



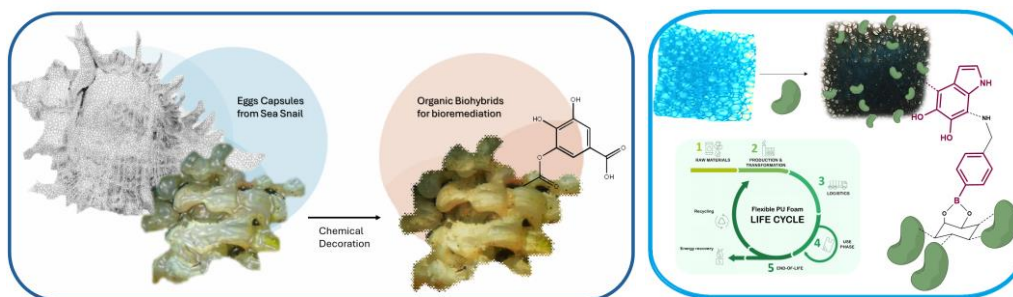
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## Valorization of natural biomasses and exhausted industrial composites *via* bioorganic approaches

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Environmental remediation often requires technology at the interface between material science, chemistry and biology, aiming to cheap materials with low

environmental impact themselves.[1] Artificial sources or non-Nature derived matrices should be optimized to avoid delivery of toxic side metabolites, produced with eco-compatible chemical conversion, and possibly imply resorption or recycle. Here we present two different time-cost efficient, environmentally friendly, sustainable, and effective biohybrid systems produced *via* various approaches. The first exploits the naturally porous eggs capsules produced by *Hexaplex trunculus* (known as the banded dye-murex), a well-known marine gastropod mollusks, in the Muricidae family. After the eggs release, these porous capsuled structures exhibit a sponge-like, biomineralized, proteinaceous bulk whose sacculae are considered here as a powerful natural, unexplored matrix to be used for removing pollutants from water, due to its rehydratable property. The bioorganic chemistry tool here helped to improve the selectivity of this material towards the adsorption of specific organic pollutants, introducing poly-phenolic moieties as additive chemical functions. In a second tale, exhausted polyurethane elastic foam has been valorised and utilized as a polymeric bulk to chemically immobilize *Pseudomonas fluorescens* bacteria for soil bioremediation purposes. The exploited chemistry here consisted of a hydroxy-indole-based polymer, processable in water with strong sticky properties [2] and biocompatibility, bearing methyn-aminophenyl boronic units [3] for linking the bacterial external glycocalyx. This biomimetic, melanin like polymer resulted efficient also in decreasing the delivery of microplastics from polyurethane foam structures. Both the investigated materials efficiently bioremoved *via* adsorption inorganic and organic model pollutants from contaminated waste water sources and soils. These works refer to Agritech National Research Center funding from the European Union Next-Generation EU and “Dipartimenti di Eccellenza-progetto MAR.V.E.L. (MARginal areas: Valorization of Ecosystem resources for fair and sustainable Livelihood, ICT-2018-20)”.

[1] I. D. Barbosa Segundo, F. C. Moreira, T. F. C. V. Silva, A. D. Webler, R. A. R. Boaventura, V. J. P. Vilar, *Development of a treatment train for the remediation of a hazardous industrial waste landfill leachate: A big challenge*, Science of The Total Environment 2020, 741, 140165. [2] D. Vona, S. R. Cicco, R. Ragni, C. Vicente-Garcia, G. Leone, M. M. Giangregorio, F. Palumbo, E. Altamura, G. M. Farinola, *Polydopamine coating of living diatom microalgae*, Photochemical&Photobiological science, 2022, 21, 949. [3] D. Vona, S. R. Cicco, R., Labarile, A. Flemma, C.V. Garcia, M. M. Giangregorio, P. Cotugno, R. Ragni, *Boronic Acid Moieties Stabilize Adhesion of Microalgal Biofilms on Glassy Substrates: A Chemical Tool for Environmental Applications*, 2023, 24, e202300284. <https://doi.org/10.1002/cbic.202300284>