The potential of dendrimers to encapsulate essential oils

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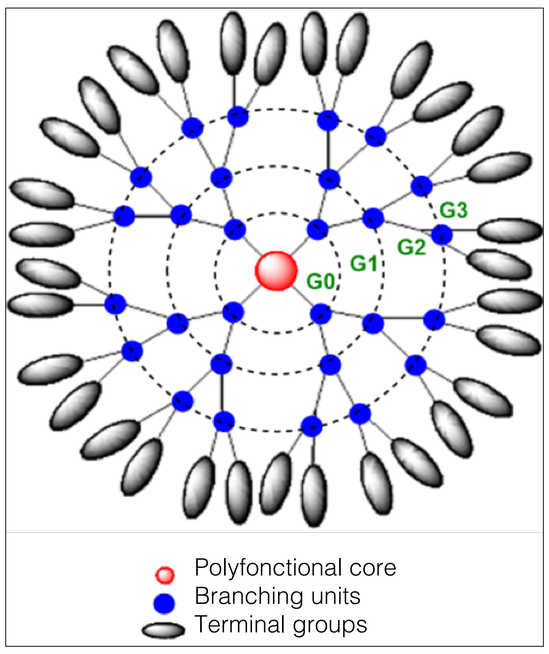
Introduction

Dendrimer structure



Context

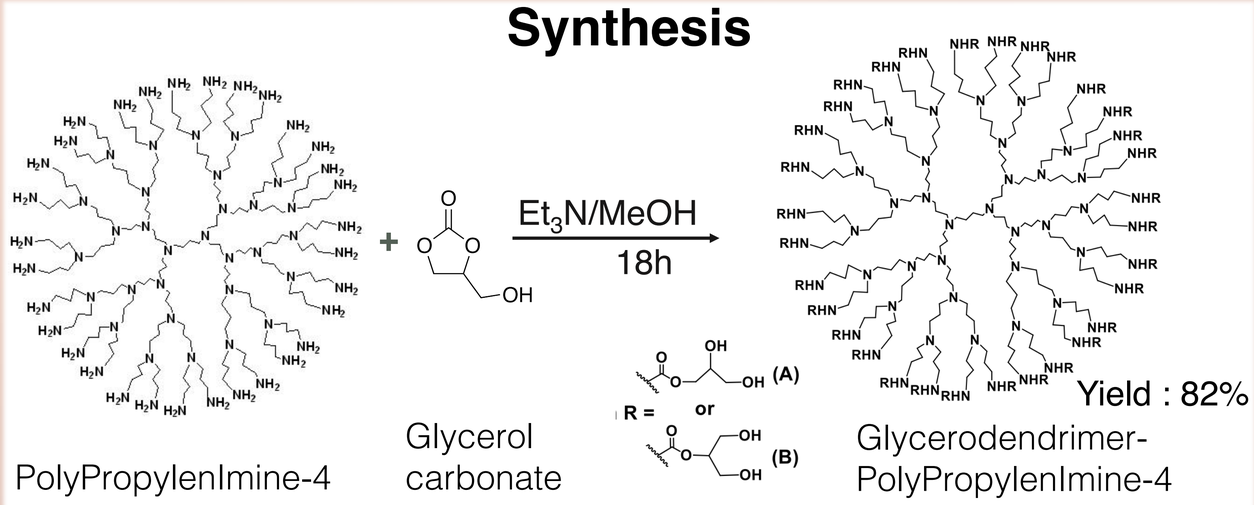
The risks coming from the use of pesticides are one of the major controversies these days. Indeed, more and more environmental and public health problems are detected following the use of these products[1]. Essential oils are prime candidates to create ecological alternatives. However, the high volatility of these compounds induces the needing to encapsulate these.
Following this, a certain number of encapsulation techniques have already been performed, but the gradual release time necessary for the proper functioning of a plant protection product has not yet been optimized. This is where our work begins. The innovative encapsulation of essential oils is realized using dendrimers, which are macromolecules with a tree structure, which gives them an encapsulation capacity. In addition, the specimens used contain a substitute of natural origin: glycerol.

