processes

Editorial

Advances in Microbial Fermentation Processes

Maria Tufariello * **and Francesco Grieco ***

National Research Council—Institute of Sciences of Food Production (ISPA), Via Prov.le, Lecce-Monteroni, 73100 Lecce, Italy
* Correspondence: maria.tufariello@ispa.cnr.it (M.T.); francesco.grieco@ispa.cnr.it (F.G.); Tel.: +39-083-2422612 (M.T.)

Citation: Tufariello, M.; Grieco, F. Advances in Microbial Fermentation Processes. *Processes* **2021**, *9*, 1371. https://doi.org/10.3390/pr9081371

Received: 3 August 2021
Accepted: 4 August 2021
Published: 5 August 2021

In the food sector, fermentation processes have been the object of great interest in regard to enhancing the yield, the quality, and the safety of the final product. Microbial fermentation has been traditionally used to produce foods denoted by a prolonged shelf life and digestibility. The benefits extended to human health by fermented foods are expressed either directly through the interactions of ingested live microorganisms with the host (probiotic effect) or indirectly as the result of the ingestion of microbial metabolites synthesized during fermentation (biogenic effect). Moreover, several beneficial microbes can inhibit pathogens/spoilers growth and degrade toxins. Several novel microbial-based biotechnological solutions have been recorded and continuous explorations of microbial diversity are being carried out worldwide. In addition, most recently, fermentation has been considered a sustainable approach for maximizing the utilization of bio-resources to address the recent global food crisis. For example, several microbial-based bioconversions have been proposed for the production of enzymes, vitamins, antioxidants, biofuels, feeds, antimicrobial molecules, and other bioactive chemicals, also exploiting agro-industrial wastes [1–6].

The Special Issue "*Advances in Microbial Fermentation Processes*" covers eleven contributes: eleven original research papers and two reviews. As guest editors, we briefly report an overview of these contributions.

Wang et al. [7] investigated, through quantitative metabolomics and a stoichiometric analysis, the role of the trehalose metabolism in the *Penicillium chrysogenum* strain. The authors showed the key role of the intact trehalose metabolism in ensuring penicillin production in the *P. chrysogenum* strain under both steady state and dynamic conditions.

Helmyati and collaborators [8] described an innovation food-based approach to address the stunting problem. They evaluated the ability of a symbiotic milk enriched with iron and zinc and fermented with *Lactobacillus plantarum* to promote growth in stunted children, obtaining excellent results. The investigation of Yogeswara et al. [9] demonstrated a significant increase in the enzymatic synthesis of GABA using purified recombinant GAD from *L. plantarum* FNCC 260. In their original paper, Li and coworkers [10] focused on the activity of volatile compounds produced by Bacillus velezensis CT32 on *Verticillium dahlia* and *Fusarium oxysporum* responsible for strawberry vascular wilt. This study highlighted the key role of some volatile compounds as a biofumigant for the management of vascular wilt pathogens.

The novel cell-level Fed-Batch (FBC) technology for the high-cell-density cultivation of *Saccharomyces cerevisiae* was proposed by Malairuang et al. [11] with a clear illustration of the principle of operation, the potential dextrin substrate, and the mechanism of substrate utilization to regulate FBC, FBC kinetics and material balances through a bioreactor design and scale-up. Yepes-García and coworkers [12] provided an important contribution to the knowledge of antibiotic biosynthesis in the *Streptomyces* genus by studying the relationship between *S. clavuligerus* ATCC 27064 morphology and CA biosynthesis. An interesting contribution of the influence of different smoking techniques on the development of polycyclic aromatic hydrocarbons (PAH) in traditional dry sausage was presented by

Mastanjević et al. [13]. These authors showed the crucial role of the smoking method in the formation of PAHs revealing that collagen samples presented significantly lower values than samples created with traditional gut. Malairuang et al. [14] selected a *Kluyveromyces marxianus* strain for single-step ethanol fermentation, also to establish a practical approach to produce a high-cell-density yeast biomass by an intensive multiple sequential batch simultaneous saccharification and cultivation.

