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PREPARATION AND NMR CHARACTERIZATION OF POLYETHYL – 2 – CYANOACRYLATE NANOCAPSULES

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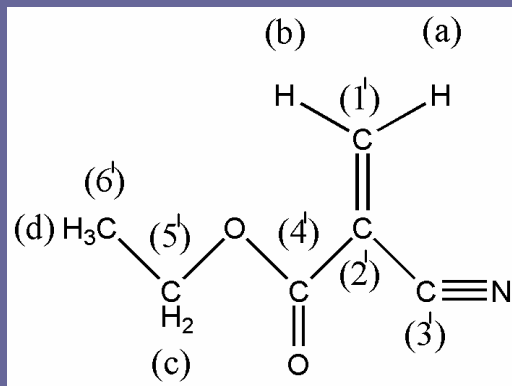
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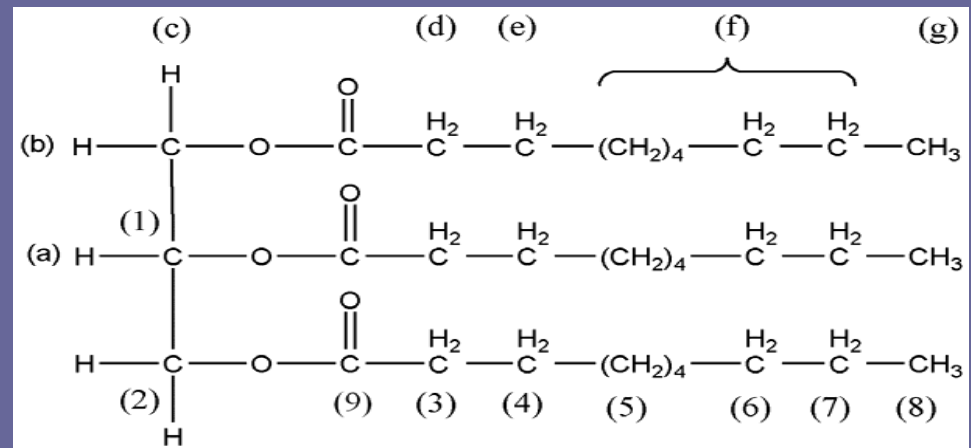
Aim of the work

The aim of this work was to prepare biodegradable nanocapsules by interfacial polymerization of ethyl – 2 – cyanoacrylate and to characterize them by NMR, SEM and DLS.

