P-003 **Controlled-release of linalool through calcium alginate capsules.**

López M.D.[1#], Pascual-Villalobos M.J.[1] and Poncelet D. [2 *]
[1] IMIDA, c/Mayor s/n, La Alberca, 30150, Murcia, Spain
[2] ONIRIS, rue de la géraudière, 44322 Nantes cedex 3, France
* denis.poncelet@bioencapsulation.net

INTRODUCTION AND OBJECTIVES

Due to restrictions in agrochemical use to control pests, new alternatives are growing in the field of agriculture such as phytochemicals, pheromones, biological control or heat treatments. Derived compounds such as monoterpenoids or phenylpropanoids have been proved to be effective insecticides against some pests (Pascual-Villalobos 2003).

It is demonstrated (López 2008) that some monoterpenoids such as linalool could be an alternative to synthetic insecticides against some pests. However, applications and handling of this volatile compound turn out to be particularly complicated due to their chemical and physical properties that involve low stability, high evaporation and losses.

Encapsulating these compounds into an inert matrix could provide protection from degradation and could prevent volatilization or leaching losses (Riggle 1990). Therefore, the aim of this work was to trap linalool inside alginate microcapsules and study the controlled-release of this chemical through calcium alginate membrane using two methods of encapsulation.

MATERIALS AND METHODS

Chemicals Linalool (97 %) was obtained from Sigma-Aldrich and was selected as the core material.
Algogel 3001 (sodium alginate powder, MW= 151,200 Dalton, M/G ratio=0.64) was purchased from Panreac Quimica Sau (Panreac art n° 131232, Spain). Sunflower oil of commercial grade was obtained from Associated Oil Packers, France.
Chitosan low viscous (n° 50494) was purchased from Sigma Aldrich.
Solvents and surfactants were of analytical grade.

Encapsulation of Linalool Two methods (A and B) were employed to prepare linalool/alginate microcapsules. A-method was developed from one solution containing linalool (100 ml) and sunflower oil (100 ml) forming an emulsion with calcium chloride (40 g/l) and surfactants (1.72 ml of SPAN85 and 2.28 ml of TWEEN85). This blend was dropped through the multineedle dispensing nozzles (eight helical-tread tapered tips) in sodium alginate solution (10 g/l) containing 1.75 ml of TWEEN85. The alginate solution was continuous stirring at 350 rpm to avoid agglomerations and the dropping time of the droplets was 15 minutes. Next, the capsules were filtered and washed with distilled water and finally were allowed to air-dry at room temperature overnight in order to reach its equilibrium moisture content (Figure 1). Capsules obtained by this method using 0.38 mm and 0.25 mm internal diameter of tips were called A1 and A2 respectively.

On the other hand, B-method was carried out preparing an emulsion consisting of alginate (10 g/l), linalool (100 ml), sunflower oil (100 ml) and surfactants (1.72 ml of SPAN85 and 2.28 ml of TWEEN85). This blend was added in a solution of chitosan (20 g/l) and acetic acid 1% at pH= 4 with continuous stirring. Beads achieved by B-method using 0,38 mm of internal diameter of tip, were called B. The assay was developed as previous one and the beads were filtered and finally were dried overnight at room temperature (Figure 2).

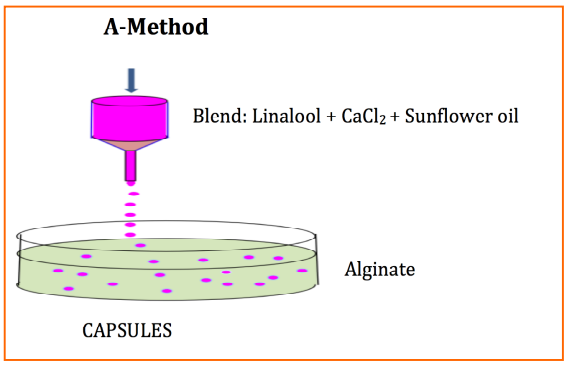


Figure 1: Scheme of A-Method

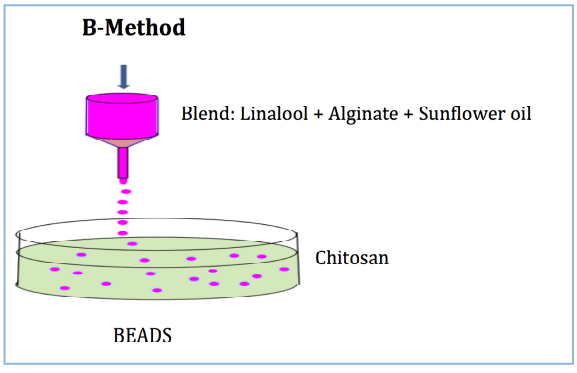
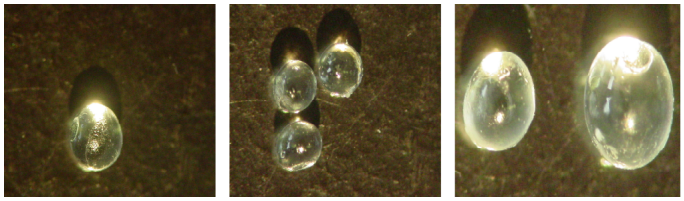


