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Editorial

Special Issue on "Progress in Food Processing in Section Food Processes"

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Food production is being confronted by numerous difficulties related to sustainability, food quality and security. By 2050, it is expected that there will be more than 10 billion people living on the Earth, which would increase demand for food and put more strain on limited resources. Moreover, widely available and highly processed food contributes to the development of several civilization diseases, such as obesity, diabetes, hypertension, cardiovascular diseases and cancer. Therefore, the production of healthy, high-quality food is now a priority in many societies. In addition, the increasing costs of energy have necessitated the development of processing methods that optimize production technology. The possibility of using by-products and waste from the food industry for both nutritional and industrial purposes is also a considerable issue. These activities, on the one hand, contribute to improvements in processes, energy saving and environmental sustainability; on the other hand, they lead to the development of new or improved processes and food products. Additionally, progress in food processing creates products with exceptional properties, expanding the diversity of foodstuffs. This Special Issue titled "Progress in Food Processing" is focused on these aspects and is available online at: https://www.mdpi.com/journal/processes/special_issues/Progress_Food_Processing (accessed on 3 January 2023).

1. Food Drying

Currently, many research papers are focused on food dehydration. Drying is one of the oldest methods of food preservation. This process, on the one hand, allows an increase in the shelf life of food; on the other hand, there is often a decrease in the product's quality and nutritional value. Three papers in this Special Issue examine food drying. In the first article [1], a Vis-NIR hyperspectral imaging technique was used to perform an online evaluation of the quality of Colocasia Esculenta L (purple-speckled cocoyam) during hot-air drying. The authors demonstrated that this non-invasive technique allows the measurement of many quality attributes during the drying process of purple-speckled cocoyam root and tuber crops. Consequently, they showed that this technique could replace standard laboratory measurements. The second paper [2] is focused on estimating the effect of drying and rehydration temperature on the quality of rehydrated apples. The authors used an artificial neural network for process modeling, and they showed that the appropriate selection of drying temperature, air velocity, dried-sample size and rehydration temperature results in rehydrated products with similar properties to fresh apples. In the research conducted by Krzykowski et al. [3], they studied the influence of air- and freeze-drying temperature on the quality and drying kinetics of wild strawberries (*Fragaria vesca* L.). They showed that the kinetics of dehydration were very accurately described by the Midilli model. This tendency was found for both drying techniques. Moreover, the freeze-dried fruits retained a better color and higher phenolics content compared with air-dried strawberries.

2. Cereal Grain and Seed Processing

Grain and seed processing is still a considerable present-day topic. Scientists are focused on optimizing various processes, such as separation, cleaning, tempering, grinding,

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drying, fermentation, etc. In this Special Issue, a few papers examine these topics. In the first paper [4], the possibilities of grain separation in an air flow were studied. The different geometries of the separation channel were analyzed, and the various distributions of air velocity and air pressure vectors were assumed using special computer software. Based on the results of the simulations, an improved pneumatic separator was proposed for the division of grains into different fractions according to their aerodynamic properties. The next paper from this series [5] analyzes the characteristics of the separation process of wheat–buckwheat grain mixture using a pneumatic cone separator. The authors obtained a separation efficiency equal to 78% and observed that the efficiency increased with an increase in the water content of the grain mixture. Moreover, equations describing the separation efficiency were put forward to model and control the separation of grain in the proposed device with a conical surface. In the third paper from this series [6], the authors determined the physical properties of Viburnum seeds useful in sorting operations. They found that the mass of seeds was correlated with the terminal velocity. The next paper is devoted to the vacuum impregnation of cereal grains [7]. This process accelerates water transfer into the seeds. The authors showed that such treatment stimulates the grain germination without decreasing its viability to be used for seed malting. In another study conducted by Hassoon at al. [8], an innovative method of whole-meal flour production from grain with a low moisture content was proposed. The moisture of grain was decreased from 12% to 5%, and a knife mill was used for flour production. Decreasing the grain moisture caused an approximate two-fold decrease in the grinding energy compared with a control grain. In addition, they observed the positive effect of such grinding on the dough's physical properties. The flour's water absorption especially increased, and the wheat dough was more stable during mixing. In the next paper from this series [9], the authors fermented durum wheat in plastic containers to produce an Algerian couscous (Lemzeïet). The product safety was determined during 3, 6, 9 and 12 months of storage. Additionally, vinegar was added to one portion of Lemzeïet. They found that durum wheat fermentation caused considerable changes in Lemzeïet's microbial load. The lactic acid bacteria content also considerably increased. Compared with unfermented wheat, they found Lemzeïet was characterized by a low microbial load. Fermentation also caused an accumulation of organic acids. As a result, grain's nutritional properties were improved, while a decrease in pH was observed. The last paper on this topic is focused on using an atmospheric pressure plasma jet to improve broccoli seed germination and growth rate [10]. The authors showed that after seven days of growing, treated seeds were characterized by a higher germination percentage and higher yield compared with the untreated sample. They suggested that atmospheric pressure plasma modifies seed coats, consequently increasing the productivity of sprouts.

