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PREPARATION AND CHARACTERIZATION OF ENCAPSULATED *Burkholderia cepacia* UPMB3

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Abstract: Encapsulation is a process of entrapping an active ingredient to shield it from adverse environmental conditions. Encapsulation of biological control agents (BCAs) enables the creation of a microenvironment wherein the viability of the cell can be maintained during storage, controlled release, and easy delivery. This study aimed to develop an optimum formulation involving the encapsulation of *Burkholderia cepacia* UPMB3 in alginate and montmorillonite (MMT) clay to improve physical property of the beads and also enhance the viability and shelf life of B. cepacia UPMB3. Encapsulation technique through extrusion process was used to prepare the *B. cepacia* UPMB3 beads. Alginate was used as carrier while MMT as a filler in order to produce the beads. In liquid form, *B. cepacia* UPMB3 was found to be easily contaminated, and handling and storage were difficult. This research demonstrates a new direction for the formulation of BCAs for improved cell viability, storage, and delivery.

Keywords**:** *Burkholderia cepacia* UPMB3, encapsulation, alginate- montmorillonite, shelf-life

INTRODUCTION

The development of cost effective, user friendly and readily available commercial formulations for beneficial microbes has always been a constraint in sustaining the performance of the BCAs. Formulation of biological control agents for commercial use generally involves the mixing of viable BCAs cells with carrier-based materials in liquid or dry form and nutritional supplements such as glucose to develop fine formulations that not only can stabilize and enhance the growth of BCAs but also convenient for storage and user friendly for field and glasshouse applications.

METHODS

This study reports on the encapsulation of *B. cepacia* UPMB3 in alginate as the matrix and montmorillonite (MMT) clay to improve the viability and shelf life of the bio-agent. MMT is most widely known for its ability to swell. The high water absorption capacity of montmorillonite also makes it very elastic and resistant to fracturing. alginate-MMT was characterized using Fourier Transform Infrared Spectroscopy (FTIR), Thermogravimetric analysis (TGA) and Scanning Electron Microscopy (SEM). The stability of *B. cepacia* UPMB3 in the encapsulated formulation was determined monthly until 7 months.

RESULTS AND DISCUSSION

FTIR results showed the interaction between the functional groups of alginate and MMT in the alginate-MMT beads. TGA analysis showed the incorporation of MMT in alginate-MMT beads increased the thermal stability of the formulations due to the high thermal stability of the MMT and to the interaction between the MMT particles and the alginate matrix**.** SEM analysis revealed homogeneous distribution of the MMT particles throughout the alginate matrix and the smooth surface of the alginate-MMT compare to alginate alone. *B. cepacia* UPM B3 was successfully encapsulated in the alginate-MMT beads. Storage analysis of the encapsulated *B. cepacia* UPM B3 showed that lower storage temperature of 5 °C significantly (P<0.05) gave better storage properties compared to room temperature (30°C).

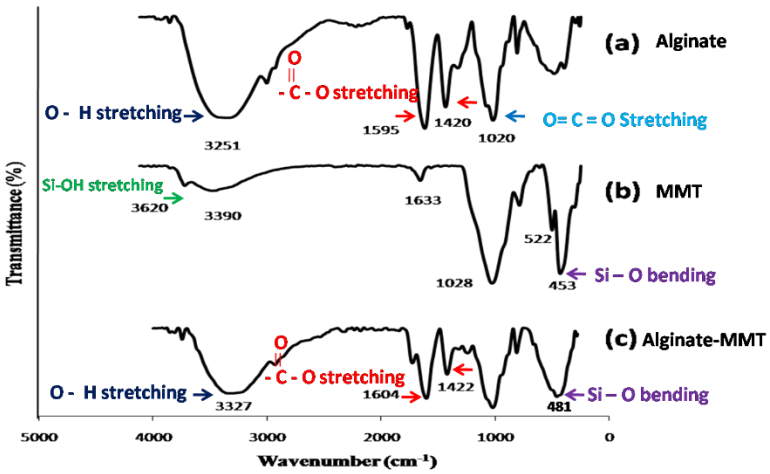

Figure 1: FTIR spectra of the alginate-MMT confirmed the interaction between alginate and MMT.

