TOPICAL DRUG DELIVERY SYSTEMS INCLUDED IN POLOXAMER 407 GEL: RHEOLOGICAL CHARACTERIZATION AND RELEASE STUDIES OF MODEL DRUG

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University «Magna Graecia» of Catanzaro

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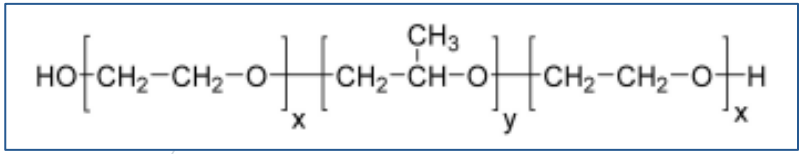
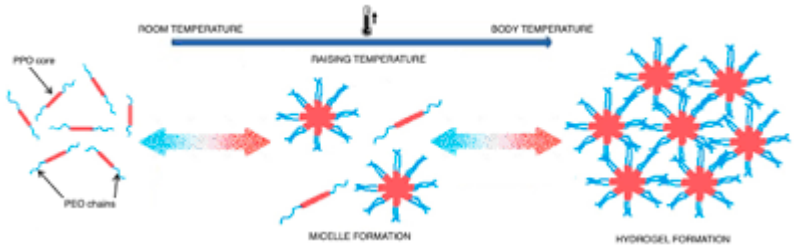
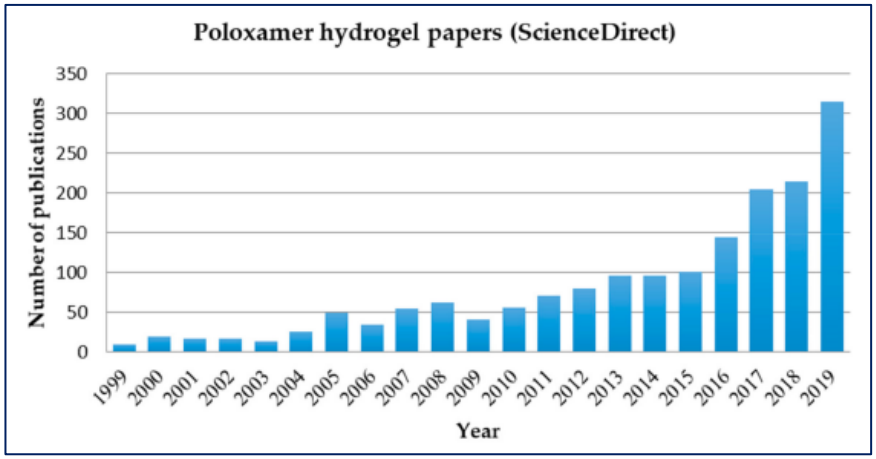
POLOXAMER P407







Poloxamer P407 Solution

ΔT (°C)

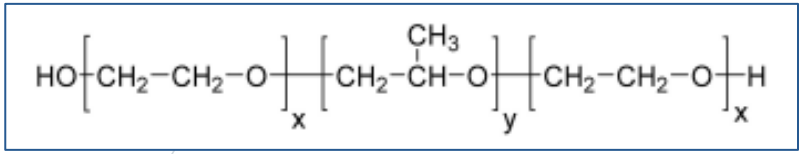
Poloxamer P407 Gel

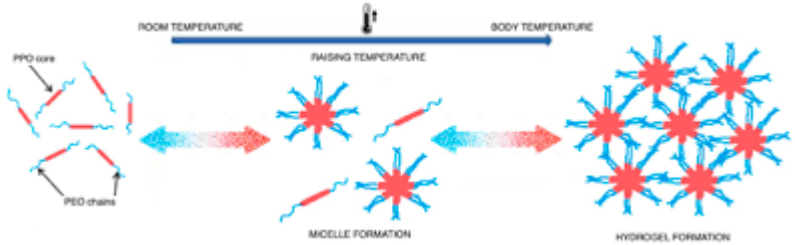
- Thermosensitive
- Reversible sol-gel transition
- Approved by FDA (safe, non-toxic, non-irritant)

- Emulsifier
- Stabilizer
- Drug delivery systems
- Oral, nasal, parenteral and topical administred
- Tissue engineering

Russo et al., Pharmaceutics 2019, 11, 671

POLOXAMER P407





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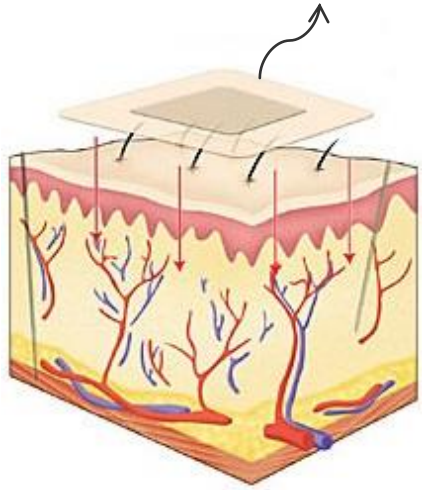

