BIOTRANS
LA ROCHELLE 2023

N°642 / OC
TOPIC(s) : Industrial biocatalysis / Enzyme discovery and engineering

ENZYMES FOR GREENER CONSUMER PRODUCTS AND FOR A HEALTHY ZERO-PLASTIC POLLUTED ENVIRONMENT

AUTHORS
Paula VIDAL RAMÓN / ICP-CSIC, MARIE CURIE 02, CANTOBLANCO - MADRID
Manuel FERRER MARTÍNEZ / ICP-CSIC, MARIE CURIE 02, CANTOBLANCO - MADRID
Laura FERNÁNDEZ LÓPEZ / ICP-CSIC, MARIE CURIE 02, CANTOBLANCO - MADRID
Cristina COSCOLÍN GALÁN / ICP-CSIC, MARIE CURIE 02, CANTOBLANCO - MADRID
David ALMENDRAL NIETO / ICP-CSIC, MARIE CURIE 02, CANTOBLANCO - MADRID
Patricia MOLINA ESPEJA / ICP-CSIC, MARIE CURIE 02, CANTOBLANCO - MADRID

PURPOSE OF THE ABSTRACT
Today, the chemosphere's and biosphere's compositions of the planet are changing faster than experienced during the past thousand year. This is a consequence of, first, the rising of CO2 emissions from fossil fuel combustion, including those from processing, manufacturing and consuming everyday products [1]. Second, the increase of the pollution level; indeed, about 140000 artificial chemicals and mixtures of chemicals, including plastics and micro-plastics, are currently produced, 220 billion-tons of which are produced and disposed each year [1]. How do we deal with the green transition to minimize global warming like CO2 and pollution? One of the solutions is to use renewable natural resources, namely, the working parts of its living systems, the enzymes. We review the consequences of climate change and chemical pollution at multiple scales and how enzymes can counteract or mitigate them. We then focus on how they mobilize sustainable and greener innovations in consumer products that have a high contribution to global carbon emissions, and how they can help reaching a healthy zero-pollution environment. Lessons learnt from past and present effort to retrieve enzymes through naïve- and bioinformatics-based metagenomics, and to engineer variants by machine learning and meta-data integration, are discussed. Recent findings in a number of target enzymes, particularly, hydrolases relevant to lipid' and plastic' hydrolysis, are finally discussed.
Acknowledgements. This research was funded by the FuturEnzyme Project, funded by the European Union's Horizon 2020 Research and Innovation Program under Grant Agreements No. 101000327 and 101060625. We also acknowledge financial support under Grants PID2020-112758RB-I00, PDC2021-121534-I00, and TED2021-130544B-I00 from the Ministerio de Economía, Industria y Competitividad, Ministerio de Ciencia e Innovación, Agencia Estatal de Investigación (AEI) (Digital Object Identifier 10.13039/501100011033) and the European Union (“NextGenerationEU/PRTR”).

FIGURES

FIGURE 1

FIGURE 2

KEYWORDS

natural resources | hydrolases | climate change | engineer

BIBLIOGRAPHY

[1] Intasian P., Prakinee K., et al. Enzymes, in vivo biocatalysis, and metabolic engineering for enabling a circular economy and sustainability (2021). Chem Rev 121:10367-10451.