

Optimization of protective agents for the freeze-drying of *Paenibacillus polymyxa* Kp10 as a potential biofungicide

ABSTRACT

Anthraxnose is a fungal disease causing major losses in crop production. Chemical fungicides widely used in crop plantations to combat fungal infections can be a threat to the environment and humans in the long term. Recently, biofungicides have gained much interest as an alternative to chemical fungicides due to their environmentally friendly nature. Biofungicide products in powder form can be formulated using the freeze-drying technique to provide convenient storage. Protective agent formulation is needed in maintaining the optimal viable cells of biofungicide products. In this study, 8.10 log colony-forming unit (CFU)/mL was the highest cell viability of *Paenibacillus polymyxa* Kp10 at 22 h during incubation. The effects of several selected protective agents on the viability of *P. polymyxa* Kp10 after freeze-drying were studied. Response surface methodology (RSM) was used for optimizing formulation for the protective agents. The combination of lactose (10% w/v), skim milk (20% w/v), and sucrose (27.5% w/v) was found to be suitable for preserving *P. polymyxa* Kp10 during freeze-drying. Further, *P. polymyxa* Kp10 demonstrated the ability to inhibit fungal pathogens, *Colletotrichum truncatum* and *C. gloeosporioides*, at 60.18% and 66.52% of inhibition of radial growth, respectively.

Keyword: Antimicrobial; Antifungal; Biofungicide; Optimization; *Paenibacillus polymyxa*; RSM