3. Progress in Drinks Production

A modern development in food processing is the designing of novel drinks. Three papers are concerned with this issue. Rodrigues et al. [11] used dielectric-barrier discharge plasma to treat ready-to-drink coffee at different excitation times and frequencies. As a result of this treatment, many chemical reactions were observed, including modifications of aldehydes and furans. This method allowed the modification of coffee aromas without producing a negative influence on the product, such as the presence of toxic or undesired compounds. The authors showed that the proposed technology can be helpful in correcting coffee with aroma defects. In the second paper, the authors [12] investigated the impact of centrifugal-filter-assisted block-freeze crystallization on the total phenolics, anthocyanins and flavonoids contents in blueberry juice. In addition, they determined antioxidant activity for different processing parameters. They found that this method allows the production of a juice with higher extraction, a higher content of phytochemicals and enhanced antioxidant activity compared with other methods. Other authors [13] compared the quality of different commercial Polish apple juices. They showed considerable differences between the total phenolics content (TPC) in the studied juices. TPC expressed in gallic acid equivalent (GAE)

ranged from 60.7 to 103.6 mg GAE/100 mL. Moreover, they found a strong correlation between total TPC and the antiradical activity of juices.

4. By-Products Processing

The global food sector produces large amounts of waste from different sources. Food by-products are an excellent source of many bioactive compounds, which can be used as valuable raw material sources in the food industry. Moreover, these by-products also have many other applications. A few papers deal with this topic. In one paper [14], the authors used grape by-products (seeds, skin and stems) as a source of hemicelluloses for the production of prebiotic oligosaccharides (POL). They found that autohydrolysis of these by-products is an efficient operation for POL production. Importantly, they found that sugar production from seeds and skin was always lower than from stems under the same conditions. Importantly, they also showed that mainly xylo-oligosaccharides were obtained during autohydrolysis, and that the yield of these compounds depended on the grape cultivar. In the other study [15], overripe banana waste was used to study bioenergy potential using a microbial fuel cell coupled with anaerobic digestion. Bananas contribute up to 20% of the waste of total banana production and about 30 tons of banana waste is produced annually. The study showed that banana waste has a significant potential for methane and electricity production, with a biodegradability value of 76.2% and 95.3 gVS/L. Additionally, the authors claimed that using a microbial fuel cell in conjunction with anaerobic digestion allows for a reduction in the impact of banana waste on the environment. In the other study conducted by [16], they studied two kinds of wastes from the fish industry (brine and post-frying oil). They used Yarrowia lipolytica (KKP 379) yeast to produce bioreactor microbial lipids from fish wastes in a laboratory. Waste rapeseed oil from frying fish fillets was used as a carbon source, while waste brine was applied as a solvent for the ingredients in the yeast growth medium. The authors found an efficient combination of used wastes in a culture medium. Moreover, they showed that this solution can be useful in the production of intracellular lipids and the valorization of selected industry wastes using a biotechnological process.

5. Optimization of Food Production Processes

In recent years, functional foods have gained a lot of attention from researchers. Functional food supplies additional health-benefit ingredients, which are also known as nutraceuticals. Several papers on this issue were devoted to this topic. In the first review paper [17], the authors discussed the possibility of using different active ingredients in conventional and nano spray-drying technologies to encapsulate bioactive food compounds. The similarities and differences between these technologies were discussed. The authors summarized that conventional spray-drying techniques allow for a high yield of powder, whereas nano spray-drying methods better preserve bioactive compounds. In the second paper from this series, the authors used a spray-drying technique for producing probiotic food: microencapsulated resveratrol. They also used *Bacillus clausii* as a co-microencapsulating agent [18], while lactose and inulin were used as carrying agents. Microencapsulated particle sizes were characterized by smooth surfaces in the micrometer size range. Moreover, *Bacillus clausii* increased the culturability and antioxidant capacity of powdered food. They found that microencapsulated food showed bacterial activity after spray-drying processes. In addition, inulin better preserved the resveratrol. The next paper conducted by Sobaszek et al. [19] focused on the physicochemical properties of gels prepared with freeze-dried and powdered maqui berries (*Aristotelia chilensis*). The authors proposed innovative gels with an increased phenolics content, enhanced antioxidant capacity and a 20% reduction in sugar content. The addition of 4% maqui berries gave the best quality gel. In the next paper from the study series [20], essential oil obtained from *Chrysanthemum* × *morifolium* Ramat (CMR) was used for the flavoring of sunflower oil. The sensory properties and oxidative stabilities of flavored oil were determined after storage at 65 °C for 30 days. It was shown that flavoring stopped lipid alteration. Consequently, the