Non-occlusive Behaviour

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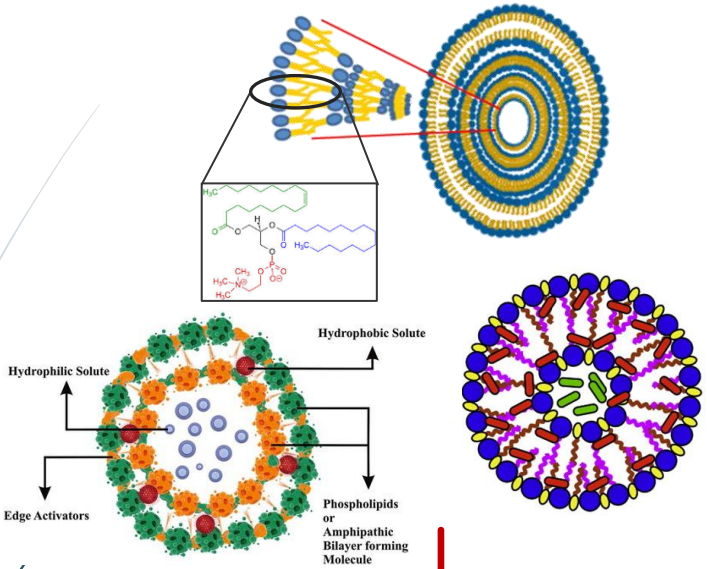
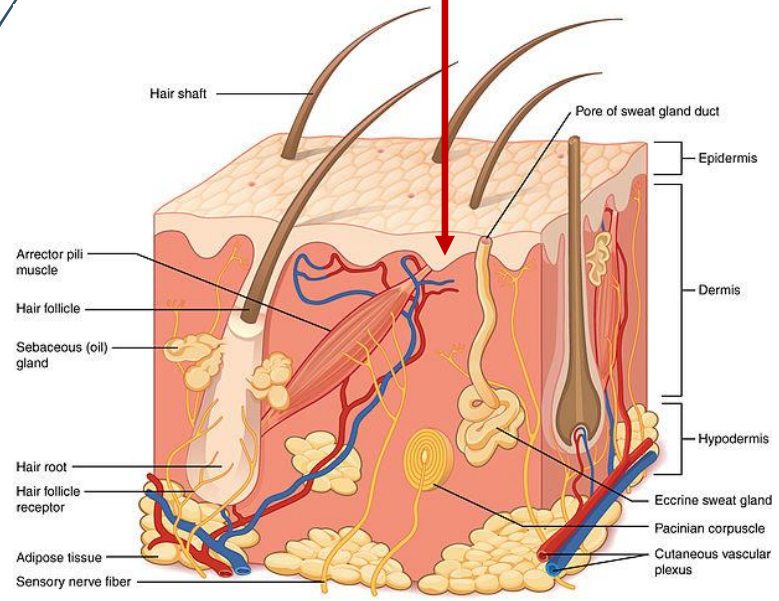
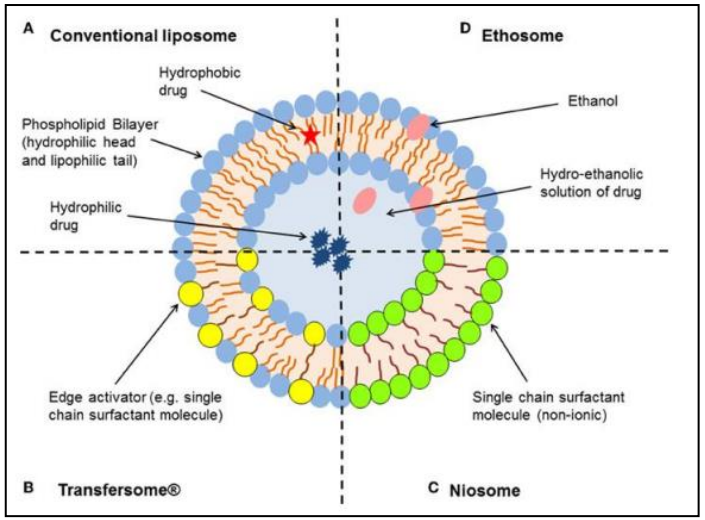
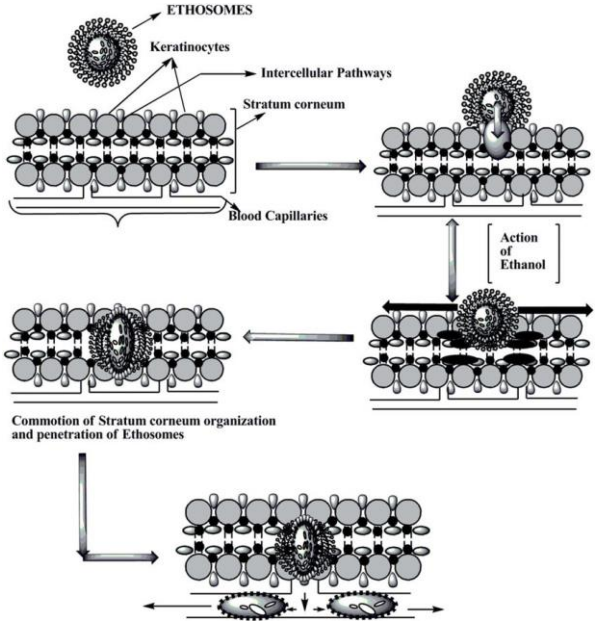
TOPICAL DRUG DELIVERY SYSTEMS



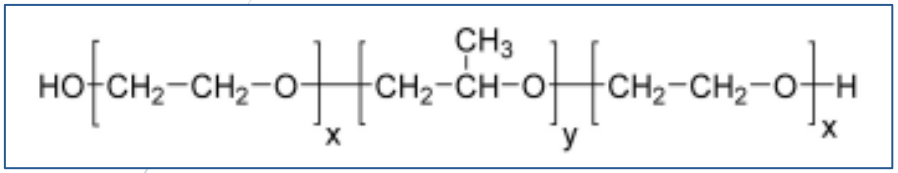


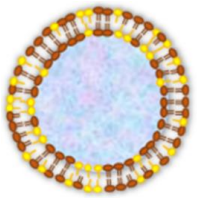


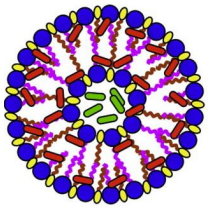


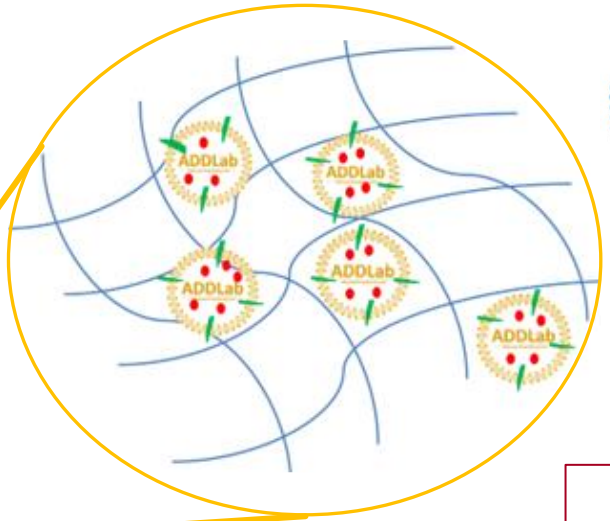
Pandey et al., Drug Delivery, 22(8)

