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International Journal of Microbiology Research
ISSN: 0975-5276 & E-ISSN: 0975–9174, Vol. 3, Issue 2, 2011, pp-85-89
Available online at http://www.bioinfo.in/contents.php?id=27

CHARACTERIZATION OF *BACILLUS POLYMYXA* FROM JAMNAGAR MINE WATER AND BIOBENEFICIATION OF BAUXITE ORE FOR IRON THROUGH SURFACE MODIFICATION

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Received: August 01, 2011; Accepted: August 22, 2011

Abstract- Preliminary screening of the mine water sample from bauxite ore deposits in Jamnagar, India showed the presence of heterotrophic bacteria *B.polymyxa*. Growth conditions for the bacteria to bring about maximum beneficiation were standardized by using the enriched Bromfield medium. *B.polymyxa* brought significant changes in the surface modifications of the mineral magnetite. The interaction resulted in surface chemical changes both on the cell and on the mineral surface by studying their electrophoretic mobility using Zeta meter 3.0. Dissolution studies in the presence of microorganisms establish the foundation in which these processes could be used for the utility of beneficiation in the efficient separation of the impurities from the ore, thus confirmed that *B.polymyxa* has greater affinity towards magnetite and could be efficiently used to remove iron from magnetite. Experiments with respect to the bauxite ore was initiated after confirming the above result. Iron removal from bauxite ore by *B. polymyxa* has been demonstrated under 2% sucrose concentrations brought about 12.5% removals in four days and under similar conditions the control in absence of *B. polymyxa* only 6% iron removal was seen. Thus, *B. polymyxa* plays a significant role in biobenficiation of bauxite mineral. These observations clearly indicate that a direct mechanism through bacterial attachment to the ore and an indirect mechanism through leaching with metabolites are involved in the biobeneficiation process.
Keywords- Chemo-organotroph, Physico-chemical changes, zeta-potential, bauxite ore, dissolution, electrophoretic mobility, biobeneficiation, bioleaching

INTRODUCTION

Bauxite is an economically important mineral used in the extraction of aluminium and in the manufacture of refractory. The mined bauxite ore needs to be beneficiated (calcium and iron being major impurities) so as to remove undesirable mineral constituents before it could be considered as a suitable raw material for the commercial use [1]. Although physico-chemical processes such as froth floatation, gravity separation, reduction roasting and magnetic separation could be used to beneficiate bauxite, all of them are energy and cost intensive, less flexible and pose environmental problems. A biotechnological route on the other hand could prove to be cheaper, environmentally benign and less complex then physico-chemical process [2-4].

Microbial mining is a process of bioleaching which recovers metals from ores that are not suitable for direct smelting due to their low metal content. The use of microorganisms in ore leaching to extract metals such as copper, uranium, gold, silver and iron has been commercialized since 1960's [5, 6 and 7]. As different from bioleaching, biobeneficiation refers to the removal of undesirable mineral components from an ore by microbes, which bring about their selective dissolution by enriching the desired mineral constituents in the solid ore matrix [1]. When microorganisms interact with minerals, many consequences of mineral processing results like adhesion of microorganisms to mineral surfaces, oxidation- reduction reactions, adsorption or chemical interactions onto mineral surfaces etc., are resulting in biosurface modification [8, 9].

In the present study, biobeneficiation was studied for the major mineral impurity magnetite of bauxite ore using *B.polymyxa*, a gram positive facultative anaerobe, and a chemo-organotroph widely distributed in soil. The bacteria adhere to the mineral through surface proteins on cell wall, or by extra cellular polysaccharides and induce its subsequent uptake from ore matrix [10, 11]. Since significant amounts of polysaccharides, residual carbohydrates and organic acids are present in liquid phase, solubilisation of mineral occurs through chelation, reductive dissolution and acidolysis [12]. Thus, it can be expected that *B. polymyxa* can simultaneously remove magnetite from the ore.

The *B.polymyxa* isolated was characterized by microbiological and biochemical methods [13]. The electrophoretic mobility with pH as a functional aspect was determined for the mineral and bacterial cell, before and after interaction at different time intervals. The