Figure 2: Scheme of B-Method

Study of controlled-release of linalool 1g of sample was placed onto a Petri dishes without sealing. These Petri dishes were maintained into the chamber at 25 °C and weight loss was monitored in an analytical balance at intervals of 1, 2, 4, 8, 24, 48, 72, 168 and 336 hours. Three replications were carried out.

RESULTS AND DISCUSSION

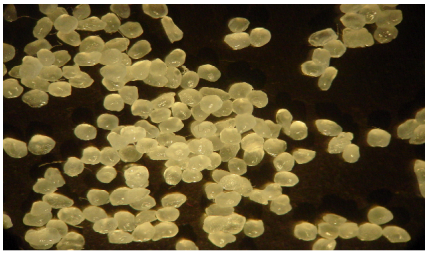
Linalool was encapsulated by two methods (A and B). With A-method we achieved the diameter of capsules in function of internal diameter of tips, ranging from 1.8 mm to 2.2 mm (Figure 3).



A1 A2 A2 and A1

Figure 3. Capsules from A-method using 0.38 mm and 0.25 mm of internal diameter of tips.

To B-method, we obtained beads with 1.8 mm of diameter using 0.38 mm of internal diameter of tip (Figure 4).



B

Figure 4. Beads from B-method using 0.38 mm of internal diameter of tip.

To study the controlled-release the weight of sample was measured over intervals of time. This study let us know indirectly the quantity of linalool encapsulated.

As shown on figure 5, A1 and A2 (A-method using 0.38 mm and 0.25 mm of internal diameter of tips respectively) showed a quick drop from 1 h until 8 h indicating a high release at the beginning. After that, weight of sample continued to decrease slowly for 2 weeks (336 h) releasing all the linalool into the capsules.

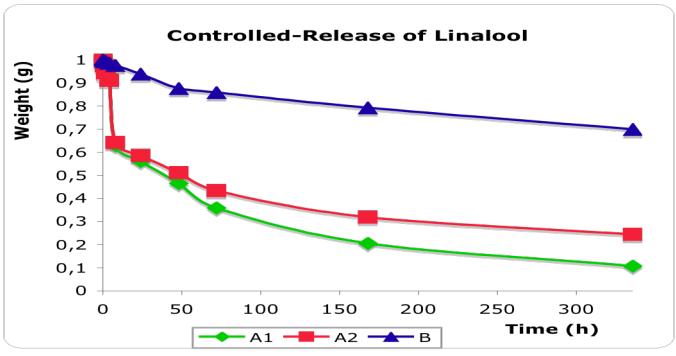


Figure 5. Controlled-release of linalool for A-method (A1 and A2) and B-method (B).

To B-method (B on figure 5), we observed a slowly liberation for two weeks representing that a great amount of linalool has not been released yet and it would be necessary to check the weight for time longer.

Comparing these two methods, the encapsulation of linalool turned out to be more adequate for B-method since beads released this chemical more slowly. Nevertheless A-method showed a significant weight loss during 2 weeks because of alginate membrane contains an elevated porosity allowing the release of linalool easily.
Among the different tips used on the A-method, 0.38 mm seemed slightly better than 0.25 mm. In this study, parameters as tips did not turn out to be an essential point to take into account. However other factors as porosity or cross linkers were more remarkable.
(Stipanovic 2004) worked on coating with several polymer substrates and they also established porosity and coating composition as the most significant factors that defined the release rate on a study from micrometer-sized controlled-release particles focusing on the sex pheromones.
Different factors could influence on encapsulation of linalool with alginate and controlled-released and they have to be established to study this subject in depth.

CONCLUSIONS

The results obtained in the current work, point out that encapsulation of linalool depends on the method used. In fact, the presence of cross-linkers such as chitosan, make beads entrap more amount of this compound.

Comparing the controlled-release between A-method and B-method, linalool is released much more slowly using a cross-linker as chitosan (B-method) since alginate membrane (A-method) presents a high porosity.

These results prove the relevance of selecting suitable methods to encapsulate linalool and the importance of these methods on controlled-release.

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