AIM OF WORK (1)







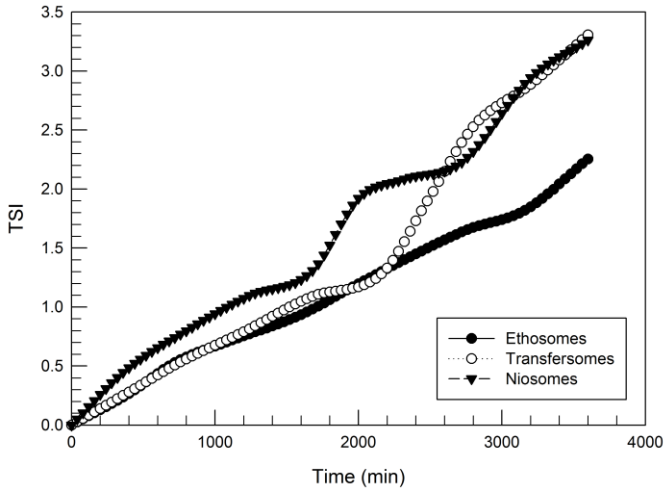


Cristiano, M.C. et al. Molecules 2020, 25, 1979

RESULTS (1)

Table 1. Physico-chemical parameters of drug delivery systems obtained by use Zetasizer Nano ZS. Values are reported as the average of three independent experiments ± standard deviation.

Sample	Mean Size (nm)	Polydispersity Index	Zeta-Potential (mV)
Ethosomes	200.00 ± 4.43	0.16 ± 0.01	−15.20 ± 0.38
Transferosomes	187.90 ± 1.87	0.24 ± 0.01	−29.50 ± 0.59
Niosomes	123.50 ± 1.01	0.22 ± 0.01	−26.00 ± 0.35



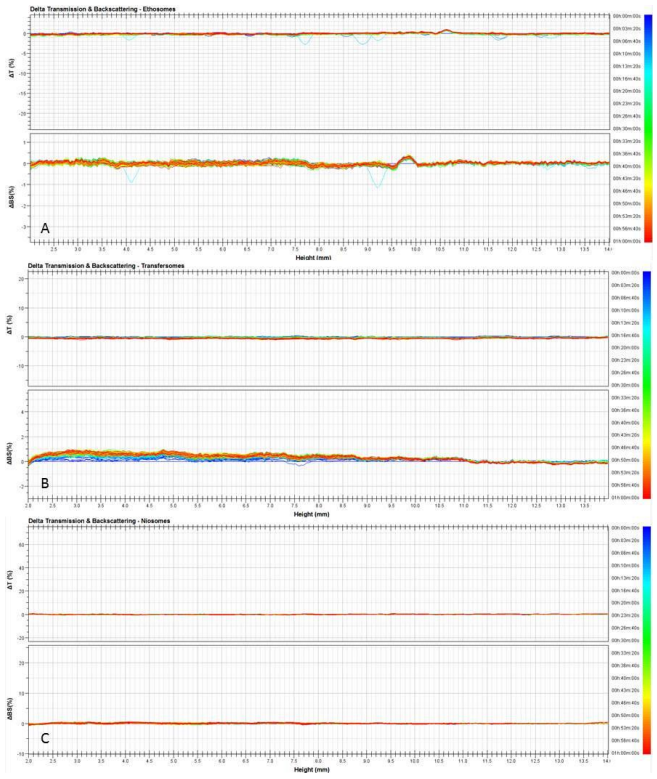
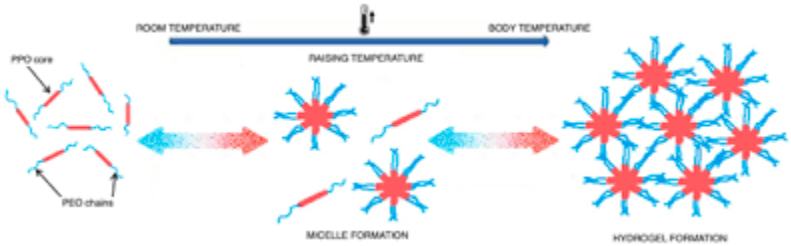
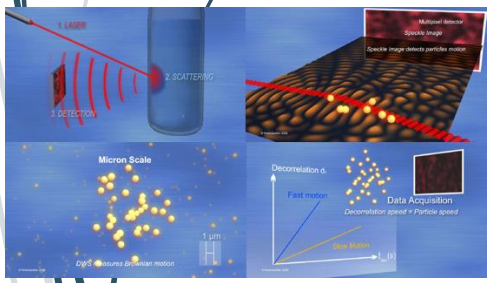