Objectives

In a first step, the encapsulation capacity of different dendrimers was studied. Then, the optimal conditions of the reaction and a complete analysis of the interactions between the dendrimers and the essential oils will be carried out. In a second step, a study of the release of each system will be performed to create an effective biological pesticide.

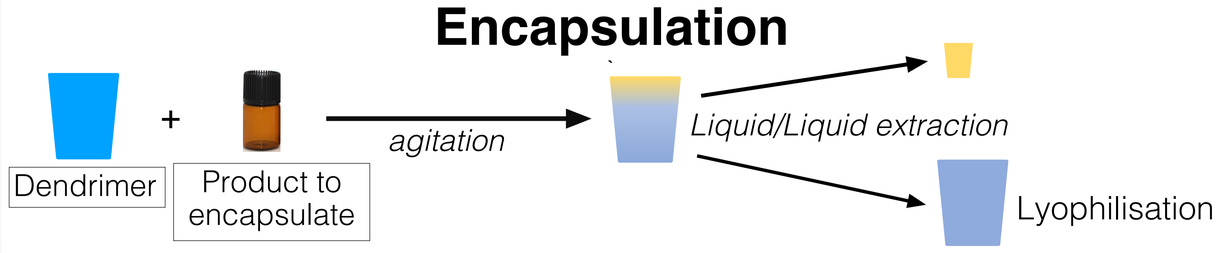
Results

Synthesis



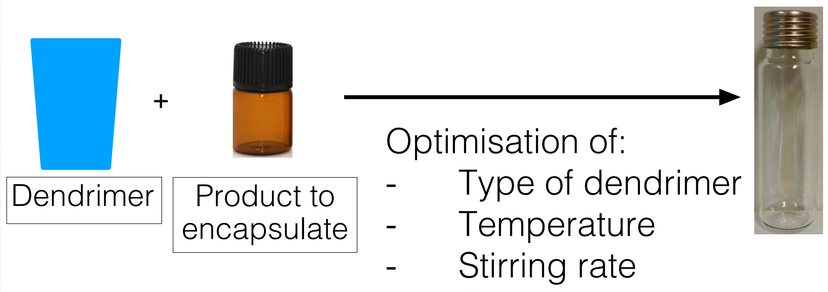
PolyPropylenImine-4 — Glycerol carbonate — Glycerodendrimer-PolyPropylenImine-4

Encapsulation



Dendrimer	Encapsulated product	Yield
GD-PPI-4	**β-estradiol**	62,66 %[3]
GD-PPI-4	**Atrazin**	62,47 %[3]
GD-PPI-4	**Diuron**	58,65 %[3]
GD-PPI-4	**Diclofenac sodium salt**	36,41 %[3]
GD-PPI-4	**Gadopentetate dimeglumine**	36,32 %[4]
GD-PPI-4	**Citronella essential oil**	18,27 %
GD-PAMAM-3	**β-estradiol**	72,03 %[3]
GD-PAMAM-3	**Diuron**	61,39 %[3]
GD-PAMAM-3	**Atrazin**	60 %[3]
GD-PAMAM-3	**Diclofenac sodium salt**	23,63 %[3]
GD-PAMAM-3	**Citronella essential oil**	16,32 %

Perspective: DHS-GC-MS Analysis



1. Yield of total retention[2]
$$r(\%) = \left(1 - \frac{\sum A_D}{\sum A_0}\right) x100$$
A_D = Area with dendrimers
A_0 = Area without dendrimers

2. Retention yield of the essential oil's majors compounds (external calibration)

Conclusion.

This study shows that essential oil encapsulation by dendrimers is possible and need to be optimized. A very precise analytic method of dynamic headspace gas chromatography with mass spectroscopy will be used to precisely optimize parameters of the encapsulation of different type of dendrimers.

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