

Editorial

# Sustainable Food Processing

Durdica Ačkar 

Faculty of Food Technology Osijek, Josip Juraj Strossmayer University of Osijek, Franje Kuhača 18,  
31000 Osijek, Croatia; dackar@ptfos.hr

In the modern world, food consumption is inevitably linked to processing. As the level of development of the society/country rises, the level to which food is processed also increases. Western countries are increasingly oriented towards ready-to-heat and ready-to-eat foods that require high levels of processing, which in turn require high energy consumption, large resources, and produce large quantities of waste and by-products. All these leave a major impact on the environment. With the rising problems of global warming, rising cost of raw materials, and energy and difficulties with food supply, the food industry is required to reduce the impact on the environment by policy-makers from the Food and Agriculture Organization (2011) [1], over the United Nations (2015) [2] and European Union [3] to the national level, and firms apply different corporate strategies in achieving the set requirements and goals. Andersen (Contribution 7) described moving to a sustainable bioeconomy in the Norwegian meat industry. Although the outcomes of by-product valorization could not be assessed, the grounds for future research are established.

Moreover, consumers are becoming increasingly aware of the environmental issues and nutritional value of food. Along with the ease of preparation for consumption, consumers demand highly nutritious and palatable food packed in convenient, environmentally friendly packaging, with a reasonable price (Contributions 2 and 3). Barbosa de Meneses et al. (Contribution 2) tried to respond to the first demand by replacing whole milk in chocolate ice-cream with whey, a by-product from cheese or butter production, which is rich in protein, low in fat, and contains bioactive compounds. Although consumers scored sensory acceptability with lower grades, their acceptance is still at a high level and the purchase intention is satisfactory. The purchase intention is a key factor in the evaluation of the commercial success of the product. Yang et al. (Contribution 3) explored if mental stimulation may influence the commercial success of (upcycled) food, and they indicated that marketing methods such as the use of slogans, posters, etc. can drive consumers to a purchase.

The complexity of the issues regarding sustainable production drove food professionals and scientists in the field of food science to seek different solutions and address different topics linked to sustainable food processing. Food industry by-products are no longer seen as waste, nor are they applied only in composting and animal feed. They are becoming raw materials for the extraction of different bioactive components (Contributions 4 and 6), the production of nutritionally improved foods, basis for sustainable packaging, source of energy through bio-gas and bio-fuel production, etc. For example, Šeremet et al. (Contribution 4) prepared different banana and red beetroot peel extracts, rich in polyphenols. Banana peel extracts were valuable sources of dopamine, and red beetroot extracts of betacyanin. Additionally, Jokić et al. (Contribution 6) prepared microencapsulated cocoa shell extracts rich in methylxanthines and polyphenols.

The path from the by-product to the value-added raw material is never simple, since different aspects must be covered, from food safety issues to the sensory acceptability of the products. Therefore, different pre-treatments of by-products, such as high-voltage electrical treatment (Contributions 1 and 8), may be required in order to assure their safety and/or functionality in a desired application. Ivanov et al. (Contribution 1) removed up to 50% of the organic compounds from olive mill waste water. Moreover, Barišić et al.



**Citation:** Ačkar, D. Sustainable Food Processing. *Sustainability* **2021**, *13*, 9628. <https://doi.org/10.3390/su13179628>

Received: 8 July 2021

Accepted: 21 August 2021

Published: 27 August 2021

**Publisher's Note:** MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



**Copyright:** © 2021 by the author. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

(Contribution 8) reviewed issues linked to the application of cocoa shell in food and the beneficial effects of high-voltage electrical treatment.

To evaluate the achievements of successful, efficient, and sustainable food production and service (Contributions 5 and 9), indicators must be carefully defined and monitored, including environmental, social, and economic aspects. Da Costa Meynard et al. (Contribution 9) stressed the importance of the identification of stages with environmental impacts, the rationalization of use of energy, and the water and education of all involved in meal production. They analyzed the current practices and indicators implemented in food service and found recycling, energy saving, planning, and modifying menus and the use of local and/or organic products to be the most common. Additionally, they developed a checklist for sustainability indicators.

To summarize, numerous issues have been raised from different aspects of these contributions, some solutions have been offered, and questions have been raised, upon which further research and development towards sustainable food production and service may advance.

#### List of Contributors

1. Ivanov, M.; Vukušić Pavičić, T.; Kraljić, K.; Grgas, D.; Landeka Dragičević, T.; Herceg, Z. Effects of High Voltage Electrical Discharge Plasma on Olive Mill Wastewater Treatment.
2. Barbosa de Meneses, R.; Guerra Monteiro, M.L.; Ferreira dos Santos, F.; Miguez da Rocha Leão, M.H.; Conte-Junior, C.A. Sensory Characteristics of Dairy By-Products as Potential Milk Replacers in Ice Cream.
3. Yang, X.; Huang, Y.; Cai, X.; Song, Y.; Jiang, H.; Chen, Q.; Chen, Q. Using Imagination to Overcome Fear: How Mental Simulation Nudges Consumers' Purchase Intentions for Upcycled Food.
4. Šeremet, D.; Durgo, K.; Jokić, S.; Huđek, A.; Vojvodić Cebin, A.; Mandura, A.; Jurasović, J.; Komes, D. Valorization of Banana and Red Beetroot Peels: Determination of Basic Macrocomponent Composition, Application of Novel Extraction Methodology and Assessment of Biological Activity In Vitro.
5. da Costa Maynard, D.; Puppini Zandonadi, R.; Nakano, E.Y.; Botelho, R.B.A. Sustainability Indicators in Restaurants: The Development of a Checklist.
6. Jokić, S.; Nastić, N.; Vidović, S.; Flanjak, I.; Aladić, K.; Vladić, J. An Approach to Value Cocoa Bean By-Product Based on Subcritical Water Extraction and Spray Drying Using Different Carriers.
7. Strøm-Andersen, N. Incumbents in the Transition towards the Bioeconomy: The Role of Dynamic Capabilities and Innovation Strategies.
8. Barišić, V.; Jozinović, A.; Flanjak, I.; Šubarić, D.; Babić, J.; Miličević, B.; Doko, K.; Ačkar, Đ. Difficulties with Use of Cocoa Bean Shell in Food Production and High Voltage Electrical Discharge as a Possible Solution.
9. da Costa Maynard, D.; Vidigal, M.D.; Farage, P.; Puppini Zandonadi, R.; Nakano, E.Y.; Botelho, R.B.A. Environmental, Social and Economic Sustainability Indicators Applied to Food Services: A Systematic Review.

**Funding:** This research received no external funding.

**Conflicts of Interest:** The authors declare no conflict of interest.

## References

1. Food and Agriculture Organization of the United Nations. *Global Food Losses and Food Waste—Extent, Causes and Prevention*; Food and Agriculture Organization of the United Nations: Rome, Italy, 2011.
2. United Nations. *Transforming Our World: The 2030 Agenda for Sustainable Development*. Available online: <https://sustainabledevelopment.un.org/post2015/transformingourworld> (accessed on 20 November 2019).
3. Council of the European Union. *European Union Review of the EU Sustainable Development Strategy (EU SDS)—Renewed Strategy*; Council of the European Union: Bruxelles, Belgium, 2006.