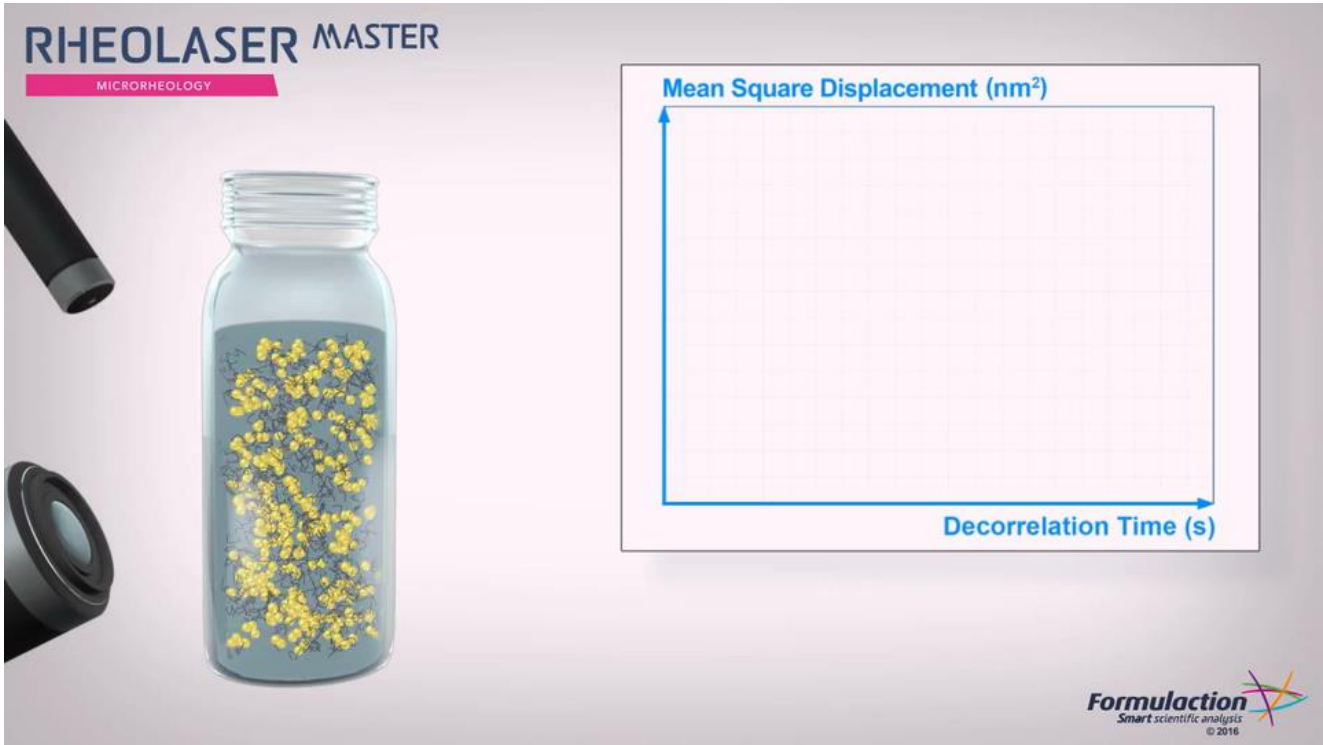
Table 2. Gelation temperature of Poloxamer 407 solutions. Each value represents the mean ± S.D. of three experiments.

Poloxamer 407 concentration (%, w/w)	Gelation temperature (°C)
15	37 ± 0.5
17	36 ± 0.5
20	21 ± 0.2
25	< 20
30	< 20

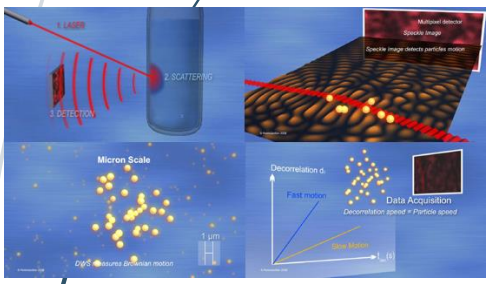
RHEOLASER MASTER AND DIFFUSION WAVE SPECTROSCOPY







RESULTS (2)



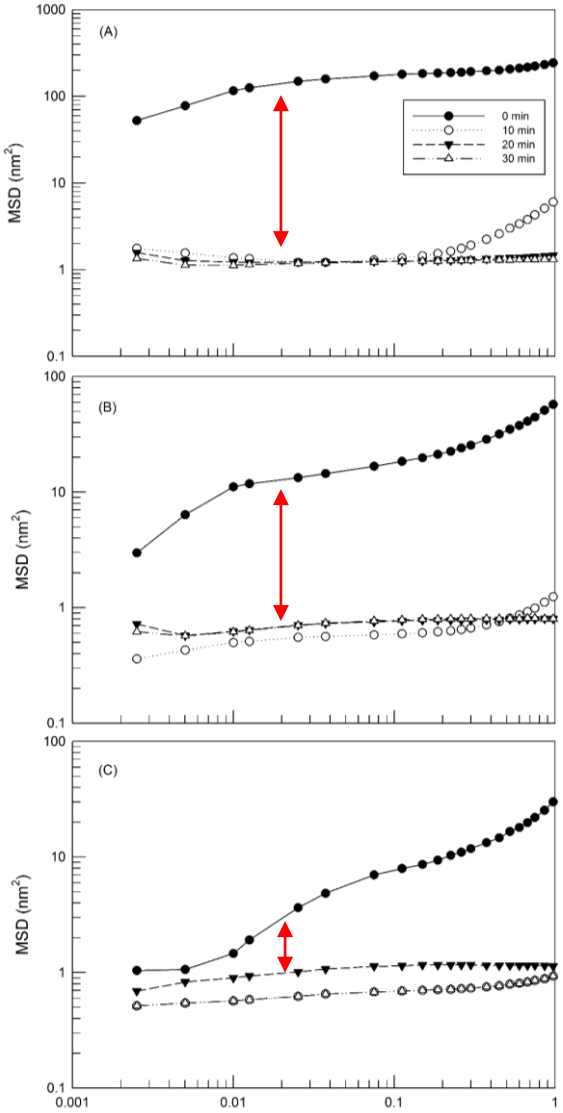


Figure 3. Mean square displacement MSD of hydrogel prepared with different concentrations of poloxamer 407: 20% (*w*/*w*) (**A**), 25% (*w*/*w*) (**B**) and 30% (*w*/*w*) (**C**), as a function of decorrelation time. The illustrated results were representative of three independent experiments.

