CHAPTER 7

EFFECT OF COMPLEX NUTRIENTS ON BIOLEACHING OF SILICA AND IRON OXIDE FROM BAUXITE ORE BY *ASPERGILLUS NIGER* X_1.

During studies on the effect of carbon and nitrogen sources, glucose and ammonium chloride were found to be most effective for the leaching of silica and iron from bauxite ore by **A.niger** X_1.Such studies were carried out in synthetic medium. The main drawback of synthetic medium was that the leaching was limited to some extent upto a certain level, whereas a complex medium may be very useful and highly effective medium due to its inherent minor nutrients. So, investigation was carried out to find out a medium with better efficiency. As a consequence, the effect of complex media containing peptone, yeast extract, meat extract, malt extract, wheat bran extract, rice bran extract, paddy soak liquor, corn steep liquor was studied. After selection of carbon, nitrogen and minerals, the effect of complex nutrient was studied to know whether any minor nutrient associated with complex material is necessary for the leaching or not.

Mohanty et al. used yeast extract in case of silica leaching by **Bacillus lichinoformis** from magnesite ore (195). Mohanty and Mishra used peptone broth for magnesite leaching by **bacillus** species (164).

Ghosh et al. (196) used yeast extract for silica leaching from bauxite ore by **bacillus** species.

Mohanty et al. (197) also used yeast as nutrient in case of silica leaching from the magnesite ore.

The present investigation was made with a view to assess the individual role of complex nutrients of natural origin on bioleaching of silica and iron from bauxite ore by

A.niger X_1.

7. EXPERIMENTAL AND RESULTS :

The basal medium used for the determination of the effect of different complex nutrients on bioleaching of bauxite ore consisted of glucose 5%, NH_4Cl 0.13%, KH_2PO_4 0.1%, KCl 0.05%, $MgSO_4.7H_2O$ 0.05%, $ZnSO_4.7H_2O$ 10 µgm/ml, $MnSO_4.4H_2O$ 5 µgm/ml. The pH was maintained at 4.

The above mentioned complex nutrients were separately sterilized and added to the sterile basal medium in different concentrations (w/v). Solutions of malt extract, yeast extract, meat extract and peptone were prepared by dissolving the materials in double distilled water, sterilized and added to the medium.

The method of preparation of some of the nutrients are indicated below.

7.1 Paddy soak liquor :

132 gms of paddy were thoroughly washed with 400 ml distilled water for 15 mins. The purpose of washing was to remove muds and extraneous materials adhering to the paddy. The washed paddy was then dipped in 200 ml of hot distilled water (55°C) and was allowed to soak water for two hrs. at about 55°C when the grain swelled completely. The soaked water was filtered through cotton. It was then sterilized in auto clave at 15 lbs/in^2 pressure for 15 mins and stored at 4°C. Solid content was found to be 0.1 gms per 100 ml of extract.

7.2 Extracts of wheat bran and rice bran :

20 gms of brans (free from muds) were taken in 200 ml of hot distilled water (55°C) in a 500 ml beaker. The suspensions were kept at 55°C for 18 hrs. The extracts were filtered through cotton and then sterilized at 15 lbs/in^2 for 15 mins and stored at 4°C. The solid contents of wheat bran and rice bran extracts were 1.55% and 0.8% of extract respectively.

7.3 Corn steep liquor :

100 gms of maize was taken in 250 ml of distilled water containing 0.52% potassium metabisulphite in a 500 ml beaker and heated in a controlled bath for 48 hrs at a temperature of 50-55°C . The corn steep water was filtered off and then concentrated by evaporation under vacuum. It was then sterilized at 15 lbs/in^2 pressure for 15 mins and stored at 4°C. The solid content was 1.55% of the extract.

7.4 Soyabean meal extract :

44 gms of soyabean were taken in 200 ml of hot distilled water (55°C) in a 500 ml beaker. The suspensions were kept at 55°C for 18 hrs. The extract was filtered through cotton and then sterilized at 15 lbs/in^2 for 15 mins and stored at 4°C. The solid content was 3.96% of the extract.

Cultural, isolation and determination of silica leaching are same as before (Chapter 2 Page No. 47 of the thesis). The results are shown in Table 7.1-7.9.

Table 7.1 Effect of peptone on bioleaching of silica and iron from bauxite ore by A.niger X_1

Concentration of Peptone(%)	Cellular growth Dry wt (g/l)	Silica* leaching (%)	Iron* oxide leaching (%)
Control (without peptone)	6.8	70.2	77.0
0.03	6.8	70.2	77.0
0.05	7.0	70.6	77.2
0.075	7.2	70.8	77.9
0.10	7.4	72.4	79.0
0.12	7.6	69.6	77.2

*Each figure is the mean value of 3 individual experiments.

Table 7.1 indicates that the peptone has some stimulatory effect on bioleaching of silica and iron from bauxite ore, the optimum being 0.1%.

Table 7.2 Effect of yeast extract for silica and iron leaching from bauxite ore by A.niger X_1

Concentration of Yeast extract(%)	Cellular growth Dry wt (g/l)	Silica* leaching (%)	Iron* oxide leaching (%)
Control (without yeast extract)	6.8	70.2	77.0
0.05	6.8	70.2	77.0
0.10	7.1	70.8	77.8
0.20	7.3	71.7	78.4
0.30	7.5	73.6	80.1
0.50	7.8	70.0	77.2

*Each figure is the mean value of 3 individual experiments.