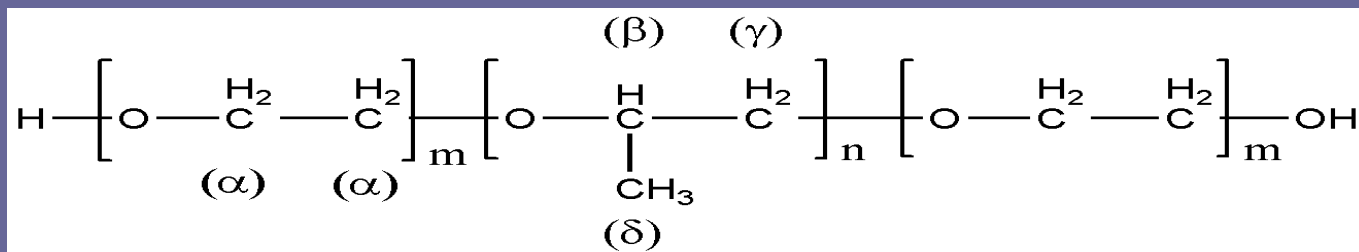
Materials



Ethyl – 2 – cyanoacrylate



Miglyol 812



Pluronic F68

Preparation of nanocapsules

Nanocapsules were prepared by the method of Al Khouri Fallouh [1], with slight modifications. In principle, the method consisted of mixing two immiscible phases (organic and aqueous). The organic phase consist in an oil (4 – 12% miglyol 812) and the polymerizing monomer (0.5% ethyl – 2 – cyanoacrylate) dissolved in an organic solvent (acetone), totally miscible with water. The aqueous phase consisted of a solution of 0.5% nonionic surfactant (Pluronic F68). The organic solution was slowly added in a 1:2 ratio to the aqueous phase, under magnetic agitation (600 rpm), at a flow rate of 0.5 ml / min. Polymerization occurred immediately at the oil / water interface of the miglyol 812 droplets. The colloidal suspension was then concentrated under reduced pressure, allowing the organic solvent and part of the water to evaporate off. The final volume of nanocapsule suspension was filtered through a sintered glass filter (9 - 15µm). Finally the suspension was frozen at –55oC and freeze – dried under 0.02 mbar vacuum for 24h.

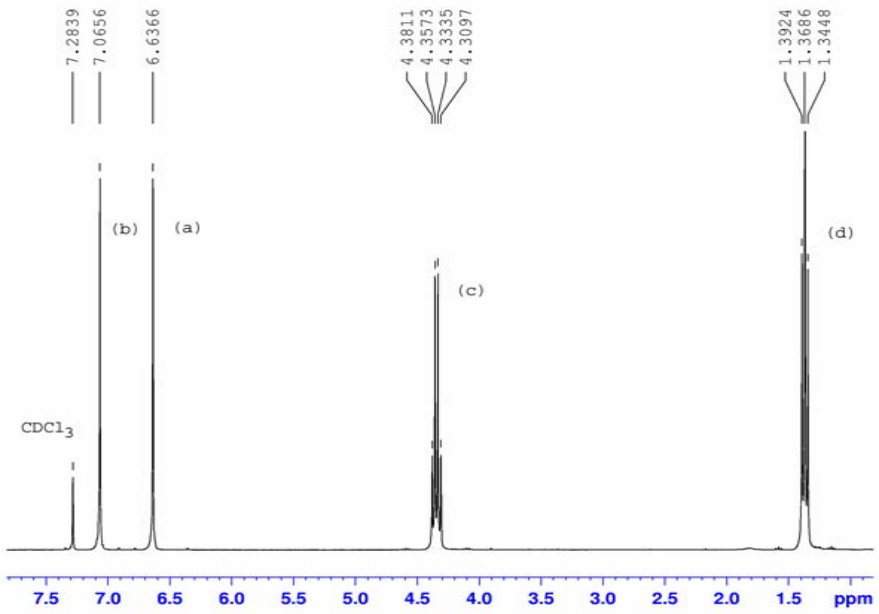
[1] N. Al. Khouri Fallouh, L. Roblot – Treupel, H. Fessi, J. Ph. Devissaguet, F. Puisieux, *Int. J. Pharm.* 28, 125 – 132 (1986)