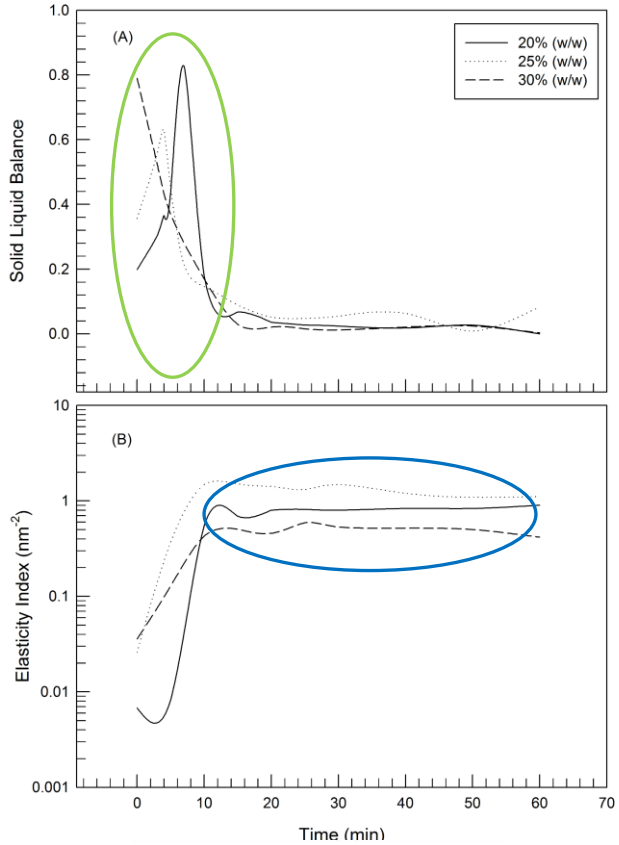


Figure 4. Elasticity Index (EI) (**A**) and Solid Liquid Balance (**B**) profiles versus time for 20% poloxamer 407, 25% poloxamer 407 and 30% poloxamer 407 samples.

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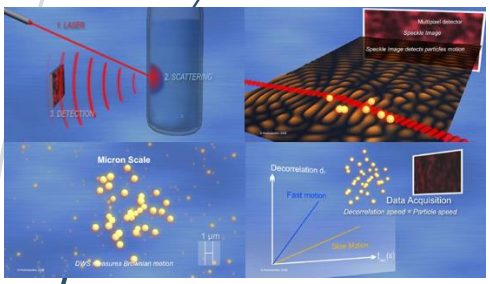
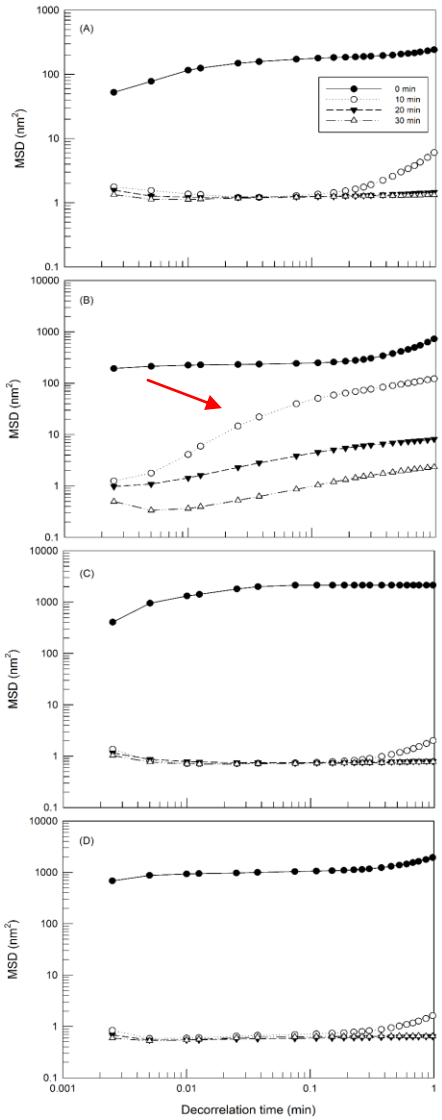
RESULTS (3)





