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POTASSIUM SOLUBILIZING BACTERIA - ISOLATION, MASS-MULTIPLICATION & LIQUID FORMULATION OF POTASSIUM SOLUBILIZING BACTERIA (KSB)

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ABSTRACT

Potassium [K] is an essential element for plants after nitrogen and phosphorus elements. It is playing an important role in the development, plant growth and such as -nutrient transportation, enzymes activities, maintaining turgor and mainly protect the plants from disease and insects. The availability of potassium is developed the productivity of paddy or grain. It is main factor but unfortunately 90 to 98% of soil is potassium bearing so that plant cannot uptake the potassium from soil. Although some micro-organism plays an important key role in potassium cycle. Potassium solubilized bacteria were isolates on modified Aleksandrov media that contain Mica powder which is use as a potassium source. The newly developed plat assay is based on improved halo- zone which is clearly visualized to add an acid-base indicator dye bromothymol blue [BTB] on agar plate. KSB micro-organisms produce acid by mica hence zone is formed. K solubilizing zone is showed after incubation for 5 to 7 days at 30˚C. Therefore this newly protocol for assay of KSB was time saving and more sensitive. The use of agricultural microorganisms as a bioinoculant is a particularly

important practice and a growing need as well. This chapter focuses on a liquid biofertilizer formulations. The present scenario of liquid inoculants and their benefits.

Keywords: **Potassium solubilizing Bacteria, Cell protectants, biofertilizer, liquid formulation**

INTRODUCTION

Potassium (K) is the 3rd main essential macronutrient and most consumedly absorbed cation that plays an impotent role in the development, growth and metabolism of Plants **[1]**. In one of the most agricultural commodities, potassium uses in the generative phase for the developing and filling of grains and paddy. It is the seventh most abundant element on the Earth's crust. First report of K was done by Sir Humphry Davy in 1807. In soil the concentration of soluble potassium is very low, more than 90% of Potassium in the soil are (K)-bearing minerals form **[2]**. As one of the agricultural commodities, paddy needs Potassium in the generative phase for the developing and filling grain. In such, the availability of Potassium become one of the major factors that effected on the productivity of paddy. Unfortunately, more than 90 to 98 % of Potassium found in the soil are K-bearing minerals which are unavailable for plant uptake.

The term of "biofertilizer" is usually refers to a product that contains microorganisms that are used in plants to improve their quality of life. growth. However, it is often misused as cinnamon of various products such as raw or animal manure, crop mixing, or organic chemical additives **[3]**. Vessey (2003) described a biofertilizer as "a substance containing living microorganisms that, when implanted in seeds, in planting material, or in soil, colon the rhizosphere or the inside of the plant as well promotes growth by increasing the availability or availability of essential nutrients in plants used. There are mant types of biofertilizer formulations such as - solid-carrier-based bioformulations, liquid formulation, polymer entrapped formulation, peat formulation, granules formulation etc.

In the case of liquid bio-fertilizers the shelf life of the microbes is higher than carrier based biofertilizers without any consideration loss in viable counts. They are tolerant to high temperatures (55 degrees) and ultra violet radiations. In the current study, conducted learn about the effects of various cell protectors i.e. glycerol (0.5%), polyvinyl pyrrolidone (PVP, 0.5%), polyethylene glycol (PEG, 0.5%), gum arabic (GA, 0.5%) and sodium alginate (SA, 0.1%) on the shelf life of separate liquid biofertilizer inoculants **[4]**.

POTASSIUM SOLUBILIZING BACTERIA

K-solubilization is caused by a large number of saprophytic bacteria (*Bacillus mucilaginosus, B. edaphicus, Acid thiobacillus, B. circulans, Paenibacillus spp. Ferrooxidans.*) And fungal species

(Aspergillus spp. And Aspergillus terreus). Large amounts of K containing minerals (muscovite, orthoclase, biotite, feldspar, illite, mica) are present in the soil as a stable form that can be taken directly by the plant **[5].**

MECHANISM OF K SOLUBILIZING BACTERIA

Solution of K-carrying minerals (micas, illite, and orthoclases) by micro-organisms reported due to pH reduction, with increase cultural chelating tied to K; organic production such as citric, oxalic, and tartaric; and due to the production of capsular polysaccharides that assisted in extinction minerals to extract potassium **[6]**. Organic acids can directly to strengthen the decay whether it is proton- or the ligand-acting method. And they can increase indirectly by the termination of the construction of solution properties with reaction products and as a result it increases chemical bonding in total extinction **[7]**. Production of citric acid-like citric acid, tartaric, and oxalic acid were associated with feldspar solubilization by B. mucilaginosus and *B. edaphicus* (Malinovskaya *et al*. 1990; Sheng and Huang 2002a). Silk bacteria have been found to dissolve potassium, silica, and aluminum from minerals that cannot be solved by phosphoric release acids that contain soluble apatite and release available nutrients from apatite identified several fungal solvents with the ability to extract metal ions and silicate ions from minerals, rocks, and soil. These fungal isolates are found to produce citric acid and oxalic acid in particular known to decompose or synthesize natural fragments and to assist in the removal of iron ions from rocks and soil **[8]**. Therefore, the production of organic compounds such as acetate, citrate, and oxalate by microorganisms found to increase the melting point of minerals.

