# CHAPTER 11

## BIOCHEMICAL CHANGES DURING BIOLEACHING OF SILICA AND IRON OXIDE FROM BAUXITE ORE BY *ASPERGILLUS NIGER* $X_1$.

## 11.1 Experimental and Results :

Carbon Balance : For this experiment, the medium was the same as mentioned in the previous chapter (Chapter 9 Page No. 114 of the thesis). pH was maintained at 4 initially. The contents of the flasks were analyzed at regular intervals to indicate the change in medium. The pH of the broth was determined by Beckman glass electrode pH meter, cellular growth was determined by an electrical balance. The concentration of glucose was determined by Bernfeld method(227).

**Table 11.1 : Carbon balance during the bioleaching of silica and iron oxide from bauxite ore by Aspergillus niger $X_1$**

| Incubation Period (days) | pH of the medium | Glucose remain in solution (% of the total glucose used in medium) | Cellular growth (gm/l) Dry wt. | Silica* leaching(%) | Iron* oxide leaching(%) |
|---|---|---|---|---|---|
| 0 | 4 | 0 | 0 | 0 | 0 |
| 1 | 3 | 76.9 | 2.4 | 0 | 3.5 |
| 2 | 2.5 | 58.8 | 4.7 | 10.1 | 12.6 |
| 3 | 2 | 50 | 6.1 | 20.9 | 23.8 |
| 4 | 2 | 40 | 6.5 | 48.6 | 49 |
| 5 | 2 | 31.2 | 6.8 | 65.1 | 6.7 |
| 6 | 2 | 20.9 | 6.9 | 72.5 | 76.6 |
| 7 | 2 | 19.2 | 7.1 | 75 | 80.2 |
| 8 | 2 | 19.0 | 7.5 | 75 | 80.3 |

* Each value is the mean of three individual experiments

It is evident from table that the rate of leaching of silica and iron from bauxite ore increases upto the 7 day

(a) **Utilization of carbon (glucose) during bioleaching of silica and iron oxide from bauxite ore by <u>Aspergillus niger</u> $X_1$**

The rate of utilization of carbon and nitrogen sources by an organism from the growth estimates of these compounds in the medium at different stages of growth. The growth of the micro-organism as well as quantitative and qualitative yield of the desired product are dependent on the availability of the nutrient and its utilisation and physicochemical environment in the medium. So, the studies on the biochemical changes occuring in the medium during the fermentation process is essential before going to standardise the large scale production methods.

Growth kinetics are dependent on the composition of the nutrient as well as on the organism under investigation.

From the previous experiments it has been observed that the growth of <u>A.niger</u> $X_1$ and the bioleaching of silica and iron from bauxite ore are dependent on the carbon and nitrogen sources. Glucose has been found to be the best carbon source and ammonium chloride has been found to be the best source of nitrogen amongst the nitrogenous compounds studied.

Experiments have been carried out to study the biochemical changes during bioleaching of silica and iron from bauxite ore by <u>A.niger</u> $X_1$ with respect to the following parameters – change in pH, mycelial growth, glucose concentration, concentration of ammonia nitrogen, amino nitrogen, total nitrogen in broth and cell nitrogen.

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.

**(b) Nitrogen balance during bioleaching of silica and iron from bauxite ore by Aspergillus niger $X_1$**

11.2 The rate of change in the composition of the fermentation was determined in regard to amino, ammonia, and the total nitrogen in broth. Total nitrogen in broth and cellular nitrogen were estimated by Microkjeldahl's method (238 ), ammonia nitrogen by Conway method(239) and the amino nitrogen was estimated by chromatographic method. The leaching of silica and iron was determined by the method as described earlier (Chapter 2 Page 47 of the thesis).

**Table 11.2 : Nitrogen balance during the bioleaching of silica and iron oxide from bauxite ore by Aspergillus niger $X_1$**

| Incubation period (days) | Cell N (g/10L) | Amino nitrogen in broth (g/10L) | Ammonia Nitrogen in broth (g/10L) | Total Nitrogen in broth (g/10L) | Silica* leaching (%) | Iron* oxide leaching(%) |
|---|---|---|---|---|---|---|
| 0 | 0 | 0.0 | 3.29 | 3.29 | 0 | 0 |
| 1 | 1.4 | 0.0 | 2.0 | 2.1 | 0 | 3.5 |
| 2 | 1.5 | 0.0 | 1.1 | 1.7 | 10.5 | 13.5 |
| 3 | 1.8 | 0.0 | 1.04 | 1.35 | 19.8 | 24.1 |
| 4 | 1.9 | 0.0 | 1.0 | 1.1 | 48.5 | 49 |
| 5 | 2.3 | 0.38 | 0.71 | 0.9 | 65 | 67.9 |
| 6 | 2.3 | 0.5 | 0.56 | 0.9 | 72.7 | 75.9 |
| 7 | 2.0 | 0.61 | 0.62 | 1.01 | 75 | 80.2 |
| 8 | 1.9 | 0.91 | 0.71 | 1.23 | 75.1 | 80.4 |

* Each value is the mean of three individual experiments

Cell nitrogen increases upto 5 days of incubation and then decreases. Ammonia nitrogen decreases upto 6 days of incubation Amino-N comes in the broth after 4 days of incubation. Total nitrogen decreases upto 5 days of incubation then increases again.