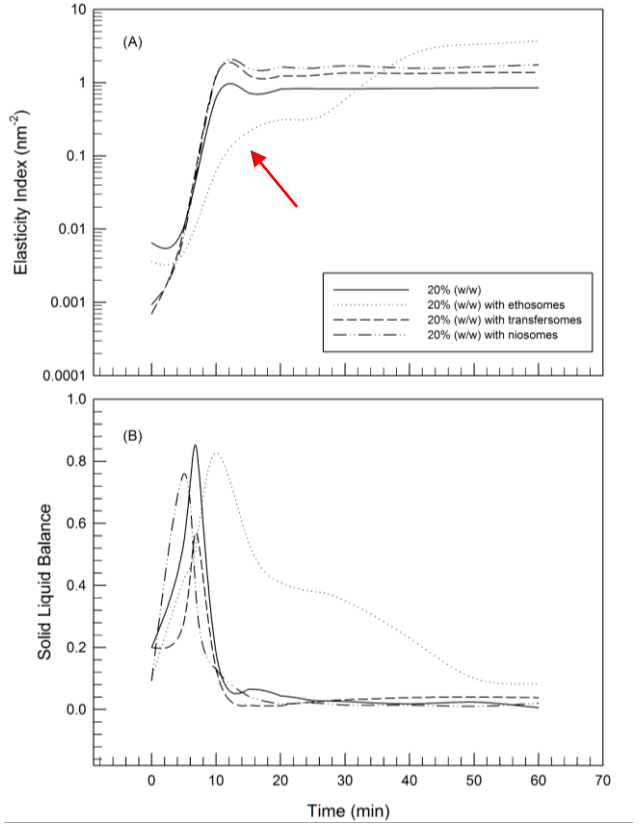
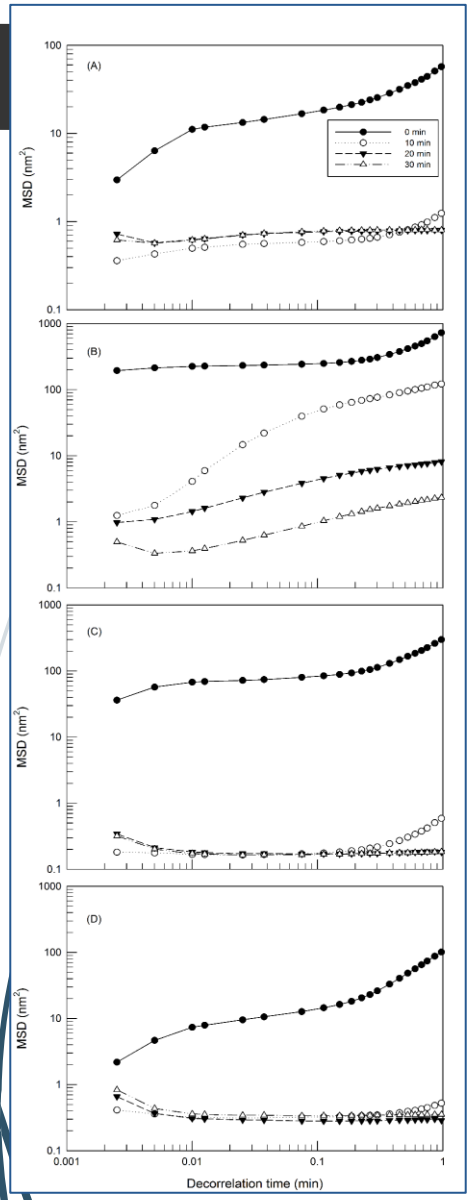
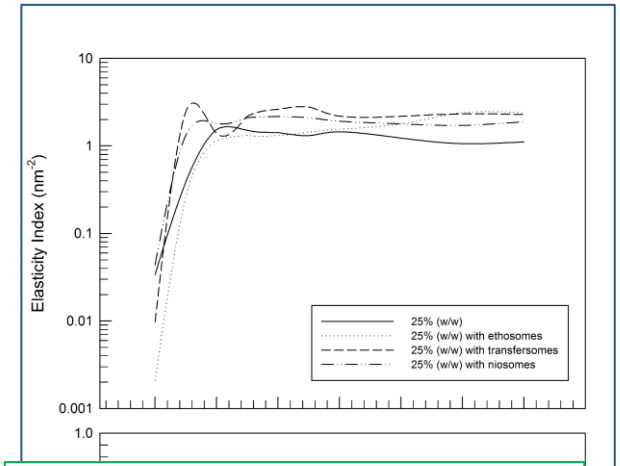


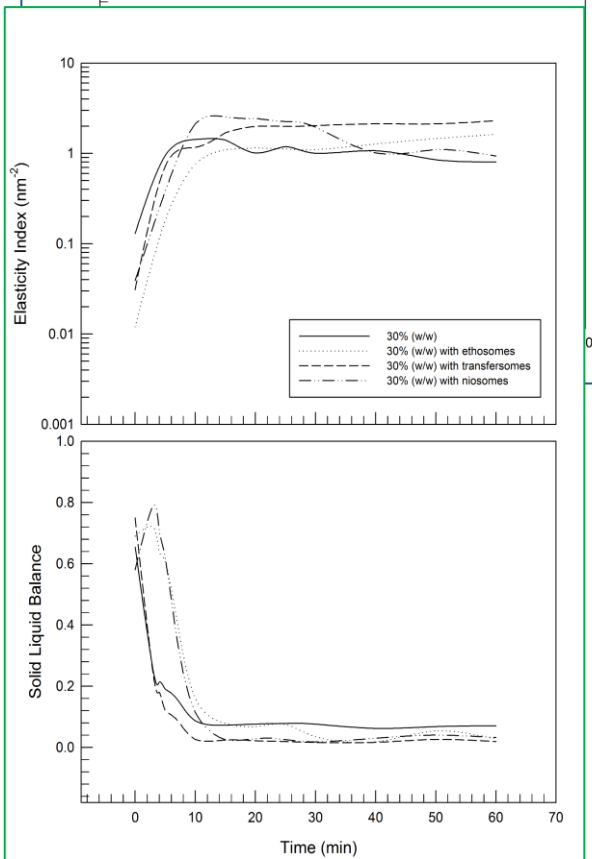
Figure 6. Elasticity Index (EI) (A) and Solid Liquid Balance profile (B) versus time for 20% poloxamer 407 with and without TDDSs.

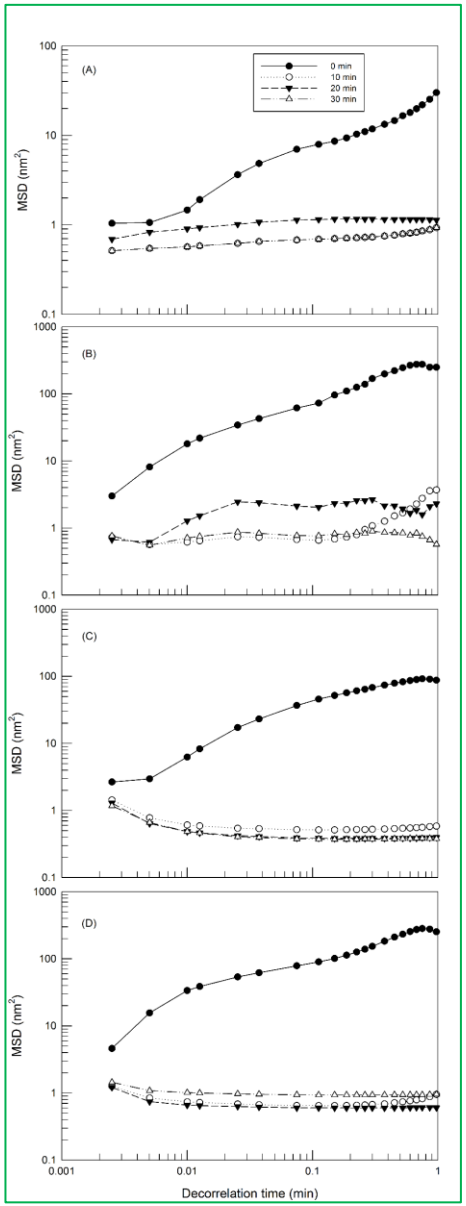
Figure 5. Mean square displacement of hydrogels made up of poloxamer 407 at 20% (*w/w*) alone (**A**) or in the presence of ethosomes (**B**), transfersomes (**C**) and niosomes (**D**) as a function of decorrelation time. The illustrated results were representative of three independent experiments.

