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ASTEROID MINING - ROLE OF MICROBES IN EXTRACTION OF MINERALS USING BIOREACTOR

Abstract

Biotechnological research in the domain of space biology has paved the way for many inventions and discoveries which have fascinated the human world. One such topic is biomining of asteroids using a bioreactor. Biomining is the technique in which microorganisms are used for extracting rare earth elements from the surface of the earth. This technique is currently being considered as a promising approach to determine the potential of extracting elements from asteroids which can change the dynamics of space mining in the near future which sets up a sustainable way of procuring rare elements. This has also been experimented aboard the International Space Station (ISS) and it has been discovered that biomining can work in microgravity conditions. A basalt rock (a constituent of Lunar-Moon and Martian-Mars surface) was used as a sample material which successfully demonstrated the extraction of valuable and rare earth elements. Most of the valuable minerals and elements likely to be found in outer space are considered to be lost and sucked into its core. So, asteroid mining has been likened to be a space-age gold rush.

Thus, this paper focuses on recreating the same conditions as that of an asteroid and trying to extract the elements using a suitable microbe by optimising a small scale bioreactor. The conditions can be mimicked in a controlled environment by adjusting the physical parameters like temperature and pH necessary for the microbe to thrive in the bioreactor. Asteroid-like samples can be prepared in the laboratory by selecting a suitable material which can be a rock, mineral or a metal which are subjected to various physical conditions like high temperature, pressure, vacuum and chemical processes like oxidation, hydrolysis etc. Furthermore, these samples can be analysed using techniques like X-ray diffraction to collect the information regarding their properties, composition and structure.

This paper aims to determine whether the asteroid-like samples created in laboratory conditions have the potential for the extraction of elements as this experiment can prove the validation of the theory hypothesised behind the biomining of asteroids. The elements extracted can also be a potential source of rocket fuels and building of space related equipment.This can further be used as a base for mining beyond the earth and for establishing a self-sustaining human presence in space.