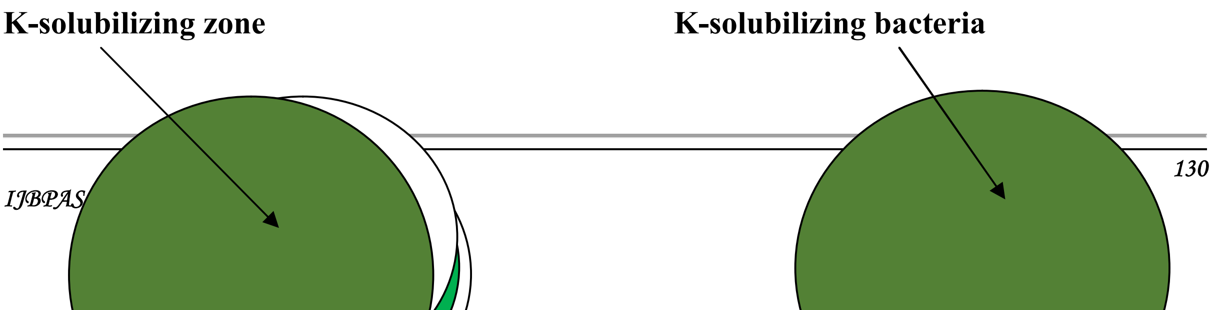
ACID PRODUCTION BY KMB

Production of citric acid-like citric acid, tartaric, and oxalic acid have been reported as a powerful mechanism contributing to the reduction. K-solubilizing silicate machine bacteria have the potential to eliminate potassium, 5 KSM Molecular Methods for Enhancing Plant Production Under. silicon, and aluminum from the insoluble K-bearing minerals such as micas, illite, and orthoclases are extracting organic matter that eliminates rock K direct or chelate Si ions to bring K to Solution **[9]**. Organic acids dissolve K by a proton- or ligand-mediated process. Organic acids indirectly improve K processing by formulation Solution properties with reaction products and increased chemical synthesis throughout melting. In the soil potassium is present in an adequate amount or source of potassium provided in soil with a K problem, KSMs have potential to resolve it and release the plant growth promotion. Mineral weather can also produce a K-silicate bacterium and discovered that they can dissolve potassium, silicon, and aluminum from unresolved minerals through the release of phosphoric acids dissolve apatite as well extract the available type of nutrients from apatite. The mold separates itself and has the ability to produce citric acid as well oxalic acid, known to dissolve silicate minerals and aids in the removal of iron ions in rock and earth. Inorganic acid production in Thiobacillus, Clostridium, and Bacillus also potassium depletion from minerals. Organic acids such as citric, tartaric, and oxalic acid are involved in K solubilization from feldspar secreted by *B. mucilaginosus and B. edaphicus*. Mineral dispersion rates were obtained expansion by organic chemicals produced by microorganisms such as acetate, citrate, and oxalate **[10]**.

SCREENING OF POTASSIUM SOLUBILIZING BACTERIA (KMB)

The KSBs were separated by a serial dilution plate using a Aleksandrov medium modification that included 5.0 g glucose; 0.5 g MgSO4.7H2O; 0.1 g CaCO3; 0.006 g FeCl3; 2.0 g Ca3 (PO4) 2; 3.0 g potassium Aluminum silicate; and 20.0 g agar in 1 liter of sterile water. The pH of this method is adjusted to 7.2 by adding 1 N NaOH. Plates placed at 28 ± 2 ° C in an oxygen oxygen demand incubator for 3-4 days **[10]**. Columns indicating clear areas were selected and the diameter of the melting point was calculated in mm and values were reported as per the standard deviation of each sample. Recently, Rajawat suggested a modified plate test to quickly test the KSB. This experiment is based on the improved appearance of the halo zone around the colonies on agar plates, with the addition of an acid-base dye (bromothymol blue, BTB), a central transformation of Aleksandrov. This experiment also saves time, is more sensitive, and beneficial compared to the Aleksandrov plate test. Comparing the combination of K on the Aleksandrov agar plate with the agar medium plate proposed by Rajawat **(Figure 1) [11]**.