An interesting evaluation of the differences in microbial communities, metabolites, and the aerobic stability between whole-plant corn silages from different areas of Inner Mongolia in North China has been assessed by Wang et al. [15]. Moreover, the same authors investigated the variation of bacterial dynamics during the fermentation process in whole-plant corn silages processed in Heilongjiang, Inner Mongolia and Shanxi of North China [16].

Concerning the review papers, both contributors focused on two interesting topics.

Stamatopoulou et al. summarized the state-of-the-art-concerning Medium-Chain Fatty Acids (MCFA) by using both pure cultures and mixed microbial communities, highlighting future perspectives to improve MCFA production from complex feedstocks [17]. Pati and collaborators [18] reviewed the aspects related to the quantitative analysis of volatile compounds in wines application by HS-SPME-GC/MS, in particular discussing the optimization approaches in the method development stage and the critical aspects related to quantification methods.

This collection contributed to improve the knowledge on the microbial-based fermentation approaches and on the latest innovative application for promoting and monitoring bacterial action in different biotechnological fields.

Author Contributions: Writing—original draft preparation, review and editing, M.T. and F.G. Both authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: None.

Acknowledgments: This work was partially supported by the Apulia Region projects: "Innovazione nella tradizione: tecnologie innovative per esaltare le qualità dei vini autoctoni spumante della murgia barese—INVISPUBA" (P.S.R. Puglia 2014/2020 -Misura 16.2); "Birra: dal campo al boccale—BEˆ2R" (P.S.R. Puglia 2014/2020—↑Misura 16.2). We would like to thank Giovanni Colella, Domenico Genchi, and Vittorio Falco of the Institute of Sciences of Food Production—CNR—for their skilled technical support provided during the realization of this work.

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

References

1. Sharma, R.; Garg, P.; Kumar, P.; Bhatia, S.K.; Kulshrestha, S. Microbial Fermentation and Its Role in Quality Improvement of Fermented Foods. *Fermentation* **2020**, *6*, 106. [CrossRef]
2. Hill, D.; Sugrue, I.; Arendt, E.; Hill, C.; Stanton, C.; Ross, R.P. Recent advances in microbial fermentation for dairy and health. *F1000Research* **2017**, *6*, 251. [CrossRef] [PubMed]
3. Pham, J.V.; Yilma, M.A.; Feliz, A.; Majid, M.T.; Maffetone, N.; Walker, J.R. A review of the microbial production of bioactive natural products and biologics. *Front. Microbiol.* **2019**, *10*, 1404. [CrossRef] [PubMed]
4. Parekh, S.; Vinci, V.A.; Strobel, R.J. Improvement of microbial strains and fermentation processes. *Appl. Microbiol. Biotechnol.* **2000**, *54*, 287–301. [CrossRef] [PubMed]
5. Tufariello, M.; Durante, M.; Ramires, F.A.; Grieco, F.; Tommasi, L.; Perbellini, E. New process for production of fermented black table olives using selected autochthonous microbial resources. *Front. Microbiol.* **2015**, *6*, 1007. [CrossRef] [PubMed]
6. De Bellis, P.; Tristezza, M.; Haidukowski, M.; Fanelli, F.; Sisto, A.; Mulè, G.; Grieco, F. Biodegradation of ochratoxin A by bacterial strains isolated from vineyard soils. *Toxins* **2015**, *7*, 5079–5093. [CrossRef] [PubMed]
7. Wang, X.; Zhao, J.; Xia, J.; Wang, G.; Chu, J.; Zhuang, Y. Impact of Altered Trehalose Metabolism on Physiological Response of Penicillium chrysogenum Chemostat Cultures during Industrially Relevant Rapid Feast/Famine Conditions. *Processes* **2021**, *9*, 118. [CrossRef]

