Production of Liquid Bio fertilizer by using Azotobacter Species and their Effect on Plant Growth

Sumanto Prasad Barat¹, Abhishek Gupta²*, Dharmendra Singh², Arpita Srivastav², Summit Kumar Srivastav¹, Ravi Kumar², Pooja Singh², Nikhat firdous² and Neelam Soni²

¹Vinoba Bhave University (J.H.), India
²Center for Microbiology and Biotechnology (CMBT) Research & Training Institute, Bhopal (M.P.), India
*Corresponding author

Abstract

Due to the function of Azotobacter in nitrogen fixation and to their probable biotechnological applications, there are few challenges in developing an effectual approach for the selective isolation of these micro-organisms from soil. One hundred ninety-six Gram-negative strains were isolated from 35 soils sampled in central Italy, by using and comparing three different methods. The screening of soil samples by means of soil paste-plate method mutual with isolation on mannitol-agar proved to be the finest strategy in terms of consistency and selectivity. Moreover, preliminary recognition of free-living nitrogen-fixing isolates on differential LG medium exposed to be tremendously precise, since the majority of the isolates with Azotobacter-like morphology on such a average were presumptively identified as members of the family Azotobacteriaceae, by means of amplified ribosomal DNA restriction analysis.

Keywords
Azotobacter, Liquid Bio fertilizer, Plant Growth.

Introduction

Microorganisms employed to improve availability of nutrients, viz, nitrogen (by fixing atmospheric N₂ and phosphorus (by solubilizing soil phosphorus), to the crops are called biofertilizer the various micro-organism having realized/prospective application as biofertilizer are:bacteria (Rhizobium spp., Azospirillum, Azotobacter), fungi (microrhizae like glomus), blue – green algae or cyanobacteria (anabena, nostoc etc.) and azolla (a fern containing symbiotic anabena azallae. Biofertilizer are products of elected valuable live microorganism, which help to improve plant growth and productivity mainly through supply of plant nutrients. Biofertilizer are also known as microbial inoculants or bio inoculants (Chen and Alexander, 1973; Moffett et al., 1983).

Synthetic/chemical manure not only provides essential nutrients to food crops but also provides simply available manner. So, these fertilizers can rapidly improve the increase and efficiency of food crops and are quick to gain popularity. However broad use
of such fertilizer leads to serious concerns. Nitrate leakage and exterior/soil water toxic waste due to augmented use of fertilizer is straight linked to human health problems. Likewise, fresh water pollution through chemical fertilizer/fertilizer remains be single of the main cause of eutrophication.

Organisms to be often used while biofertilizers component be nitrogen fixers (N-fixer), potassium solubilizer (K-solubilizer) and phosphorus solubilizer by the formulation of mold and fungi. Nearly all of the bacteria included in biofertilizer include a close association through plant roots. Rhizobium has symbiotic interaction by legume roots and rhizobacteria in habit on roots surface or in rhizosphere soil. The phospho-microorganism mainly bacteria and fungi make insoluble phosphorus available to the plants (Gupta, 2004).

A number of reports include examine the different bacterial species to solubilizer insoluble organic phosphate compounds, such as tricalcium phosphate, dicalcium phosphate, hydroxyapatite, and rock phosphate. Among bacterial genera with this capacity are *Pseudomonas, Bacillus, Rhizobium, Burkholderia, Achromobacter, Agrobacterium, Micrococcus, Aereobacter, Flavobacterium and Erwinia* a.. There are considerable populations of phosphate solubilizing bacteria in soil and in plant rhizospheres (Wani and Lee, 2002).

**Biochemical characterization**

Chosen colonies were more characterize for a variety of biochemical test as well as Catalase test activity sugar fermentation test hydrogen sulphide test in dole production test amylase test casein test etc.

**Fermentation**

Prepare Modified Ashby’s medium contain Tryptone, Yeast Extract, Nacl Divide it in different bottles and sterilized it by autoclaving it for 15 min. Now inoculate the medium with the help of inoculating loop using Bacillus microbes from the agar slant. Keep warm the broth at the 35°C for 15 days for the process of fermentation.

The exhausted medium is centrifuged at 2000 rpm for about 30 minutes. During the centrifugation, the mycelia fragments and spores settle down at the bottom of the centrifuge tube. The clear solution is separated from the tube and treated with 6N HCl to reduce the pH to 3. This acidified solution is transfer to a separating funnel and treated with ethyl ether. This solution is shaken well at 4°C for about one hour.

The IAA gets dissolved in the ether the fraction of ether is separated from the separating funnel and its volume is reduced to ¼ of the original volume of ether. The concentrated ether fraction is treated with an equal volume of sodium bicarbonate solution in order to extract more Auxin. This process is repeated for 2-3 times. The bicarbonate fraction is again treated with 6N HCL to acidify the bicarbonate fraction. The resulting solution is treated with ethyl ether which dissolves more IAA from bicarbonate fraction. This process repeated 2 or 3 times to draw more IAA. The ethyl ether fraction contains IAA. It is concentrated by exposing it to air to gate a powder of IAA. It has mixture of different types of Auxin. They are separated by chromatography.

