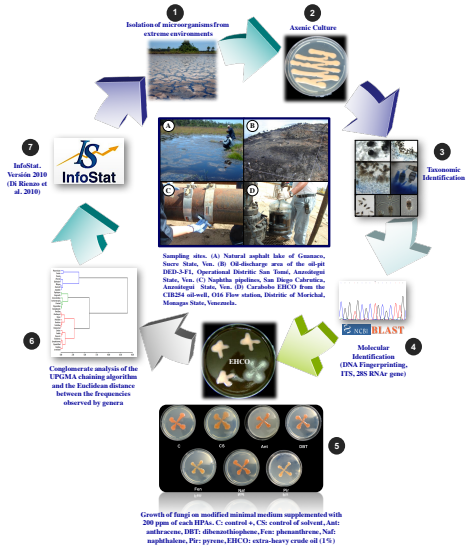
Discovery X-Fungi strains for the sustainable development of the oil industry

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Abstract

The increasing global demand of fuels in addition to the reduction of conventional crude oil reserves has generated a greater interest on the exploitation of unconventional crude oil reserves worldwide. Heavy and extra-heavy crude oil (EHCO) contains elevated amounts of asphaltenes, a high-molecular-weight polar compounds with low availability to be biotransformed. The development of new clean fuel technologies for bioremediation and bioupgrading of unconventional crude oil that including promissory microorganisms is mandatory, like extremophilic hydrocarbonoclastic fungi (X-Fungi), which are defined as a large and heterogeneous group of cultivable fungi which live optimally under extreme conditions and are characterized by having a high ability to grow using hydrocarbons as sole carbon source and energy (Naranjo et al., 2019). However, the studies of both hydrocarbonoclastic potential as well as their tolerance to xenobiotic and toxic compounds abilities are crucial for the selection of powerful X-Fungi as biocatalysts. The aim of the present work was focused on the analyses of the cultivable fungal communities from extreme environments (Figure 1), according to Naranjo et al., (2007, 2013, 2015), and Pernía et al., (2012). The results obtained, allows us to identify members of the phylum Ascomycota (Eurotiales, Hypocreales and Saccharomycetales) as the most common groups, with the following species-rich genera Aspergillus (14), Penicillium (7), Fusarium (6), Trichoderma (3), Candida (2) and, Byssochlamys (2). While, only few species of the phylum Basidiomycota were isolated, in the orders Sporidiobolales and Polyporales, which are constituted by the yeast-like fungi Rhodothorula (3) and *Trametes coccinea* (1), respectively. However, surprisingly the more common species isolated from all the extreme environments studied was *Rhodothorula mucilaginosa*. The fungal strains with greater hydrocarbonoclastic and tolerance capabilities were isolated from Carabobo-EHCO wells and belonging mainly to unicellular fungi, such as *Candida tropicalis*, *Candida viswanathii*, *Cyberlindnera saturnus* and *R. mucilaginosa*. These yeast-like fungi, are the most tolerant species to EHCO and PAHs. Regarding to the relationship between the lignin enzymatic degrading system (LDS) and EHCO bioconversion, a strong induction of the lignin peroxidase activity and a low induction of the laccase activity were obtained repetitively in the all filamentous fungal strains studied. The perspective is the application of the promissory X-Fungi as biocatalysts for mycoremediation or EHCO bioupgrading processes under stressed conditions for the sustainable development of the oil industry.



Recent Publications

1. Leopoldo Naranjo-Briceño, Beatriz Pernia, Trigal Perdomo, Meralys González, Ysvic Inojosa, Ángela De Sisto, Hector Urbina and, Vladimir León (2019). Potential Role of Extremophilic Hydrocarbonoclastic Fungi for Extra Heavy Crude Oil Bioconversion and the Sustainable Development of the Petroleum Industry, in the book: Fungi in Extreme Environments: Ecological Role and Biotechnological Significance. Edited by Sonia Tiquia-Arashiro and Martin Grube. Springer Publishers (In publishing).
2. Pernía B, Rojas-Tortolero D, Sena L, De Sisto A, Inojosa Y, Naranjo L (2018) Fitotoxicidad de HAP, crudos extra pesados y sus fracciones en *Lactuca sativa*: una interpretación integral utilizando un índice de toxicidad modificado. Rev Int Contam Ambient 34: 79-91.
3. Naranjo L, Pernía B, Inojosa Y, Rojas D, Sena D'Anna L, González M, De Sisto, A (2015) First evidence of fungal strains isolated and identified from naphtha storage tanks and transporting pipelines in Venezuelan oil facilities. Advances in Microbiology 5: 143-154.
4. Pernía B, Demey JR, Inojosa Y, Naranjo L (2012) Biodiversidad y potencial hidrocarbonoclástico de hongos aislados de crudo y sus derivados: un meta-análisis. Latinoam Biotecnol Amb Algal 3: 1-40.
5. Naranjo L, Urbina H, De Sisto A, Leon V (2007) Isolation of autochthonous non-white rot fungi with potential for enzymatic upgrading of Venezuelan extra-heavy crude oil. Biocatalysis and Biotransformation 25: 341-349.



Biography

*PhD in Molecular Biology and Biotechnology, genetic and metabolic engineering of filamentous fungi graduated at the Universidad de León, Spain, and worked as Researcher at the Instituto de Biotecnología de León (INBIOTEC). In 2005, he returned to Venezuela as Associated Researcher in the Biotechnology Centre at the Fundación Instituto de Estudios Avanzados (IDEA) for more than 10 years. Currently, is permanent Professor and Researcher in Applied Mycology at the Universidad Regional Amazónica Ikiam and Head of the Grupo de I+D+i de Microbiología Aplicada. He has been Regional Representative of the Latin American Association of Mycology, Vice Gestor of the CYTED Program, and Liaison Officer at the International Centre for Genetic Engineering and Biotechnology (ICGEB).

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Notes/Comments: