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A REVIEW ON LIQUID FORMULATION OF PHOSPHORUS SOLUBILIZING BACTERIA

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ABSTRACT

Soil microorganism plays an important role in regulating the levels of carbon, nitrogen, phosphorus and sulfur in the Rhizosphere. Macronutrient resolution is an important factor in plant growth and development research. Phosphorus is one of the most important nutrients needed for good plant growth. Phosphorus Solubilizing Bacteria plays an important role in increasing plant absorption by phosphate. Phosphorus is one of the lowest microelements available. The use of microorganisms in biofertilizers can release phosphorus to unresolved chemicals. *Pseudomonas putida* P13 and *Pantoea agglomerans*

P5 are best known for their use as phosphate solubilizing bioinoculants and are used as a soluble agent. Liquid bioinoculants are chosen to save the production process and longevity.

Keywords: Phosphorus solubilizing Bacteria, Rhizosphere soilbacteria, microorganism, Bio fertilizer, Plant Growth-Promoting Rhizobacteria

INTRODUCTION

Phosphorus is one of the major plant nutrients that inhibit plant growth. Most of the essential nutrients, including phosphorus, remain in the reliable process, as many filters that do not show a clear location on agar plates dissolve the soluble phosphates in the aqueous solution. It can be concluded that soil bacteria should be tested in NBRIP broth to obtain the most effective phosphate broth soil **[1, 2]**. Most of the rare phosphates used in the soil as fertilizer are removed immediately after application and are not found in plants **[2]**. Therefore, the release of insoluble and unchanging phosphorus is an important factor in the increase in the availability of phosphorus soils. Inoculation of seeds or soils containing phosphate-solubilizing bacteria is known to improve the solubility of stable soils phosphorus and phosphates used which results in higher crop yields **[2, 3]**. Several authors argue that the synthesis of inorganic phosphate is a minor factor in the production of organic acids and the decomposition of oxoacids derived from sugar **[2, 4]**. Phosphate-soluble bacteria's are regularly tested on a plate test method using Pikovskaya (PVK) agar Pikovskaya **[5]** Testing for the equilibrium of the separated species is performed by selecting microorganisms that are able to produce a halo / clear surface on the plate due to the production of organic matter in the medium **[6]** However, the reliability of this halo-based method is questioned as many filters that do not produce a visible halo / zone on agar plates can solve various types of phosphates that cannot be solved internally **[7]**.

ROLE OF PHOSPHORUS

Phosphorus is the second largest nutrient in plant production. plays an important role in many communities and chemical activities. such as cell division, photo-synthesis, sugar degradation, the conversion of sugar into starch, the transfer of nutrients within a plant, the transfer of genetic traits from one generation to the next. Regulation of body movements.

DIVERSITY OF PHOSPHATE SOLUBILIZING BACTERIA

Phosphate Solubilizing Bacteriaare a group of micro-organisms that are capable of producing hydrolyzing organic and inorganic phosphorus compounds from soluble chemicals. Among these phosphorus solubilizing bacteria s, species from bacterial species (*Bacillus, Pseudomonas, and Rhizobium*), fungal species (*Penicillium and Aspergillus*), Actinomycetes, and Arbuscular Mycorrhizal (AM) are notable.

Soil is a natural medium for the growth of bacteria. Mostly, one gram of fertile soil contains 101 to 1010 bacteria, and its live weight can exceed 2,000 kg ha. Among the total number of pathogens in soil P, processing bacteria containing 1-50% and P fungal processing 0.1 to 0.5% of humans is complete. Phosphorus solubilizing bacteria's are ubiquitous, and their numbers vary from soil to soil. Many phosphorus solubilizing bacteria have been isolated from the rhizosphere of various plants, where they were known to be extremely active **[3]**. In addition to those species, symbiotic nitrogenous rhizobia and fungus fungus *Arthrobotrys oligospora* **[8]** also showed phosphate melt activity.

MECHANISM OF PHOSPHORUS SOLUBILIZATION

Phosphorus solubilizing bacteria s uses a variety of methods to make phosphorus accessible to plants. These include reducing PH, chelation elation, and mineralization.