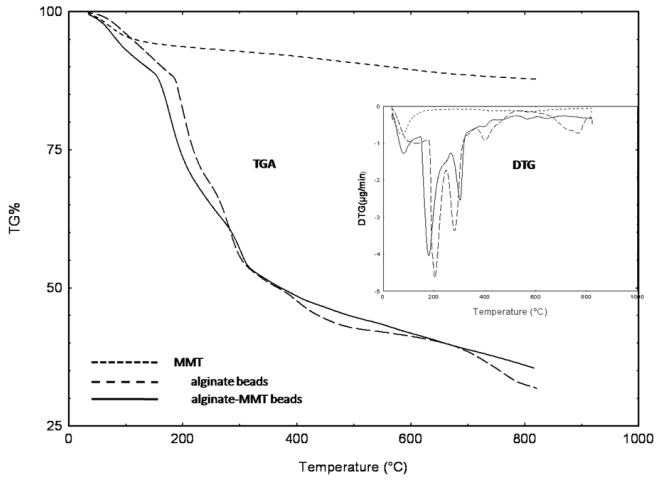

Figure 2: TGA and DTG thermogram of alginate and alginate-MMT beads.

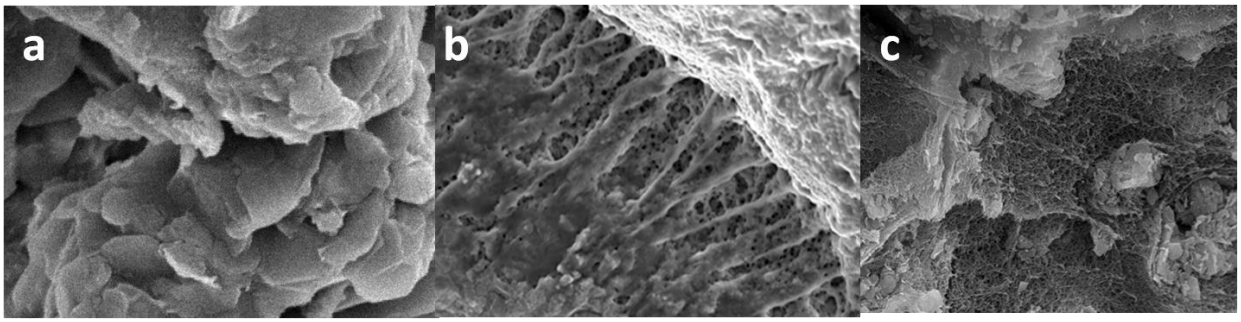

Figure 3: SEM of cross section of (a) alginate beads (b) MMT (c) and alginate-MMT beads.

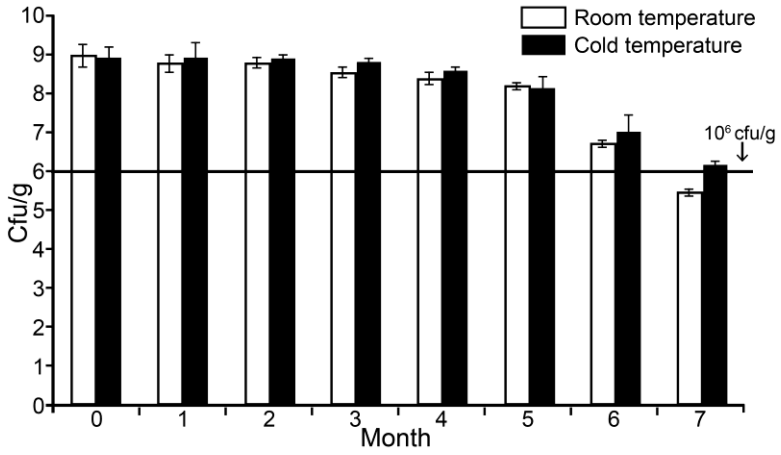

Figure 4: Means values of the viable counts of the cell released from the beads. Points on the graphs with the same letter are not significantly different at P≤0.01.

CONCLUSIONS

This study proposes the use of a combination of alginate and MMT as a suitable matrix for the encapsulation of *B. cepacia* UPMB3 and suggests a novel means of formulating BCA. This formulation can also be potentially used for the storage, delivery, and practical application of other BCAs. In future studies, *B. cepacia* UPMB3 beads will be tested against *S. rolfsii* in a field experiment.

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