RESULTS (4)


(A)
(B)
(C)
(D)
MSD (nm²)
0 min
10 min
20 min
30 min
Decorrelation time (min)


Elasticity Index (nm⁻²)
25% (w/w)
25% (w/w) with ethosomes
25% (w/w) with transfersomes
25% (w/w) with niosomes


Elasticity Index (nm⁻²)
30% (w/w)
30% (w/w) with ethosomes
30% (w/w) with transfersomes
30% (w/w) with niosomes
Solid Liquid Balance
Time (min)


(A)
(B)
(C)
(D)
MSD (nm²)
0 min
10 min
20 min
30 min
Decorrelation time (min)

RESULTS (5)

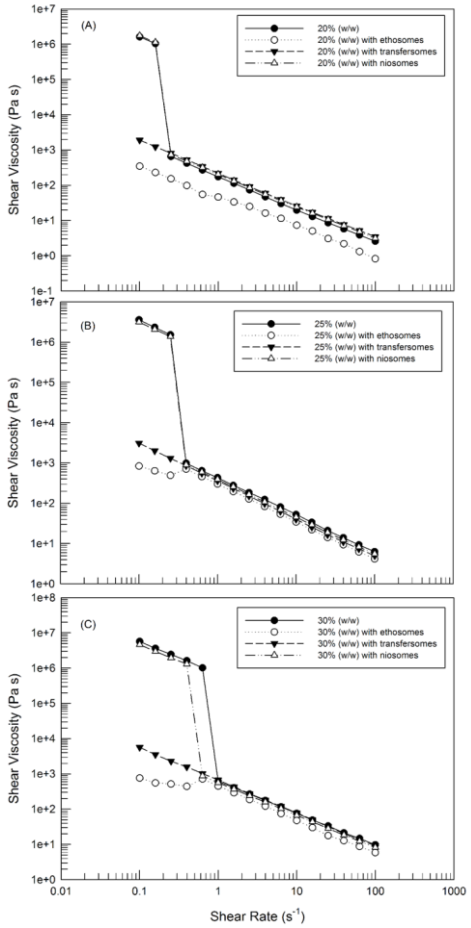


Figure 7. Flow curves (shear viscosity versus shear rate) of (**A**) 20% Poloxamer 407, (**B**) 25% Poloxamer 407 and (**C**) 30% Poloxamer 407, with and without carriers. The illustrated results were representative of three independent experiments.

Table 3. Shear rate-dependent viscosity (Pa·s) for Poloxamer 407 gels at 25 °C and at different shear rates. Values are reported as the average of three independent experiments ± standard deviation.

Sample	Shear Viscosity (Pa·s) at Different Shear Rate			
	0.1 s^{-1}	1 s^{-1}	10 s^{-1}	100 s^{-1}
20% Poloxamer 407	1618000.0 ± 230.1	173.5 ± 10.6	19.7 ± 2.5	2.6 ± 0.6
25% Poloxamer 407	3577000.0 ± 307.6	434.3 ± 7.9	52.8 ± 1.6	6.3 ± 0.9
30% Poloxamer 407	5708000.0 ± 98.7	610.1 ± 24.0	75.9 ± 2.0	9.7 ± 1.0

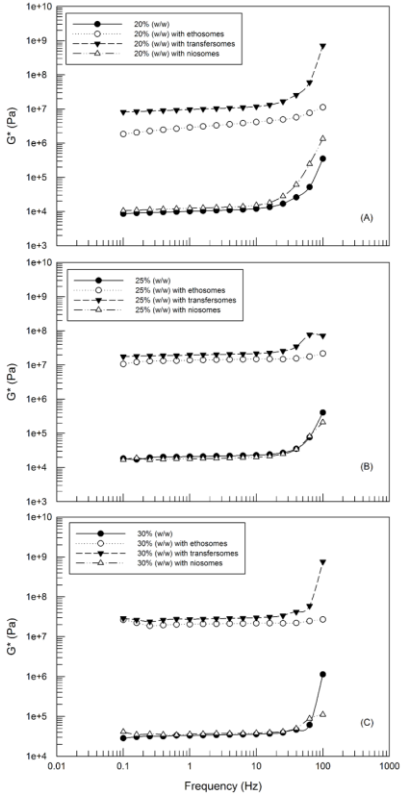


Figure 8. Complex shear modulus (*G**) versus Frequency for 20% Poloxamer 407 (**A**), 25% Poloxamer 407 (**B**) and 30% Poloxamer 407 (**C**) with and without TDDSs. The illustrated results were representative of three independent experiments.

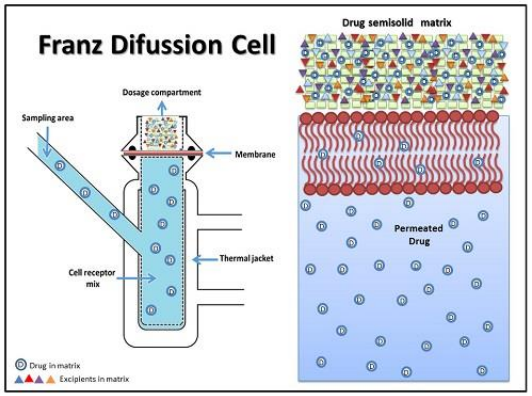
Table 2. Shear rate values correspondent to yield points for 20%, 25% and 30% poloxamer samples. Values are reported as the average of three independent experiments ± standard deviation.

