



Extreme Microbial Life of the Atacama Desert, Chile: Potential Biotechnological Source

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The Atacama Desert in the north of Chile, is one of the most ancient, driest and warmest of the planet [1], where the basin of the Salar de Atacama is located and it occupies a geological depression arranged between Domeyko Mountain chain in the West and the Mountain chain of the Andes in the East, between approximately 22°30' and 24°15' of latitude South, with a surface of 13.300 Km² [2]. Due to its geographical, climatic characteristics and chemical composition, the Salar de Atacama is recognized as an extreme environment [3] where in several lakes, microbial communities are growing in extreme conditions, including high salinity, high solar insolation, and high levels of metals such as lithium, arsenic, magnesium, and calcium. Evaporation creates hypersaline conditions in these lakes and mineral precipitation is a characteristic geomicrobiological feature of these benthic ecosystems [4].

In the last years, these extreme environments have been explored increasingly, and diverse studies have demonstrated that these conditions result in variable habitats with different forms of life [bacteria, archaea, chlorophytes, cyanobacteria, and diatoms] existing at the edge of biological limit under extreme physiological conditions [5-7], well adapted to unfavorable conditions for growth [8]. Even, a characterization of endolithic microbial communities of gypsum deposits under extremes of aridity and solar radiation has been reported, identifying the presence of Cyanobacteria, Proteobacteria, and Actinobacteria group representatives [9,10].

Particularly, microalgae are an important source of infinity of natural products with potential therapeutic and industrial applications, such as dietetic and medical area [11,12], in bioremediation [13] and biodiesel production [14-16], between others. Recently, it has been characterized and cultured *In vitro*, an extreme tolerant and oleogenic microalgae *Chlorella sorokiniana* isolated from a microbial mat of salt flat water in Salar de Atacama. This microalga

showed for the most part lipids [30.8%] and proteins [64.8%] as biochemical components [17]. Its rapid growth in laboratory conditions, makes it a biological model strain for future studies; and the high contents of proteins and lipids that it showed, turn it into a potential source of compounds for the biotechnological industry.

The great variety of extreme environments like, salt lakes, microbial mats and rocks, between others, supporting endolithic life shows the versatility of microorganisms to colonize a wide array of substrates and their incredible potential for adaptation to extreme environmental conditions, which has enormous potentials in research and biotechnological applications. [4,18-23]. Further attention has also been devoted to identification, isolation and characterization of biomolecules, like as fatty acids, pigments, proteins and enzymes named as extremozymes, which are well adapted to be active also at extreme conditions [24].

Then, unlike the idea that deserts have a low biological diversity, several studies have evidenced the presence of a microbial diversity in such extreme environments conditions, as are those that lodge the Atacama Desert. Particularly, the Salar de Atacama is a heterogeneous and fragile ecosystem where small changes in environmental conditions may alter the balance of microbial communities with possible consequences at different trophic levels [18].

In addition to strengthening researches on ecology and applications of these unique and diverse microbial communities, there is a need to communicate it to general community, and this way promote the natural heritage assessment with great scientific and technological potentials that are projected worldwide from this Atacama Desert, northern Chile.

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