Nanocapsule Characterization

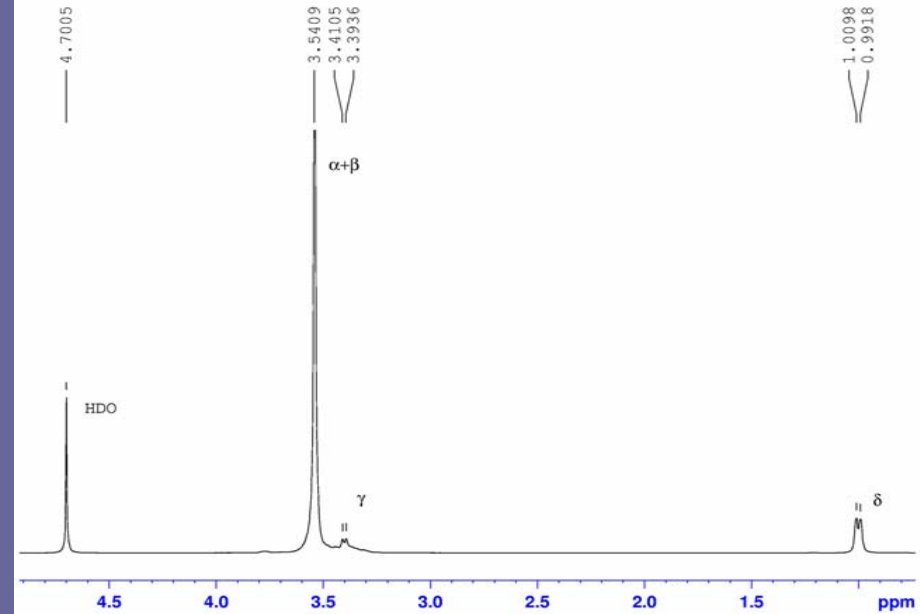
^1H NMR Spectra

^{13}C NMR Spectra

Spectral width	4.5 KHz	15 KHz
Data points	64 K	64 K
Pulse width (45°)	5 μsec	8 μsec
Frequency	300 MHz	75.45 MHz
Transients	64	8000
Repetition time	5 sec	7 sec