Mineralization

Organic phosphate is converted into a form used by phosphorus solubilizing bacteria through the mineral processing process, and occurs in the soil due to plant and animal residues, which contain large amounts of organic phosphorus compounds such as nucleic acid, phospholipids, sugar phosphates, phytic acid, polyphosphates, and phosphonates. .

Phosphorus solubilizing bacteria s makes soil minerals P by the production of phythatases such as phytase phosphorus which will be immovable by plants. Alkaline and acid phosphatases use organic phosphate as a substrate to convert it into an inanimate form. The following are some of the fungi that commonly produce phytase: Some phosphorus solubilizing bacteria's produce siderophores, causing hydrolyze of organic P in the soil leading to the discovery of P **[9]**.

Phosphorus Solubilizing Bacteria Practice Use As A Biofertilizer and Feature Prospect

Phosphorus efficiency in agricultural countries can be enhanced with the introduction of phosphorus solubilizing bacteria inoculation. Indications for their contribution to the reduction of inorganic phosphates and mineral phosphates were reported **[10-12]** showed that the P-level released by *Pseudomonas putida, Pseudomonas fluorescens* CHAO, and Tabriz Pseudomonas fluorescens was 51, 29, and 62%, respectively. Similarly, the inclusion of *Glomus fasciculatum* with Azotobacter led to a significant improvement in the absorption of P, K, and N by the mulberry leaf compared to the excluded plants Leyval **[3]**. Similarly, the detection of phosphorus development and increased wheat yields were reported following the incorporation of phosphate solubilizing *Pseudomonas* and *Bacillus* species **[6]**. Phosphorus solubilizing bacteria increases the availability of P without interfering with the chemical composition of the soil. This is especially true, where access to chemical fertilizers is limited. Phosphorus solubilizing bacteria can be used for a variety of plants and not for specific hosting.

Numerous studies have reported that the use of phosphorus solubilizing bacteria has increased growth, yield, and quality in many crops including walnut, apple, corn, rice, mustard, palm oil, aubergine and chili, beans, wheat, beetroot, sugarcane, chickpea, peanuts and legumes, and potatoes phosphorus Solubilizing bacteria have been shown to increase P intake, growth, and productivity when used in plant extracts **[11, 12]**. The moderate distribution of P contributes to seed formation and early maturing of crops such as cereals and legumes**.** It causes early maturation and stimulates young plants to produce deeper and fuller roots**.**

Phosphorus solubilizing bacteria improved the sugarcane yield by 12.6%, while wheat yields of up to 30% were supplemented with *Azotobacter* and up to 43% with Bacillus ointment prescribed **[13]**. Similarly, a 10-20% increase in yield was reported in field trials using a combination of *Bacillus megaterium* and *Azotobacter chroococcum*.

Peanut seed extraction with P to dissolve Pseudomonas fluorescent is highly differentiated to improve nodule number and dry weight beyond control **[14]**. Similarly, the Pseudomonas vaccine produced a paositive effect on the slat tolerance of *Zea mays* L. under NaCl pressure.have shown that phosphate solubilizing bacteria and arbuscular mycorrhizal fungi (AMF) alone and their combination have led to an increase in the yield of dry matter (both SDW and RDW), the number of grain spike, and wheat yield . Extremely dry shoot weight and recorded dry weight were appropriate for root growth and shoot length as well as phosphorus detection by roots following the phosphorus solubilizing bacteria and AMZ system compared to control. Also, indicated that double absorption of Rhizobium and phosphorus solubilizing bacteria without fertilizer

To date, the only phosphate inoculum available in large quantities is Jump Start, which is made with the weight of *Penicillium bilaii* **[5]**. The influence of phosphorus solubilizing bacteria on sugarcane production and juice quality has been well established, and the use of phosphorus has become an important component of the sugarcane fertilizer system. Many phosphorus solubilizing bacteria s have been identified as active biofertilizers or biocontrolling agents especially *Bacillus megaterium*, *Bacillus circulans, Bacillus subtilis*, and *Pseudomonas striata* are active biofertilizers **[5]**.

Liquid Formulation Of Phosphorus Solubilizing Bacteria

Fluid formulations are propagules that are sprayed with microbial agents located in a suitable liquid (or) Consortium for microorganisms (phosphorus solubilizers) given the appropriate way to maintain their function for a period of time which helps to improve the biological function of the target site **[15]**.

