

S U M M A R Y

Investigation on the development of a high yielding mutant strain of Aspergillus niger resulted in the isolation of mutant strain A.niger 10 l. This was obtained by treating the wild strain with ethylene imine. This could effect a maximum leaching of silica and iron ^{oxide} as 22.7% and 25.2% respectively. This mutant strain on further treatment with X-rays produced another mutant A.niger X₁ which gives a leaching of silica and iron oxides ^{oxide} as 49.8% and 56.4% respectively.

It has been observed that the mutant A.niger X₁ is stable in the medium consisting of Malt Extract - 0.5%, Yeast Extract - 0.5%, Agar - 3%, pH - 4.

The optimum conditions for bioleaching of silica and iron oxide from bauxite ore by Aspergillus niger X₁ in a complex medium are as follows :

- (1) Particle size of ore -170 to -200 mesh.
- (2) Pulp density of bauxite ore . 0.3%
- (3) Temperature of incubation 30°C
- (4) Volume of the medium . 80 ml
- (5) Initial pH of the medium . 4
- (6) Time period of fermentation 7 days.
- (7) Inoculum volume . 6%
- (8) Age of inoculum 6 days.

Studies on the effect of different carbon and nitrogen compounds on silica and iron oxide leaching from bauxite ore by A.niger X₁ show that glucose 5% and ammonium chloride 0.13% are the suitable carbon and nitrogen sources.

Investigation on the requirement of minerals by A.niger X₁ for bioleaching of silica and iron oxide from bauxite ore indicates that the ZnSO₄.7H₂O and MnSO₄.4H₂O are required for better leaching at the concentration of 10 µgm/ml and 5 µgm/ml, respectively. After the addition of these two mineral salts silica and iron leaching ^{increased to} obtained 70.2% and 77% respectively.

The present study has resulted in the selection of a suitable synthetic medium for bioleaching of silica and iron oxide from bauxite ore by A.niger X₁. The medium should be as follows :

glucose-5%, NH₄Cl-0.13%, KCl-0.5%, KH₂PO₄-1%, MgSO₄.7H₂O-0.5%, ZnSO₄.7H₂O-10 µg/ml, MnSO₄.4H₂O-5 µgm/ml, pH- 4

Some of the complex nutrients have stimulatory effect for silica and iron oxide leaching. Peptone at the concentration of 0.1% increased silica and iron leaching to 72.4% and 79%, respectively. Beef extract when added at the concentration of 0.1% to the medium silica and iron oxide leaching ^{was} obtained at 72.9% and 78.8%, yeast extract ^{at 0.3%} at the concentration of 0.3% improves silica and iron oxide leaching to 73.6% and 80.1%, respectively. Wheat bran extract has also a positive effect on silica and iron oxide leaching from bauxite ore by A.niger X₁.

Studies on bioleaching of silica and iron oxide from bauxite ore by A.niger X₁ show that some amino acids have stimulatory and others have inhibitory effect. L(-) proline has

increasing effect (Max. 72.4% and 77.8% silica and iron oxide leaching respectively). It has also been found that the folic acid has increasing effect on both silica and iron oxide leaching at the concentration of 3 $\mu\text{gm/ml}$ (silica and iron oxide leaching obtained ~~75%~~ 75% and 80.2% respectively). Mercuric chloride is the most effective metabolic inhibitor. It inhibits silica leaching at all concentrations but iron leaching is not totally inhibited. Sodium arsenite and sodium azide inhibit effectively. Chloramphenicol inhibits silica leaching at the latter phase of fermentation and at the concentration above 10 $\mu\text{gm/ml}$. Streptomycin inhibits silica leaching completely when added at 0 day of fermentation.

Surface active agents have no appreciable effect on silica and iron oxide leaching from bauxite ore by A.niger X₁.

Evidences in favour of direct attack (enzymatic breakdown) of silicate matters by Aspergillus niger X₁ come from

- (a) SEM and petrographic thin section study.
- (b) Silicon adsorption by the fungus.
- (c) Silica solubilizing agent being inducible and extracellular in nature.
- (d) The solubilising agent being destroyed with the increase of temperature indicates its proteinaceous nature.
- (e) Increase of extra cellular hydrolytic enzyme (exoprotease, endoprotease, alkaline phosphatase and catalase) activity in presence of silica.

- (f) Inhibition of silica release in presence of monomer Si suggesting a feed back inhibition.

During investigation on biochemical changes on bioleaching of silica and iron oxide from bauxite ore by Aspergillus niger X₁, the findings are as follows :

The rate of leaching of silica and iron oxide increases upto 7th day and attains the peak value. Maximum cellular growth is obtained in 5 days. pH decreases from 4 to 2. Glucose is utilised mostly in 5 to 6 days. Cell nitrogen increases upto 5 days of incubation and then decreases. Ammonia nitrogen decreases upto 6 days of incubation. Amino-Nitrogen comes in the broth after 4 days of incubation. Total nitrogen in broth decreases upto 5 days of incubation then increases again.