Ratio = D/d = Diameter of zone of clearance / Diameter of growth



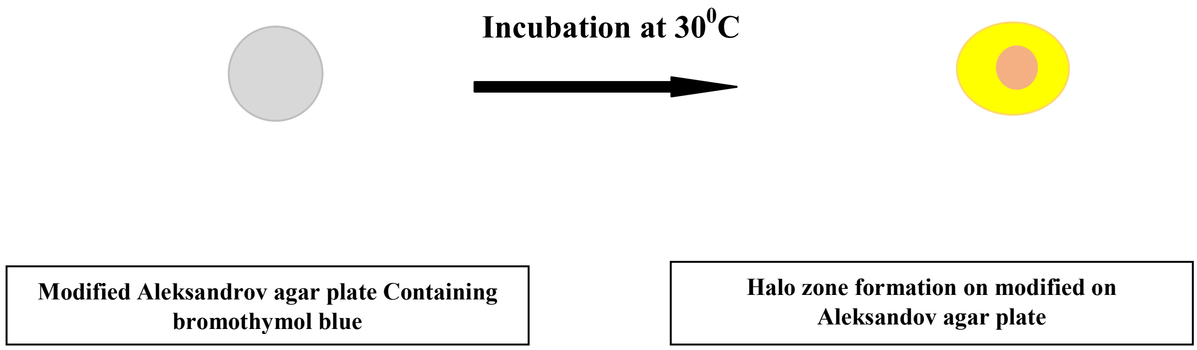


Figure 1: Comparison of K solubilization in Aleksandrov agar plate (a) and agar medium plate (b) after 72 h incubation

LIQUID FORMULATION

Liquid formulations usually contain water, oil, or polymer-based products. They are a form of formation they contain not only the necessary microorganisms and their elements but also special cell protection and additives that improve cell survival in storage and after the planting of seeds or soil**.** Peat is an exceedingly popular carrier for many ages, but availability is limited and repeated depletes energy quickly, so researchers now want it is possible for liquid injectors in all types of biofertilizers. Instant fluid inoculants are available are designed for advanced sowing machines, as it can be sprayed on the seed as it passes the auger seeds and then dry before entering seed bin for the planter **[12]**. It can be produced with simple fermentation process, packed directly from the fermenter aseptically, and stored for a long time without loss of performance.

Liquid inoculants are not a standard broth extract from fermenter or water suspension network-based biofertilizers, as is often thought be. Liquid inoculants contain a content of nitrogen, carbon, and vitamin sources for growth of microorganisms and certain compounds that act as cell protection. These cells protector and additives are added in the broth improving vaccine quality such as:

- Prevention of osmosis.
- Better seed adhesion.
- Product sustainability.
- The binding or malfunction of the soluble seed coat poison.
- Improving rhizobial survival at the end.
- Protection of the inoculums after exposure the worst natural conditions in seed and seed vaccination **[13]**.

Legumes are sometimes sown in the ground temperature up to 40˚C. As high temperatures affect the survival of rhizobia and nitrogen fixation, these additives protect rhizobial cells from seeds at such a high temperature and during suspension. Water cultures that contain cell protectors do not only maintain high numbers of bacteria but it also promotes the formation of resting cells such as cysts and bullets, which contribute more resistance to abiotic pressure, thereby increasing the survival of bacteria**.**

Advantages of liquid formulation -

- A small amount of stove is needed.
- There is no need for any adhesive material other than the transport carriers.
- Supports high cell count over time.
- Easy to produce.
- It is easy to sterilize completely, so it prevents pollution.
- Compatible with modern agricultural equipment in its use.
- Easy movement of large amounts of inoculum to small bottles.
- Easy to use and as a Fertilizer.
- It can be used to reduce stress.

CONCLUSIONS

K- (potassium) bearing minerals have a prominent position in an explosion of land that could contribute to K fertilization plant species., k- potassium can be released into soil solution from insoluble mineral. Plant requirements, K fertilizers should be used, living in the modern era practice giving the K available in comprehensive agricultural systems. For isolation modified Aleksandrov media was used with acid-base indicator dye. BTB showed that the visibility and clarity of yellow-colored halo zones improved with increases in BTB concentration.

All of these isolated factors were identified on the basis of morphological and physiological-biochemical experiments up to 39 factors. The seventh KSB in this study is able to dissolve Potassium in K-carrying minerals with both economic and environmental benefits, so that these separates can be used as another bio-fertilizer agent Potassium, usually bio-fertilizer can be used for seed, soil, or during composting.

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