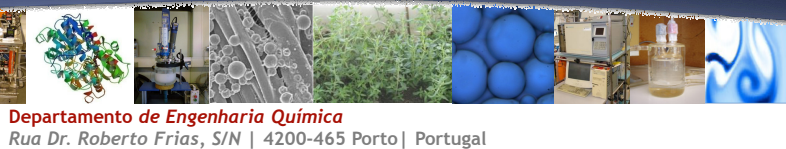


Release studies of essential oil of *Thymus vulgaris* L. from PLA microcapsules

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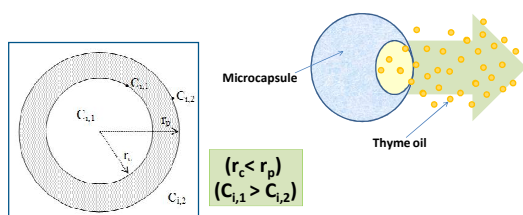


Introduction / Objectives

The incorporation of essential oils, perfumes, deodorants and other active agents in microcapsules to provide controlled release over a certain period of time is being a topic of extensive research in recent years [1-2].

Controlled release systems are used to deliver compounds such as drugs, pesticides, fragrances or flavours at prescribed rates, together with improved efficiency, safety and convenience [3].

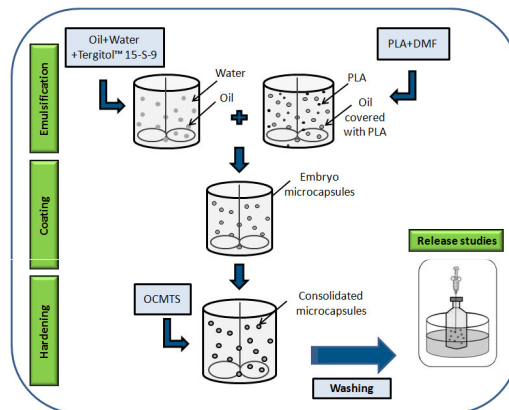
The aim of this work is to study the release of *Thymus vulgaris* L. essential oil (thyme oil) during the first days of release in solution and develop a general diffusion model to predict mass transport phenomena.



Schematic representation of a microcapsule.

Materials and Methods

The used PLA-based biodegradable polymer microcapsules have been prepared by a coacervation technique as described elsewhere [4,5]. The release studies have been performed using the microcapsules in solution medium and calculated and experimental diffusion profiles of the essential oil across the polymer membrane, compared. Experimental release profile was determined as the sum of the individual components profiles.



Process steps for microencapsulation of thyme oil

Analytical Model / Results

Analytical model of thyme oil release

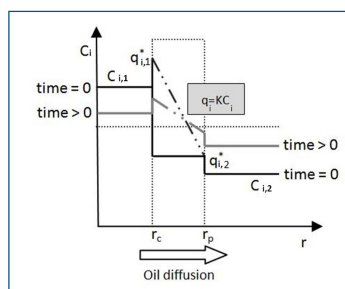
The type of microcapsules considered in this study can be described as liquid core (essential oil of thyme) coated with a permeable membrane (polymer).

Percentage of oil release

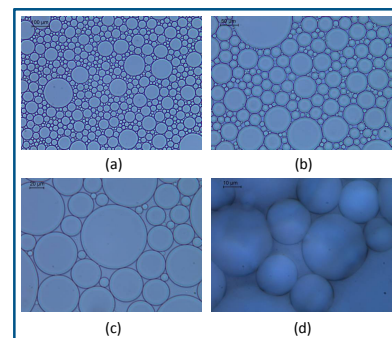
	Release (%)		
	initial	1 day	5 days
γ -Terpinene	27.2	31.4	35.9
<i>p</i> -Cymene	19.7	22.1	25.0
Linalool*	97.9	—	—
Thymol	66.7	81.9	93.2
Carvacrol	66.1	82.0	92.6
Total	46.5	55.4	63.1

* The release of linalool was not followed since, at time zero, almost all of the encapsulated component was already in the surrounding solution.

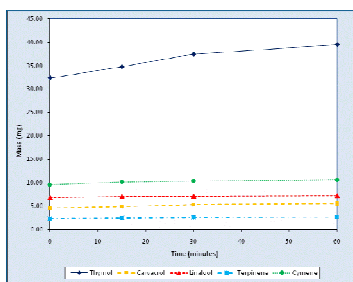
Thyme oil concentration profile:



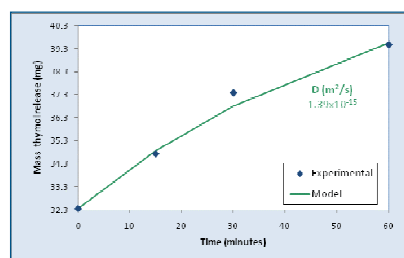
Optical microscopy of PLA microcapsules



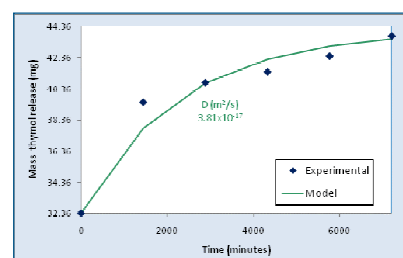
Magnification of images: (a)100x; (b)200x; (c)400x and (d)1000x.



Experimental data of individual thyme oil components release.



(a)



(b)

Comparison between experimental and theoretical release profiles obtained in the first hour (a) and during 5 days

(b).

Conclusions

- Microcapsules size distribution was bimodal in volume and unimodal (quite narrow distribution) in number. The average size was 36 μ m.
- Analysis by MOP revealed spherical particles with absence of agglomerates and allowed to estimate the wall thickness around 2 μ m.
- PLA microcapsules showed a higher encapsulation efficiency for the apolar compounds of thyme oil. Furthermore a higher rate of release was detected for the polar ones. This difference in the release of the oil is due to the lipophilic solubility of oil compounds.
- The quite small diffusion coefficients values obtained in this work may be interpreted in terms of the very dense polymer membrane, which may constitute a significant impeditive effect.

References

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