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POLYLACTIC ACID (PLA) PRODUCED FROM BREWER'S SPENT GRAIN (BSG): SUSTAINABLE PRODUCTION AND BIOMEDICAL APPLICATIONS

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Abstract

Poly(lactic acid) (PLA) is a linear aliphatic polyester bioplastic, biodegradable and bioabsorbable, derived from renewable sources. With PET-like characteristics including transparency, gloss, and excellent mechanical resistance, it represents a sustainable alternative to traditional plastics. Its technical properties enable diverse applications: single-use products, textiles, durable goods, and packaging. In the medical field, PLA is used to produce sutures, wound dressings, bone plates, and drug delivery systems in the form of electrospun nanofibers, hydrogels, nanoparticles, and microparticles. These systems allow controlled release of active ingredients such as antipsychotics (risperidone), anti-inflammatories (betamethasone, dexamethasone), and chemotherapeutics (doxorubicin) through three main mechanisms: dissolution from the polymer matrix, diffusion through water-filled pores, and transport through the polymer itself. In aesthetic medicine, PLA also serves as a temporary dermal filler with regenerative properties. Traditionally, PLA is produced through fermentation of sugars extracted from corn, potatoes, cane molasses, or sugar beets, but this production chain involves high costs and potential conflicts with food production. A valid alternative is the use of agricultural byproducts like brewer's spent grain (BSG), an abundant and underutilized byproduct of the brewing industry. In Italy, approximately 240,000 tons of BSG are generated annually, with 70% used for animal feed, 10% for biogas production, and 20% disposed in landfills. BSG represents a complex matrix whose sugar composition (maltose, glucose, maltotriose, fructose) varies significantly depending on the cereal origin, yeast strain, and production process. Thanks to the presence of both fermentable sugars and structural polysaccharides (cellulose and hemicellulose), the substrate can be converted into lactic acid through fermentation with *Lactobacillus rhamnosus* GG. The obtained lactic acid is then transformed into PLA through thermal

treatment followed by catalytic polymerization. This production pathway represents a virtuous circular economy model, transforming an industrial waste into a high-value resource. Beyond reducing the environmental impact of waste disposal, it offers an economically advantageous alternative to traditional biopolymer production, with significant positive impacts in both industrial and biomedical/pharmaceutical sectors.

Downloads



References

1. Vakati, S.R.; Vanderlaan, G.; Gacura, M.D.; Ji, X.; Chen, L.; Piovesan, D. Synthesis of Poly-Lactic Acid by Ring Open Polymerization from Beer Spent Grain for Drug Delivery. *Polymers* 2024, 16, 483, doi: 10.3390/polym16040483
2. Qazanfarzadeh, Z.; Ganesan, A.R.; Mariniello, L.; Conterno, L.; Kumaravel, V. Valorization of Brewer's Spent Grain for Sustainable Food Packaging. *Journal of Cleaner Production* 2023, 385, 135726, doi: 10.1016/j.jclepro.2022.135726.
3. Assobirra (2018). Annual Report for the year 2024 Available online: <https://www.assobirra.it/wp-content/uploads/2025/05/AnnualReport-2024.pdf> (accessed on 20 July 2025)

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Section

Abstract Book

Categories

[Contents](#)

[Abstract Book](#)

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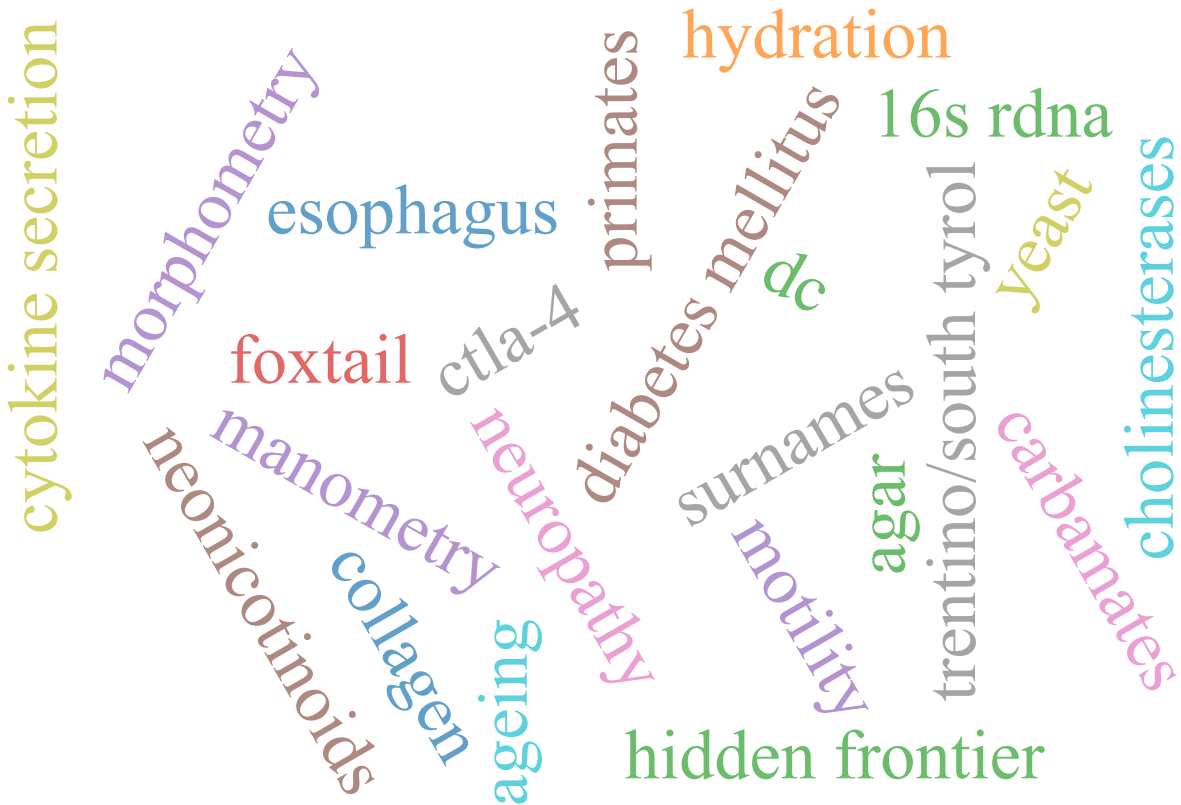
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