, M.C.; Onwude, D.I.; Ehiem, J.; Abada, U.C.; Ekop, I.E.; Chen, G. The effectiveness of different household storage strategies and plant-based preservatives for dehulled and sun-dried breadfruit seeds. *Processes* **2021**, *9*, 380. [CrossRef]
3. Tomlins, K.; Parmar, A.; Omohimi, C.I.; Sanni, L.O.; Adegoke, A.F.; Adebowale, A.-R.A.; Bennett, B. Enhancing the shelf-life of fresh cassava roots: A field evaluation of simple storage bags. *Processes* **2021**, *9*, 577. [CrossRef]
4. Esua, O.J.; Chin, N.L.; Yusof, Y.A.; Sukor, R. A Review on individual and combination technologies of UV-C radiation and ultrasound in postharvest handling of fruits and vegetables. *Processes* **2020**, *8*, 1433. [CrossRef]
5. Raut, S.; von Gersdorff, G.J.E.; Münsterer, J.; Kammhuber, K.; Hensel, O.; Sturm, B. Impact of process parameters and bulk properties on quality of dried hops. *Processes* **2020**, *8*, 1507. [CrossRef]
6. Gürdil, G.A.K.; Kabutey, A.; Selvi, K.Ç.; Mizera, Č.; Herák, D.; Fraňková, A. Evaluation of postharvest processing of hazelnut kernel oil extraction using uniaxial pressure and organic solvent. *Processes* **2020**, *8*, 957. [CrossRef]
7. Tan, S.F.; Chin, N.L.; Tee, T.P.; Chooi, S.K. Physico-chemical changes, microbiological properties, and storage shelf life of cow and goat milk from industrial high-pressure processing. *Processes* **2020**, *8*, 697. [CrossRef]
8. Kwofie, E.M.; Mba, O.I.; Ngadi, M. Classification, force deformation characteristics and cooking kinetics of common beans. *Processes* **2020**, *8*, 1227. [CrossRef]
9. Khaled, A.Y.; Kabutey, A.; Selvi, K.Ç.; Mizera, Č.; Hrabe, P.; Herák, D. Application of computational intelligence in describing the drying kinetics of persimmon fruit (Diospyros kaki) during vacuum and hot air drying process. *Processes* **2020**, *8*, 544. [CrossRef]
10. Megat Ahmad Azman, P.N.; Shamsudin, R.; Che Man, H.; Ya'acob, M.E. Some physical properties and mass modelling of pepper berries (*Piper nigrum* L.), variety kuching, at different maturity levels. *Processes* **2020**, *8*, 1314. [CrossRef]
11. Ebadollahi, A.; Taghinezhad, E.; Setzer, W.N.; Chen, G. Susceptibility of tribolium castaneum (Coleoptera: Tenebrionidae) to the fumigation of two essential satureja oils: Optimization and modeling. *Processes* **2021**, *9*, 1243. [CrossRef]