RECOVERY/PRODUCTION OF BIO-BASED COMPOUNDS AND BIOMATERIALS FROM AGRO-INDUSTRIAL RESIDUES OR MICROORGANISMS FROM NON-CONVENTIONAL HABITATS

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The research is dedicated to the biotechnological production of bio-based compounds and biomaterials. To that aim, two main strategies are followed: (a) the exploitation of microorganisms collected from non-conventional environments, which could represent a 'reservoir' of microbial diversity and hence of new compounds and bioactive molecules; (b) the valorization of agro-industrial waste through the recovery and/or the transformation of their organic fraction. Bacteria adapted to the extreme environmental conditions could be a resource of new pigments that can be used as natural colorants, biosurfactants for the stimulation of the bioremediation of xenobiotics-contaminated marine sites, or extracellular enzymes that can be exploited in industrial processes. Microbiota actually taken into consideration are those from extreme environments including desert sand/rocks, inland ('Chott') or coastal ('Sebkha') saline systems in the south of Tunisia, and several polluted sites in the Mediterranean Sea.

Target residues to be valorized are: (i) wastewaters from the industrial production of olive oil, wine and cheese, and (ii) bran. If wastewaters contain high added-value compounds, they are pre-treated according to solid-phase extraction procedures for the recovery of such molecules (e.g., polyphenols occurring in olive mill wastewaters, which are natural antioxidants employed in several industrial fields). Wastewaters are employed as the feedstock for the biotechnological production of polyhydroxyalkanotes (PHAs), i.e., microbial biopolymers whose mechanical properties are similar to those of polypropilene. Wastewaters are previously digested under anaerobic acidogenic conditions for the production of volatile fatty acids, which represent a suitable substrate for PHA production. Bran is enzimatically hydrolyzed for the recovery of ferulic acid and its conversion into biovanillin via microbial conversion, after ferulic acid purification from carbohydrates (to be employed as the carbon source for the bioconversion process), and fructooligosaccharides (FOS) with prebiotic properties.

Fig.1 Pigmented bacteria from desert sand and saline systems.

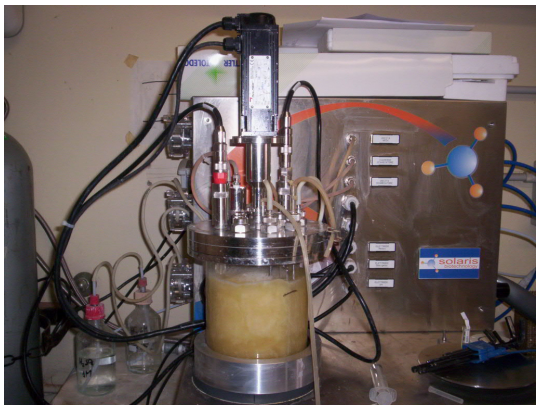

Fig. 2. Fermenter for bioconversion to biovanillin.

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RESEARCH PROJECTS

EU FP7-KBBE-2010-4 Project ID. 266473: ULIXES (Unravelling and exploiting Mediterranean Sea microbial diversity and ecology for xenobiotics' and pollutants' clean up).

EU FP7-KBBE-2009-3 ID 245267 Project: NAMASTE (New Advances in the integrated Management of food processing wAste in India and Europe: use of Sustainable Technologies for the Exploitation of byproducts into new foods and feeds).

EU FP7-KBBE-2010-4 ID. 265669 Project: ECOBIOCAP (Ecoefficient Biodegradable Composite Advanced Packaging).

EU FP7-2012-ID 311933 Project: WATER4CROPS (Integrating bio-treated wastewater with enhanced water use efficiency to support the Green Economy in EU and India).

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