



Editorial

# Bioconversion Processes

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Bioprocesses represent a promising and environmentally friendly option to replace the well-established chemical processes used nowadays for the production of platform chemicals, fuels, and other commercial products. Significant research is being performed to optimize bioconversion processes and biorefineries, which do already coexist, to some extent, with conventional refineries.

A range of different options and technologies are being studied and are presently available to obtain different useful end-products through bioprocesses. Many such processes focus on renewable resources, biomass, or pollutants as primary feedstocks. The latter avoid food–fuel competition, contrary to some other feedstocks considered in the past, and, sometimes, still today. This special issue offers some examples of interesting alternatives. Some suitable feedstocks include biomass [1,2], solid waste [3–5], sludge [6], wastewater [7,8], waste gases [9], or even byproducts, such as glycerol, from other biorefinery processes [10,11]. Several of those feedstocks and their corresponding bioconversion processes are addressed here. Some prime matters may need specific pre-treatments before undergoing microbial fermentation, such those composed of complex polymeric materials, which first need to be converted to smaller or monomeric molecules in order to be accessible and metabolized by microorganisms [1,4,12]. Different types of microorganisms have been studied and can be used as biocatalysts, including pure or mixed cultures of aerobic and anaerobic bacteria [6,13], yeasts and fungi in general [1,3], as well as algae. The biocatalysts may be wild-type or engineered ones [10]. Direct application of enzymes can also be considered.

Bioconversion processes generally take place in bioreactors, which may be operated in batch, continuous, or semi-continuous mode, among others. Moreover, different bioreactor configurations may be suitable depending on the specific application. The technology may range from solid-phase bioconversion processes to gas-phase ones, besides aqueous phase bioprocesses. In any case, a given amount of moisture is generally needed, as this is required, in most cases, for optimal microbial activity. For any given feedstock, biocatalyst and bioreactor configuration and operating conditions will need to be optimized, in terms of aspects such as residence time in continuous processes, pH, or media composition (e.g., C/N ratio), as studied and reported in several manuscripts in this issue [3,10,14].

In conclusion, bioconversion processes and biorefineries are environmentally friendly alternatives to common chemical processes and conventional oil refineries. They allow the production of a wide range of products with cheap biocatalysts, usually under mild conditions. Additional intensive research is still needed in order to further optimize such processes.

**Conflicts of Interest:** The author declares no conflict of interest.

## References

1. Xiu, S.; Bo Zhang, B.; Boakye-Boaten, N.A.; Shahbazi, A. Green Biorefinery of Giant Miscanthus for Growing Microalgae and Biofuel Production. *Fermentation* **2017**, *3*, 66. [[CrossRef](#)]

2. Nghiem, N.P.; O'Connor, J.P.; Hums, M.E. Integrated Process for Extraction of Wax as a Value-Added Co-Product and Improved Ethanol Production by Converting both Starch and Cellulosic Components in Sorghum Grains. *Fermentation* **2018**, *4*, 12. [[CrossRef](#)]
3. Mahboubi, A.; Ferreira, J.A.; Taherzadeh, M.J.; Lennartsson, P.R. Production of Fungal Biomass for Feed, Fatty Acids, and Glycerol by *Aspergillus oryzae* from Fat-Rich Dairy Substrates. *Fermentation* **2017**, *3*, 48. [[CrossRef](#)]
4. Velasco, D.; Senit, J.J.; de la Torre, I.; Santos, T.M.; Yustos, P.; Santos, V.E.; Ladero, M. Optimization of the Enzymatic Saccharification Process of Milled Orange Wastes. *Fermentation* **2017**, *3*, 37. [[CrossRef](#)]
5. Chalima, A.; Oliver, L.; de Castro, L.F.; Karnaouri, A.; Dietrich, T.; Topakas, E. Utilization of Volatile Fatty Acids from Microalgae for the Production of High Added Value Compounds. *Fermentation* **2017**, *3*, 54. [[CrossRef](#)]
6. Alrawashdeh, K.A.B.; Pugliese, A.; Slopiecka, K.; Pistolesi, V.; Massoli, S.; Bartocci, P.; Bidini, G.; Fantozzi, F. Codigestion of Untreated and Treated Sewage Sludge with the Organic Fraction of Municipal Solid Wastes. *Fermentation* **2017**, *3*, 35. [[CrossRef](#)]
7. Souza Filho, P.F.; Brancoli, P.; Bolton, K.; Zamani, A.; Taherzadeh, M.J. Techno-Economic and Life Cycle Assessment of Wastewater Management from Potato Starch Production: Present Status and Alternative Biotreatments. *Fermentation* **2017**, *3*, 56. [[CrossRef](#)]
8. Ben, M.; Kennes, C.; Veiga, M.C. Optimization of polyhydroxyalkanoate storage using mixed cultures and brewery wastewater. *J. Chem. Technol. Biotechnol.* **2016**, *91*, 2817–2826. [[CrossRef](#)]
9. Fernández-Naveira, Á.; Veiga, M.C.; Kennes, C. H-B-E (hexanol-butanol-ethanol) fermentation for the production of higher alcohols from syngas/waste gas. *J. Chem. Technol. Biotechnol.* **2017**, *92*, 712–731. [[CrossRef](#)]
10. Abghari, A.; Chen, S. Engineering *Yarrowia lipolytica* for Enhanced Production of Lipid and Citric Acid. *Fermentation* **2017**, *3*, 34. [[CrossRef](#)]
11. Matsakas, L.; Hruzová, K.; Ulrika Rova, U.; Christakopoulos, P. Biological Production of 3-Hydroxypropionic Acid: An Update on the Current Status. *Fermentation* **2018**, *4*, 13. [[CrossRef](#)]
12. Kennes, D.; Abubackar, H.N.; Diaz, M.; Veiga, M.C.; Kennes, C. Bioethanol production from biomass: Carbohydrate vs. syngas fermentation. *J. Chem. Technol. Biotechnol.* **2016**, *91*, 304–317. [[CrossRef](#)]
13. Fernández-Naveira, Á.; Abubackar, H.N.; Veiga, M.C.; Kennes, C. Production of chemicals from C1 gases (CO, CO<sub>2</sub>) by *Clostridium carboxidivorans*. *World J. Microbiol. Biotechnol.* **2016**, *33*, 43. [[CrossRef](#)] [[PubMed](#)]
14. Ginésy, M.; Rusanova-Naydenova, D.; Rova, U. Tuning of the Carbon-to-Nitrogen Ratio for the Production of L-Arginine by *Escherichia coli*. *Fermentation* **2017**, *3*, 60. [[CrossRef](#)]



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