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## ***Tenebrio molitor*: INNOVATIVE TOOL FOR FOOD LOSS AND WASTE VALORIZATION AND BIOPOLYMERS RECOVERY**

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### **Abstract**

Modern society is faced with a series of important challenges for its very survival, related to climate change, resource depletion, population increase, soil scarcity, and environmental pollution. It is now clear that the linear economy model, adopted up to now mainly by the most industrialised countries, is no longer sustainable, and urgent alternative solutions are required. The insects, and in particular *Tenebrio molitor* (TM), are a valid food alternative, and they can be used to valorise and reduce food loss and waste (FLW) in the Circular Economy perspective, converting FLW into high-value products including food, feed, pharmaceuticals, biomaterials, and lubricants. Furthermore, TM rearing waste provides fertilisers and bioproducts, such as chitin and chitosan, as well as biofuels and biochar. TM and its gut microbiota also represent a valid tool for plastic degradation, even though plastic pollution management using TM is quite controversial. Finally, TM can provide valuable assistance in the biological recovery of new biopolymers, such as polyhydroxyalkanoates (PHA) from plastic-producing microorganisms, (e.g. *Cupriavidus necator*), used as Single Cell Protein. In a circular system and following a bioeconomy approach, these microorganisms can be fed on FLW, produce PHA, and then be used as feed for mealworms to obtain PHA and, at the same time, protein biomass, as well as rearing waste (frass and exuviae) from which to obtain fertilisers for new crops and chitin/ chitosan for biomaterials.

*Key words:* agri-food by-products, bioplastics, circular bioeconomy, chitin and chitosan, plastic waste

*Received:* April, 2022; *Revised final:* October, 2022; *Accepted:* October, 2022; *Published in final edited form:* October, 2022

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