Table 7.2 shows that the maximum bioleaching rate of silica and iron is observed at a concentration of 0.3% yeast extract.

Table 7.3 Effect of malt extract on silica and iron leaching from bauxite ore by A.niger X_1

Concentration of Malt extract(%)	Cellular growth Dry wt (g/l)	Silica* leaching (%)	Iron* oxide leaching (%)
Control (without malt extract)	6.8	70.2	77.0
0.05	6.8	70.2	77.0
0.10	6.8	70.2	77.0
0.20	6.8	70.2	77.1
0.30	6.9	70.3	77.1
0.50	6.9	70.1	77.2

*Each figure is the mean value of 3 individual experiments.

Table 7.3 shows that Malt extract has no effect on bioleaching of silica and iron from bauxite ore.

Table 7.4 Effect of beef extract on silica and iron leaching from bauxite ore by A.niger X_1

Concentration of Beef extract(%)	Cellular growth Dry wt (g/l)	Silica* leaching (%)	Iron* oxide leaching (%)
Control (without beef extract)	6.8	70.2	77.0
0.05	6.8	70.2	77.1
0.10	7.0	72.9	78.8
0.15	7.0	72.0	77.6
0.20	7.2	71.2	77.1
0.30	7.5	68.4	74.5

*Each figure is the mean value of 3 individual experiments.

Table 7.4 indicates that beef extract at a concentration of 0.1% gives a slightly better leaching of silica (72.9%) and iron (78.8%) from bauxite ore respectively but the cellular growth increased on further increase of beef extract concentrations.

Table 7.5 Effect of rice bran extract on silica and iron leaching from bauxite ore by A.niger X_1

Concentration of rice bran extract(%)	Cellular growth Dry wt (g/l)	Silica* leaching (%)	Iron* oxide leaching (%)
Control (without rice bran extract)	6.8	70.2	77.0
0.05	6.8	70.2	77.0
0.10	6.8	70.3	77.1
0.15	7.1	70.3	77.2
0.20	7.2	70.0	77.0
0.30	6.5	70.0	77.0

*Each figure is the mean value of 3 individual experiments.

Table 7.5 shows that rice bran extract has no effect on bioleaching of silica and iron from bauxite ore by A.niger X_1.

Table 7.6 Effect of paddy soak liquor on silica and iron leaching from bauxite ore by A.niger X_1

Concentration of paddy soak liquor(%)	Cellular growth Dry wt (g/l)	Silica* leaching (%)	Iron* oxide leaching (%)
Control (without paddy soak liquor)	6.8	70.2	77.0
0.05	6.8	70.2	77.0
0.10	6.8	70.0	77.1
0.15	7.0	70.0	77.1
0.20	7.2	70.0	77.2
0.30	7.4	70.1	77.0

*Each figure is the mean value of 3 individual experiments.

Table 7.6 shows that paddy soak liquor has no effect on silica and iron leaching from bauxite ore but cellular growth increased with the increased concentration of paddy soak liquor.

Table 7.7 Effect of wheat bran extract on silica and iron leaching from bauxite ore by A.niger X_1

Concentration of wheat bran extract(%)	Cellular growth Dry wt (g/l)	Silica* leaching (%)	Iron* oxide leaching (%)
Control (without wheat bran extract)	6.8	70.2	77.0
0.05	6.8	71.4	77.6
0.10	6.8	73.0	78.8
0.15	6.9	72.2	78.0
0.20	6.9	71.3	77.3
0.30	6.8	70.0	76.8

*Each figure is the mean value of 3 individual experiments.

Table 7.7 indicates that wheat bran extract at a concentration of 0.1% has slight increasing effect on silica and iron leaching but no effect on cellular growth.

Table 7.8 Effect of corn steep liquor on silica and iron leaching from bauxite ore by A.niger X_1

Concentration of Corn Steep liquor (%)	Cellular growth Dry wt (g/l)	Silica* leaching (%)	Iron* oxide leaching (%)
Control (without Corn steep liquor)	6.8	70.2	77.0
0.05	6.8	70.2	77.1
0.10	6.8	70.3	77.2
0.15	6.9	70.3	77.4
0.20	6.9	70.3	77.4
0.30	6.9	70.0	77.1

*Each figure is the mean value of 3 individual experiments.

Table 7.8 shows that corn steep liquor has no considerable effect on silica and iron leaching from bauxite ore and also on cellular growth of A.niger X_1.

Table 7.9 Effect of soyabean meal extract on silica and iron leaching from bauxite ore by A.niger X_1

Concentration of Soyabean meal extract(%)	Cellular growth Dry wt (g/l)	Silica* leaching (%)	Iron* oxide leaching (%)
Control (without Soyabean meal extract)	6.8	70.2	77.0
0.05	6.8	70.0	76.2
0.10	6.8	68.4	76.0
0.15	6.7	66.2	75.3
0.20	7.0	60.4	74.0
0.30	7.0	56.1	70.1

***Each figure is the mean value of 3 individual experiments.**

Table 7.9 shows that with increasing concentration, soyabean meal extract gradually lowers the bioleaching rate of silica and iron from bauxite ore.

It was found that some complex nutrient has certain effect on bioleaching of silica and iron from bauxite ore, therefore the effect of known vitamins, amino acids, inhibitors were further studied.