



Università degli Studi di Napoli Federico II

PhD in Biotechnology - 38th cycle

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Design of bioprocesses for waste valorization into functional polyhydroxyalkanoates

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Bioplastics are nowadays considered a competing alternative to fossil-based plastics with the potential to benefit from both biodegradability and bio-based origin, *i.e.* deriving from renewable resources rather than products of oil refining¹. Such double potential finds a concrete example within polyhydroxyalkanoates (PHA), a family of polyesters produced by several microorganisms in the form of intracellular granules². Different strategies exploiting biotechnological approaches are being developed to support their economically feasible production at the industrial scale. In particular, PHA biosynthesis can be addressed as part of a biorefinery scheme, thus involving renewable raw materials as feedstocks³. In this context, the present PhD project aims to design and set up biotechnological processes addressed towards microbial PHA production from biomasses, *e.g.* agri-food wastes. The overall experimental activities will follow a biorefinery valorization scheme, hence involving the definition of an upstream, a midstream, and a downstream process. The final products of the experimental activities will be represented by different classes of PHA, whose properties will be investigated and accurately tailored, evaluating their applications in the bioplastics field.

References

1. Rosenboom, J. G., Langer, R. & Traverso, G. Bioplastics for a circular economy. *Nat. Rev. Mater.* **7**, 117–137 (2022).
2. Koller, M., Mukherjee, A., Obruca, S. & Zinn, M. Polyhydroxyalkanoates (PHA): microbial synthesis of natural polyesters. in *Microbial Production of High-Value Products* 185–236 (2022).
3. Kumar, V. *et al.* Commercialization potential of agro-based polyhydroxyalkanoates biorefinery: a technical perspective on advances and critical barriers. *Int. J. Biol. Macromol.* **234**, 123733 (2023).