8. Helmyati, S.; Shanti, K.M.; Sari, F.T.; Sari, M.P.; Atmaka, D.R.; Pratama, R.A.; Wigati, M.; Wisnusanti, S.U.; Nisa', F.Z.; Rahayu, E.S. Synbiotic Fermented Milk with Double Fortification (Fe-Zn) as a Strategy to Address Stunting: A Randomized Controlled Trial among Children under Five in Yogyakarta, Indonesia. *Processes* **2021**, *9*, 543. [CrossRef]
9. Yogeswara, I.B.A.; Kittibunchakul, S.; Rahayu, E.S.; Domig, K.J.; Haltrich, D.; Nguyen, T.H. Microbial Production and Enzymatic Biosynthesis of γ-Aminobutyric Acid (GABA) Using *Lactobacillus plantarum* FNCC 260 Isolated from Indonesian Fermented Foods. *Processes* **2021**, *9*, 22. [CrossRef]
10. Li, X.; Wang, X.; Shi, X.; Wang, B.; Li, M.; Wang, Q.; Zhang, S. Antifungal Effect of Volatile Organic Compounds from *Bacillus velezensis* CT32 against *Verticillium dahliae* and *Fusarium oxysporum*. *Processes* **2020**, *8*, 1674. [CrossRef]
11. Malairuang, K.; Krajang, M.; Sukna, J.; Rattanapradit, K.; Chamsart, S. High Cell Density Cultivation of *Saccharomyces cerevisiae* with Intensive Multiple Sequential Batches Together with a Novel Technique of Fed-Batch at Cell Level (FBC). *Processes* **2020**, *8*, 1321. [CrossRef]
12. Yepes-García, J.; Caicedo-Montoya, C.; Pinilla, L.; Toro, L.F.; Ríos-Estepa, R. Morphological Differentiation of *Streptomyces clavuligerus* Exposed to Diverse Environmental Conditions and Its Relationship with Clavulanic Acid Biosynthesis. *Processes* **2020**, *8*, 1038. [CrossRef]
13. Mastanjević, K.; Kartalović, B.; Puljić, L.; Kovačević, D.; Habschied, K. Influence of Different Smoking Procedures on Polycyclic Aromatic Hydrocarbons Formation in Traditional Dry Sausage *Hercegovačka kobasica*. *Processes* **2020**, *8*, 918. [CrossRef]
14. Malairuang, K.; Krajang, M.; Rotsattarat, R.; Chamsart, S. Intensive Multiple Sequential Batch Simultaneous Saccharification and Cultivation of *Kluyveromyces marxianus* SS106 Thermotolerant Yeast Strain for Single-Step Ethanol Fermentation from Raw Cassava Starch. *Processes* **2020**, *8*, 898. [CrossRef]
15. Wang, C.; Sun, L.; Xu, H.; Na, N.; Yin, G.; Liu, S.; Jiang, Y.; Xue, Y. Microbial Communities, Metabolites, Fermentation Quality and Aerobic Stability of Whole-Plant Corn Silage Collected from Family Farms in Desert Steppe of North China. *Processes* **2021**, *9*, 784. [CrossRef]
16. Wang, C.; Han, H.; Sun, L.; Na, N.; Xu, H.; Chang, S.; Jiang, Y.; Xue, Y. Bacterial Succession Pattern during the Fermentation Process in Whole-Plant Corn Silage Processed in Different Geographical Areas of Northern China. *Processes* **2021**, *9*, 900. [CrossRef]
17. Stamatopoulou, P.; Malkowski, J.; Conrado, L.; Brown, K.; Scarborough, M. Fermentation of Organic Residues to Beneficial Chemicals: A Review of Medium-Chain Fatty Acid Production. *Processes* **2020**, *8*, 1571. [CrossRef]
18. Pati, S.; Tufariello, M.; Crupi, P.; Coletta, A.; Grieco, F.; Losito, I. Quantification of Volatile Compounds in Wines by HS-SPME-GC/MS: Critical Issues and Use of Multivariate Statistics in Method Optimization. *Processes* **2021**, *9*, 662. [CrossRef]