Building a bio-based industry in the Middle East through harnessing the potential of the Red Sea biodiversity

The incentive for developing microbial cell factories for production of fuels and chemicals comes from the ability of microbes to deliver these valuable compounds at a reduced cost and with a smaller environmental impact compared to the analogous chemical synthesis. Another crucial advantage of microbes is their great biological diversity, which offers a much larger "catalog" of molecules than the one obtainable by chemical synthesis. Adaptation to different environments is one of the important drives behind microbial diversity. We argue that the Red Sea, which is a rather unique marine niche, represents a remarkable source of biodiversity that can be geared towards economical and sustainable bioproduction processes in the local area and can be competitive in the international bio-based economy. Recent bioprospecting studies, conducted by the King Abdullah University of Science and Technology, have established important leads on the Red Sea biological potential, with newly isolated strains of Bacilli and Cyanobacteria. We argue that these two groups of local organisms are currently most promising in terms of developing cell factories, due to their ability to operate in saline conditions, thus reducing the cost of desalination and sterilization. The ability of Cyanobacteria to perform photosynthesis can be fully exploited in this particular environment with one of the highest levels of irradiation on the planet. We highlight the importance of new experimental and in silico methodologies needed to overcome the hurdles of developing efficient cell factories from the Red Sea isolates.

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