

In the present study *Lysinibacillus macroides* was used to assess the phosphate solubilizing activity in immobilized form. *Lysinibacillus macroides* was immobilized on various immobilization matrices such as sodium alginate, agar, Ca-alginate perlite and perlite. The effect of critical immobilization parameters on phosphate solubilizing activity in NBRIP broth medium was assessed through Molybdate blue method. The critical optimized parameters for maximum Phosphate solubilization in sodium-alginate matrix were achieved at sodium alginate concentration (3%), CaCl<sub>2</sub> concentration (0.2 M), pH (7), temperature (35°C), agitation speed (150 rpm), incubation time (7 days), curing time (20 min), bead size (1.75 mm), bead number (75 beads). The critical optimization parameters for maximum Phosphate solubilization in agar beads was attained at agar concentration (3%), pH (7), incubation time (7 days), bead size (3 mm). Comparison of phosphate solubilizing activity of immobilization matrices showed that sodium alginate beads showed maximum phosphate solubilizing activity  $3576 \pm 0.04 \mu\text{g/ml}$ , while free bio-inoculant exhibited  $3034 \pm 0.02 \mu\text{g/ml}$ , agar beads showed  $2985 \pm 0.02 \mu\text{g/ml}$ , calcium-alginate perlite matrix showed  $2243 \pm 0.06 \mu\text{g/ml}$  and perlite exhibited  $2109 \pm 0.03 \mu\text{g/ml}$ . Pot trials were also conducted to evaluate growth parameters of *Coriander sativum*. Seven treatments were conducted to evaluate maximum performance. The maximum growth was achieved through T1 (sodium alginate beads) which exhibited root length ( $3.72 \pm 0.07\text{cm}$ ), shoot length ( $7.28 \pm 0.03\text{cm}$ ), shoot dry weight ( $0.157 \pm 0.01\text{g}$ ), root dry weight ( $0.022 \pm 0.06 \text{g}$ ), plant length ( $11.00 \pm 0.04\text{cm}$ ). Other parameters including leaf area ( $4.83 \pm 0.01 \text{cm}^2$ ), no. of leaves/shoot ( $6 \pm 0.69$ ) and no. of branches/ plant (3) also exhibited maximum growth with sodium alginate beads. The findings of this research can play a pivotal role in promoting the acceptance and trustworthiness of bio-fertilizers among farmers, as the prolonged viability and enhanced shelf life will result into more consistent and efficient results in the field.