Sample	Shear Rate (s^{-1})
20% Poloxamer 407	0.1585 ± 0.0015
25% Poloxamer 407	0.2512 ± 0.0003
30% Poloxamer 407	0.6310 ± 0.0032

RESULTS (6)

Table 4. Physico-chemical parameters of paclitaxel-loaded drug delivery systems obtained by use Zetasizer Nano ZS. Values are reported as the average of three independent experiments ± standard deviation.

Sample	Mean Size (nm)	Polydispersity Index	EE (%)
Ethosomes	309.00 ± 2.51	0.19 ± 0.01	65.54 ± 1.47
Transferosomes	265.07 ± 19.00	0.56 ± 0.01	57.27 ± 1.03
Niosomes	218.50 ± 7.53	0.32 ± 0.01	42.5 ± 0.35



Salamanca C. et al. Pharmaceutics 2018, 10(3), 148

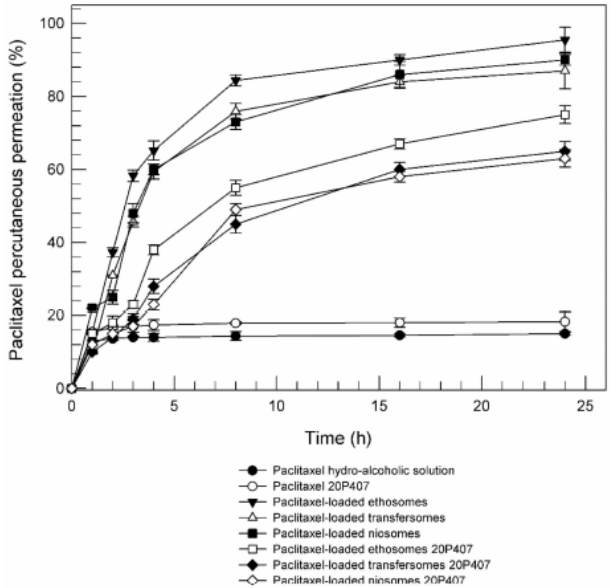
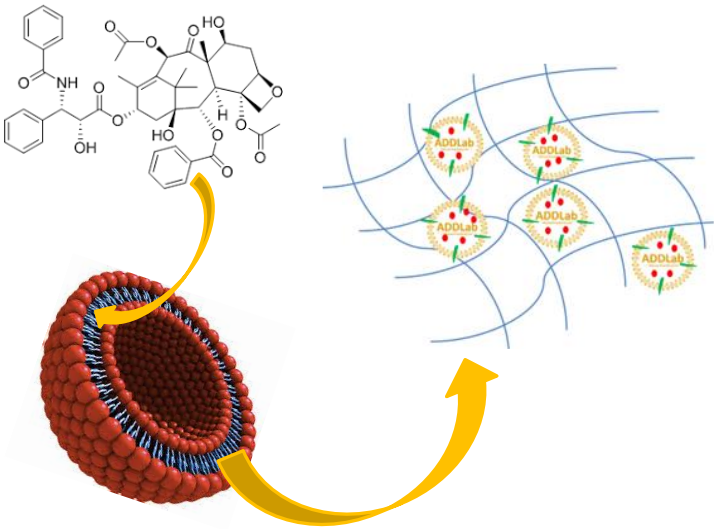


Figure 9. In vitro percutaneous permeation of paclitaxel from different formulations through SCE membranes, in comparison with a hydroalcoholic drug solution (as the control). Values represent the mean of three different experiments ± standard deviation.



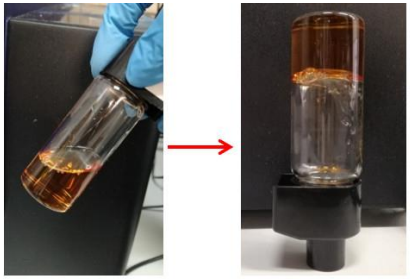
CONCLUSION

The topical application of the proposed Matrioska system may lead to:

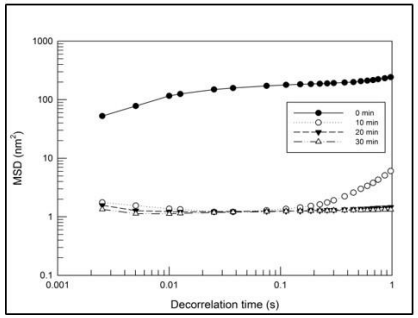
(i) the achievement of a synergistic effect between nanocarriers and hydrogel matrix

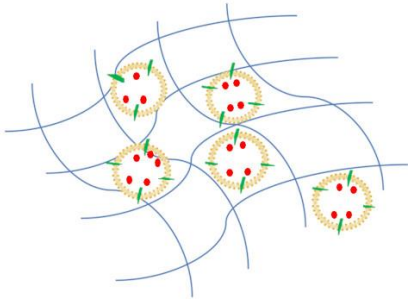
(ii) allow a more controlled release of the drug and

(iii) the increase of the persistence time of nanocarriers on the skin.



4°C 25°C





› Molecules. 2020 Apr 23;25(8):1979. doi: 10.3390/molecules25081979.

The Rheolaser Master™ and Kinexus Rotational Rheometer ® to Evaluate the Influence of Topical Drug Delivery Systems on Rheological Features of Topical Poloxamer Gel

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Dr Agnese Gagliardi
Dr Elena Giuliano
Dr Antonia Mancuso
Dr Silvia Voci

Prof. Donato Cosco
Prof. Donatella Paolino
Prof. Massimo Fresta

THANK YOU
for your kind attention

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Conference & Exhibition