Basic structural features

1. Stabilization during the distribution and production of the product.
2. Easy delivery in the field at the right time.
3. Protecting the microorganism from harmful environmental factors in the target area (field), thus increasing persistence.
4. Improving physical activity in the target area by increasing its performance, reproduction, contact and interaction with targeted plants.

Biofertilizers are not a special liquid formulation that contains not only the necessary microorganisms and their biological bees, but also special Protestant cells or substances that promote the formation of long-lived shelf or cysts on shelf and intolerance to adverse conditions **[15]**.

Water-based suspension

Sleeping technology is still used by a few current commercial manufacturers. Typically, they use growth suppressants, contaminants suppressants such as sodium azide, sodium benzoate, butanol, acetone, fungicides, and insecticide etc. In the case of PSM, it is clear that these bacteria have fallen into a very serious category. Therefore, when planting plants they take longer to regenerate. This long term is not desirable for temporary crops. To address this deficiency a new process was adopted in the process of liquid formulation involving the binding of bacteria without protection **[15]**.

Inactive oil suspension

The oil serves as a complete source of supply of inoculants that are in good working order. Microorganisms can be suspended in oil at high concentrations at various levels of water loss and remain active. This invention brings organisms to a dormant environment and does not promote the growth of impurities during storage. Bacteria / fungi successfully dried by continuous aeration such as oil suspension provide inoculants with shelf life for several years. The viscosity is approximately equal to the degree of particle formation. This is achieved by the use of colloidal clay, polysaccharide gums, starch, cellulose or synthetic polymers **[15]**.

CONCLUSIONS

One of the major problems to be solved in the coming decades is to reduce dependence on phosphate fertilizers. To meet this challenge, phosphorus solubilizing bacteria must play a major role. It is well known and well documented that phosphate Solubilizing bacteria are capable of dissolving rock phosphate. Exploitation of this ability can be a promising way to nourish phosphate. Therefore, many experiments have been performed on selection, identification, performance, and bio composition in the past to meet this need. However, these reviews have shown that most tests are performed on a laboratory or greenhouse scale and few papers have yielded results in the field. Therefore, we propose certain lines for the future: (i) knowing that the results of laboratory conditions or temperatures do not always reflect that of the field, therefore, consistent field results are a requirement for greater acceptance of phosphorus solubilizing bacteria s for biofertilizers; (ii) there is also a need for further research to understand the complex associations between microbes-rock phosphate, microorganisms, phosphorus solubilizing bacteria methods, and the appropriate process for inoculation according to the intended yield and / or stain.

This data will allow illustrating the process of re-integration of solubilization and bioformulation (iii) the market for phosphorus solubilizing bacteria -based biofertilizers is much lower compared to the nitrogen-based bacterium biofertilizer, 14 vs. 79% according to Transparency Market Research. Therefore, potential problems associated with the quality and stability of the phosphorus solubilizing bacteria inoculum should be investigated in new ways arising from collaborations between microbiologists, material scientists and agricultural scientists. In addition, the strategies and methodology should be described in detail to allow for duplication of research (iv) Among phosphorus solubilizing bacteria s, Actinobacteria are the ones that can be studied most about their agricultural interests. These bacteria deserve special attention because of their ability to adapt to a variety of ecosystems such as desert soils, sea sand, rock deposits etc. Therefore, future research should look at this group that still has a hidden text that can be tested for high quality fertilizer. By combining these bacteria with Arbuscular mycorrhiza fungi, they can decompose and synthesize P stored within the soil leading to an efficient biofertilizer. It is also necessary to focus on the many functions of Actinobacteria including nitrogen fixers and phosphorus solution since plant production is highly dependent on the availability of N and P. Actinobacteria biotechnology has the potential to create profound changes in agricultural practices, if developed. Therefore, there is a need to disrupt innovation and scientific research to ensure that rock phosphate-soluble rock and bioformulation of agriculture are sustainable and friendly. Adjustment of selection processes, replication, phosphorus solubilizing bacteria maintenance and their interaction with the rhizosphere are the learning steps to develop effective microbial inoculants with high phosphorus solubilization potential.

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