# ABSTRACT

Essential nutrient for the growth of plant is phosphorus, which have significant role in the metabolism of plant. The present research work was concerned with the isolation, production, optimization and effect of free and immobilized phosphate solubilizing bacteria on plant growth. Isolation was done using two different media such as LB agar medium and tryptic soy agar medium. Distinct colonies were isolated and screened both qualitative and quantitative. Qualitative method of screening was performed by using Pikovskaya agar medium and quantitative method was performed using chlorostannous reduced molybdophosphoric acid blue method. Among all isolates (C7) was found to be very efficient in solubilizing phosphorus. The most potent isolate C7 was identified to be *Micrococcus spp.* through biochemical characterization. Maximum solubilization of P (2.91 ± 0.07 g/L) was obtained when free cells of C7 was used and the optimized conditions with optimum pH value of 7, agitation speed 150 rpm, age of inoculum 24 hours and size of inoculum 3% (v/v). Different traits that promote plant growth were also checked and it was found that C7 exhibit that traits like; production of bio-surfactants, production of amylase, production of indole acetic acid and also have some ability to tolerate heavy metals to some extent. Phosphate solubilization can be done by C7 cells that were immobilized on different types of matrices. At lab level, maximum P solubilization was achieved i.e. 3.54 ± 0.01 g/L by using agar and were applied to pot experiments along with free cells treatments to evaluate their effects on *Mentha piperita* growth.. Plants growth showed obvious difference for free cells as well as immobilized cells. Immobilized cells treatment in pots indicated shoot and root length increase, also increase in roots and shoot's dry weight and plant's growth. However, agar showed maximum plant growth. Results also exhibited that maximum P solubilization and enhanced plant growth was achieved through immobilized cells as compared to free cells.