**Isolation of Azotobacter species from soil sample**

Rhizospheric microbes were isolated from soil that were composed from CMBT lab (Bhopal).and inoculate in Ashby agar medium and was incubate at 24 hrs. Colony trait of arbitrarily isolated colonies was recorded. Gram staining was performed.
**Quantification of Auxin**

A sample of isolated Auxin is treated with Salkowski reagent. It gives feature coloration, which indicates the presence of Auxin in the solution.

**Qualitative analysis of IAA**

Thin layer chromatography employed for the separation of different Auxin. Isopropanol-ammonia-water is used as a solvent for the chromatographic separation of Auxin.

**Result and Discussion**

A Catalase positive culture will produced bubbles of oxygen within one minute after addition of $H_2O_2$. All the tube show positive

Hydrogen sulfide, a colorless gas, when produced reacts with the metal salt (ferrous sulfate) forming visible. The production of hydrogen sulfide from cysteine and sodium thiosulfate ($Na_2S_2O_3$) takes place

![Fig: Catalase](image)

Positive result show – Gas production + colour change of media from red to yellow  
Negative result show – No change of media colour

![Fig: Fermentation of carbohydrate](image)

![Fig: hydrogen sulphide test](image)

Development of a cherry (deep) red color in the top layer of the tube. Take 5 tubes 1 2 3 tubes were positive and 4 5 were negative

![Fig: indole test](image)

Starch in the presence of iodine produces a dark-blue coloration of the medium, and a yellow zone around a colony in an otherwise blue medium indicates amylolytic activity.

![Fig: amylase test](image)

Formation of a clear zone adjacent to the bacterial growth, after inoculation and
incubation of agar plate cultures, is an evidence of casein hydrolysis.

![Image of casein test](image)

**Microbial identification using software**

On the basis of results of the gram's staining, growth on selective and differential media and biochemical analysis the isolated bacterial from sample sample S1, S2, S3, S4, S5 of soil identified using the software PIBWIN.

In conclusions, the result of the present study highlighted to nitrogen fixing bacteria as of rhizospheric soil be able to be simply isolated and might be exploited for confined cultivation use. This study indicates to azotobacter spp. exacting possesses the capability to manufacture high nitrogen in culture medium. This and the other isolates have possible for employ as plant biofertilizer or bioenhancer for the plant growth development though, additional study to determine the competence of the best isolate in situ, and mycorrhiza or plant connection is certainly needed.

**Table.1 Identification of isolated culture from sample**

| S.No. | Bacteria ID | Identified Bacteria       |
|-------|-------------|---------------------------|
| 1     | S-1         | *Azotobacter nigricans*   |
| 2     | S-2         | *Azotobacter sp.*         |
| 3     | S-3         | *Azotobacter sp.*         |
| 4     | S-4         | *Azotobacter tropicalir*  |
| 5     | S-5         | *Azotobacter sp.*         |

**Table.2 Quantities estimation of Azotobacter**

| Concentration | Absorbance |
|---------------|------------|
| 20            | 0.445      |
| 40            | 0.657      |
| 60            | 0.873      |
| 80            | 1.067      |
| 100           | 1.267      |

**Table.3 Bioassay of fermented Azotobacter**

| S.No. | Sample  | Root length (cm) | Shoot length (cm) |
|-------|---------|------------------|-------------------|
| 1     | S-1     | 11               | 12                |
| 2     | S-2     | 8                | 10                |
| 3     | Standard| 6                | 10                |
| 4     | Control | 5                | 5                 |
Fig. 1 Quantification of IAA

![Graph showing IAA production with the equation y = 0.010x + 0.245 and R² = 0.999.]

Fig. 2 Production of IAA from two samples

![Bar chart showing the quantity of produced IAA for bacterial strains S-1 and S-2.]

Bioassay of produced IAA

![Image of bioassayed seedlings.]
Four samples of rhizoflora of soil, S1, S2, S3 and S4 were analyze by a variety of physico-chemical parameter as well as microbial study have too be complete. Azotobacter has many dissimilar effects, as nitrogen fixation and produced all Auxin do, such as inducing cell elongation and cell divisions with all following results for plant enlargement and growth.

References

Chen M, Alexander M. 1973. Survival of soil bacteria during prolonged desiccation. Soil Biol. Biochem. 5:213-221.
Moffett M.L, Giles JE, Wood BA.1983.

Survival of Pseudomonas solanacearum biovars 2 and 3 in soil: effect of moisture and soil type. Soil Biol. Biochem 15:587-591.
Gupta A.K. 2004. The complete technology book on biofertilizers and organic farming. National Institute of Industrial Research Press. India.
Wani, S.P. and Lee K.K., 2002.Population dynamics of nitrogen fixing bacteria associated with pearl millet (P. americanum L.), In biotechnology of nitrogen fixation in the tropics, University of Pertanian, Malaysia, 21-30.

How to cite this article:

Sumanto Prasad Barat, Abhishek Gupta, Dharmendra Singh,ARPita Srivastav, Summit Kumar Srivastav, Ravi Kumar, Pooja Singh, Nikhat firdous and Neelam Soni. 2016. Production of Liquid Bio fertilizer by using Azotobacter Species and their Effect on Plant Growth. Int.J.Curr.Microbiol.App.Sci. 5(7): 654-659. doi: http://dx.doi.org/10.20546/ijcmas.2016.507.074