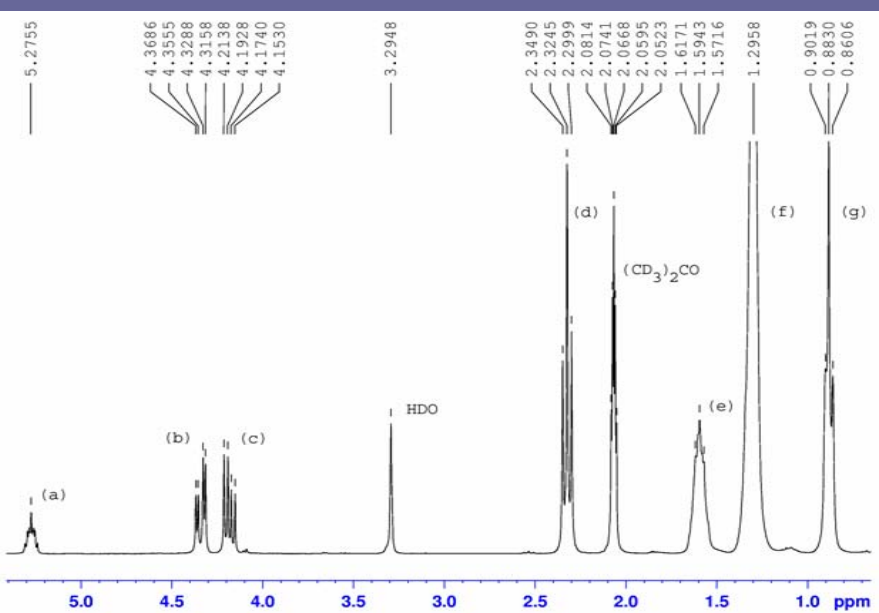


Ethyl – 2 – cyanoacrylate

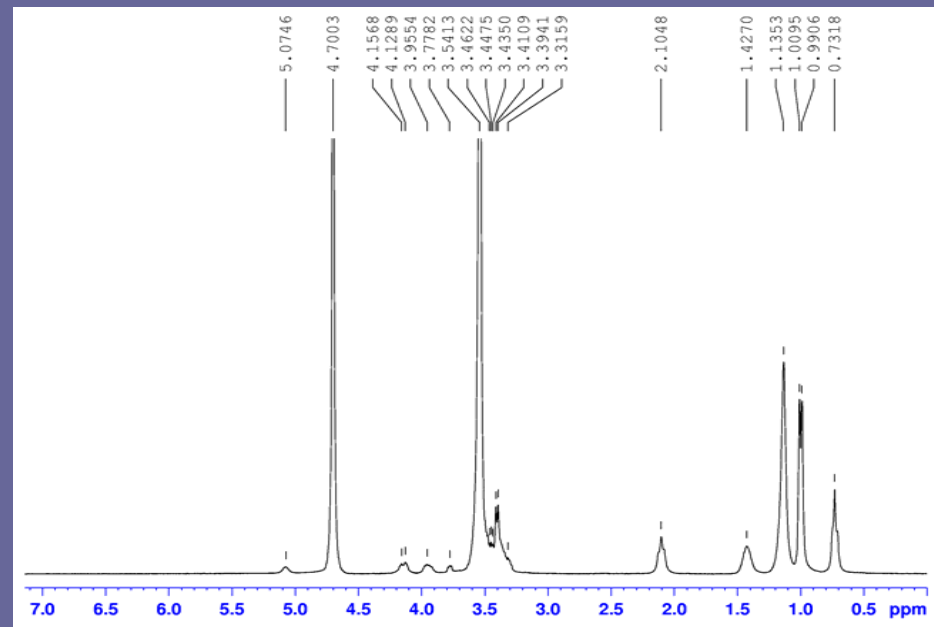


Pluronic F 68

¹H - NMR

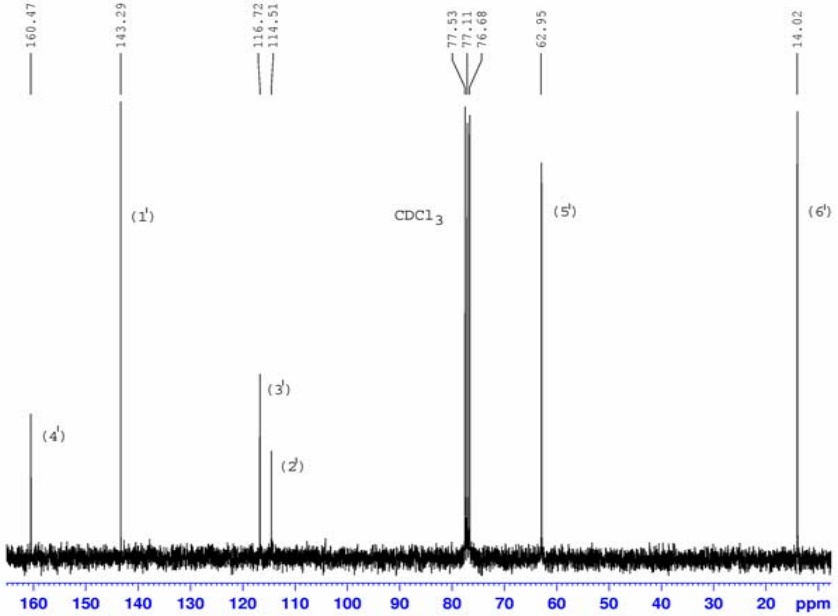


Miglyol 812

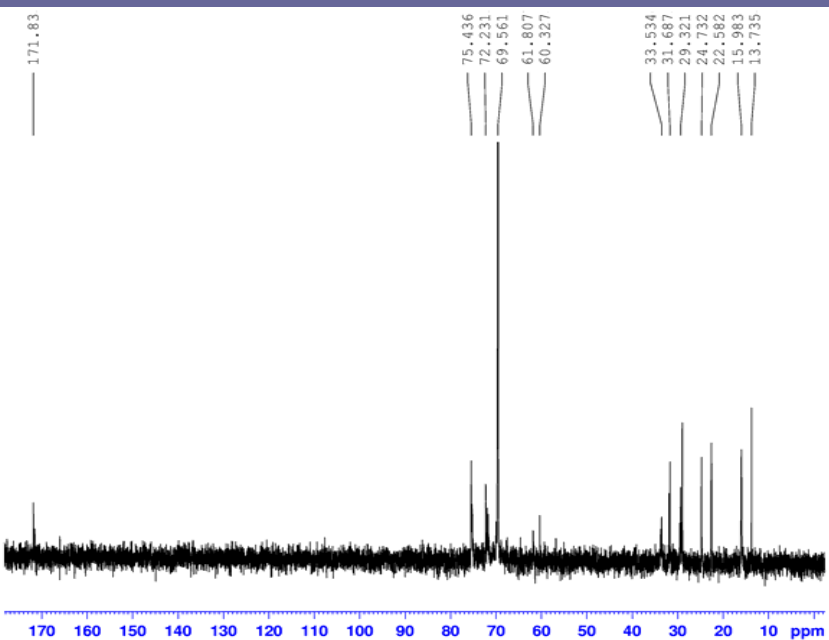


Nanocapsules

¹³C chemical shift data for investigated compounds



Ethyl – 2 – cyanoacrylate

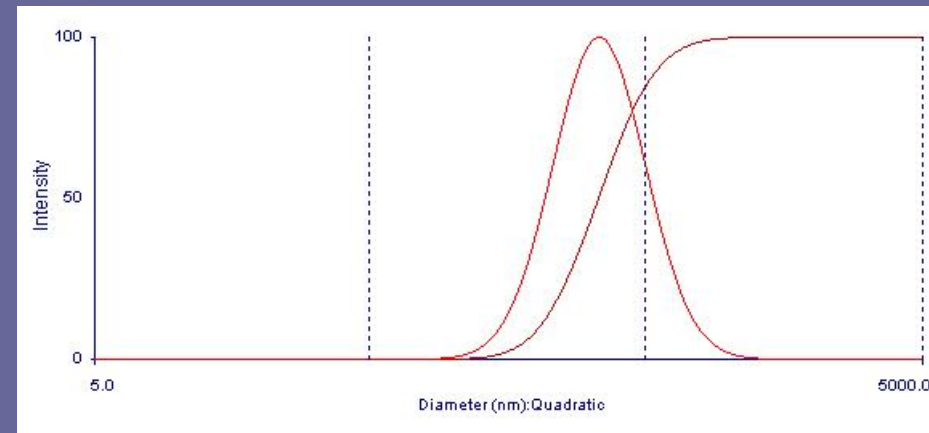
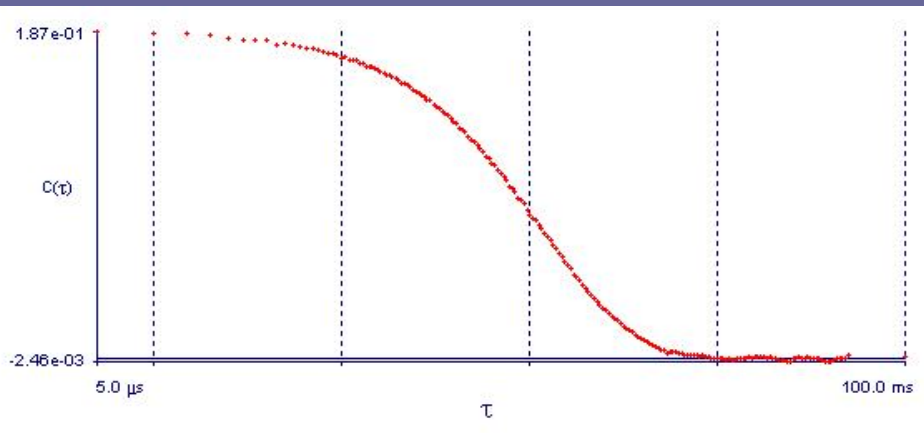


Nanocapsules

Substance C ¹³ Nucleus	δ (ppm)			
	Miglyol 812	Pluronic F68	Ethyl-2-cyanoacrylate	Nanocapsule
1	69.02			69.57
2	61.90			60.34
3	33.60			33.55
4	24.73			24.75
5	28.84			29.01
6	31.66			31.70
7	22.45			22.55
8	13.51			13.76
9	172.65			171.83
α		69.5		69.57
β		75.4		75.45
γ		71.9		72.24
δ		15.9		16.02
1'			143.3	-
2'			114.5	-
3'			116.7	-
4'			160.5	-
5'			62.9	61.8
6'			14.0	-

Particle size and polydispersity

The particle size, size distribution and polydispersity were determined by dynamic light scattering, analysing the polarised scattered light at 90° in diluted samples. Measurements were made at room temperature using a Brookhaven Instruments standard setup. A coherent He – Ne laser (5 mW, $\lambda_0 = 632.8$ nm) was used as light source.