modifications of fatty acid in flavored oil were limited, antioxidant activity was enhanced, and sensory properties were improved. A similar topic concerns the next paper from this Special Issue. In the study conducted by [21], sunflower oil was mixed with pomegranate oil obtained from blanched seeds. Such treatment resulted in better oxidative stability with higher values of ABTS and DPPH, increasing the radical scavenging capacities of blended oils compared with sunflower oil. In addition, a higher level of volatile oxidation compounds was found in sunflower oil. The next paper from this series is focused on the inhibitory activity of the porcine pancreatic α-amylase of phenolic acids extracted from *Licium barbarum* leaf [22]. The most abundant phenolic acids in *L. barbarum* leaf were chlorogenic and salicylic acids. The research data based on in vitro assay indicated that phenolic acids showed important α-amylase inhibitory activity. Moreover, chlorogenic acid was the most active compound. The results revealed that the extracts from these leaves showed a considerable α-amylase inhibitory effect. Other authors [23] studied the possibility of obtaining an antioxidant-rich extract from *Lycium barbarum* leaves using different methods of extraction (microwave, infusion and decoction). They found that the traditional infusion was the best method of extraction taking into account the contents of total phenolics and the antioxidant activity of obtained extracts. In the next paper from this series, the researchers used chitosan film with the essential oil of *Perilla frutescens* leaves for the protection of post-harvest strawberries against fungal growth [24]. The results revealed that such treatment of strawberries causes an antimicrobial effect against *Botrytis cinerea* during the storage of fruits for 10 days at 4 °C. Notably, the fruits treated with chitosan film with a concentration of 1.0% of *Perilla frutescens* leaves oil showed improved sensory attributes, such as taste, flavor and appearance.

The thermal processing of food is a very important issue. It has an influence on both the quality and nutritional value of the final product. In the paper presented by [25], mackerel (*Scomber japonicus*) was fried using three different methods: air, vacuum and deep frying. Moreover, mackerel thawing methods were studied. The results showed that vacuum frying caused little oxidation and maintained the highest nutritional value. The surface response methodology indicated that the optimal frying time and temperature for vacuum frying should be 7 min and 95 °C, respectively. In addition, a high-frequency defrosting method was selected as the best method before mackerel frying. The next paper from this series [26] is concerned with the influence of UV-C radiation and thermal processing on the selected physicochemical and microbiological characteristics of agave (*Agave tequilana* Weber var. azul) extracts. The results revealed that the inactivation of the natural microbiota of agave extracts strongly depended on pH. The total inactivation of the microbiota was obtained at an irradiation dose of 10.93 mJ/cm^2 and pH of 4.5. Moreover, both the irradiation frequency and pH had little influence on the total phenolic and flavonoid content in the extracts.

Many papers from recent years have been focused on gluten-free products. One article in this Special Issue focuses on this issue. In work conducted by [27], an extrusion-cooking process was applied to produce gluten-free pasta from rice flour. The influence of flour moisture and screw speed on pasta quality parameters was studied. Both feed moisture and screw speed considerably influenced the cooking time, cooking losses, texture and water absorption of the pasta; moreover, pasta obtained with 30% of rice flour moisture content and at 80 rpm screw speed showed the best quality.

The optimization of production is an important issue in manufacturing engineering. It influences production expenses and reduces environmental pollution. The paper published by [28] examines this topic. The authors applied a non-dominated sorting genetic algorithm to improve production optimization. They focused on minimizing the makespan in bakery production. According to their results, the application of the proposed method allows for a reduction in oven idle time of up to 26%, which consequently reduces the makespan by up to 12%. The proposed solution is especially recommended for medium- and small-sized bakeries.

All the papers presented in this Special Issue directly or indirectly concern new knowledge and novel practical applications in the area of food processing. As a guest editor of this Special Issue, I would like to thank the authors for their valuable articles, as well as the Editorial Staff of *Processes* for their support.

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