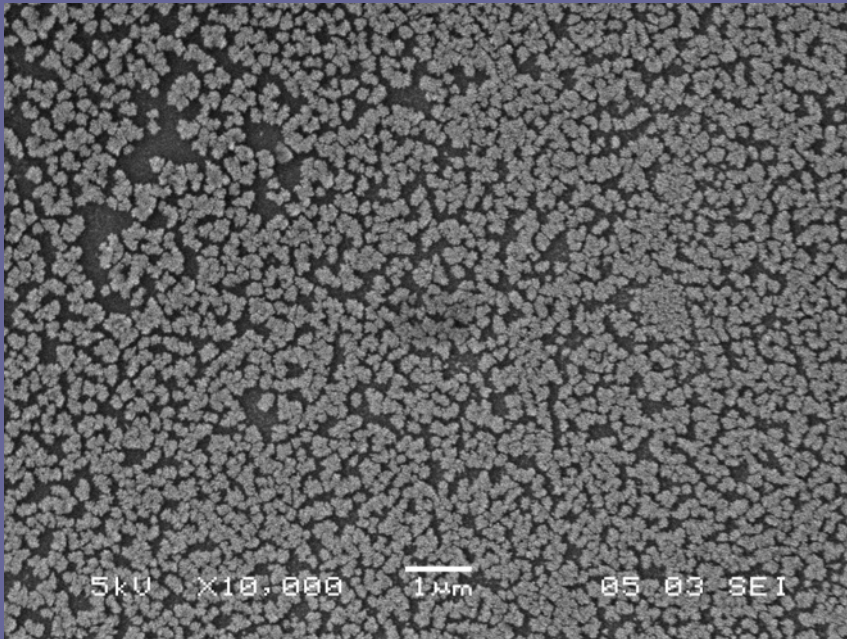
Size distribution of PECA nanocapsules determined by DLS

$D_{\text{eff}} = 338.5 \text{ nm}$
 $\text{P.I.} = 0.158$

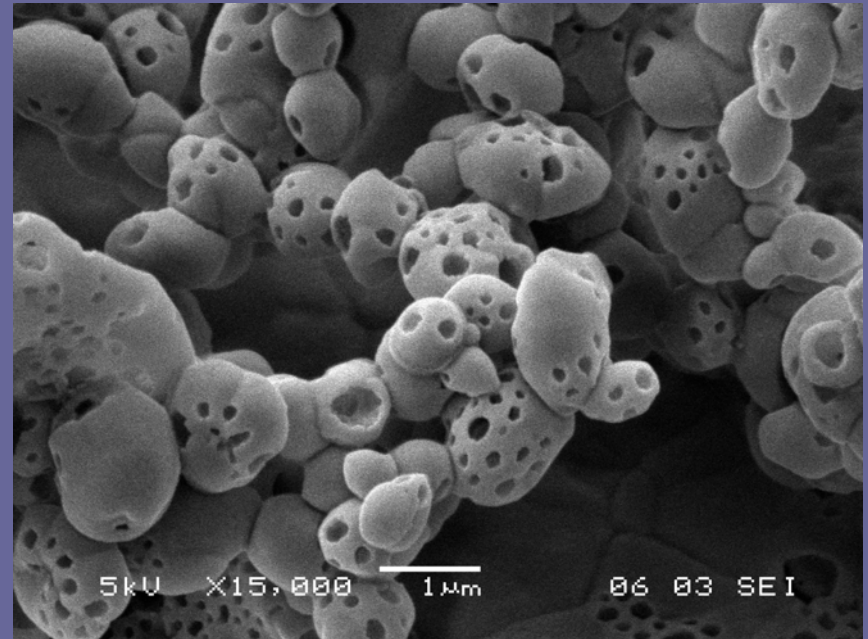
Miglyol (%)	D (nm)	PI
4	286.5	0.146
8	338.5	0.158
12	397.7	0.142

Size of PECA nanocapsules as a function of Miglyol concentration

Scanning electron micrographs of nanocapsules produced by interfacial polymerization



a) Liophilized nanocapsules with 5% sucrose



b) Liophilized nanocapsules

Aknowledgements

This work was financed in the frame of a CEEEX – MATNANTECH 58/2006 project.