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Evaluation of the impact of IL on SLNs with Gelucire® or Precirol ATO®

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INTRODUCTION & AIM

Nanosystems are being increasingly utilized in various applications, offering a novel approach to therapeutics by enhancing the pharmacokinetic profiles of several compounds [1]. This has led to an increase in the search for bioinspired and sustainable materials for novel nanotechnology-based formulations with pharmaceutical and cosmetic purposes. For the delivery of bioactives to the skin, lipid nanoparticles, such as solid lipid nanoparticles (SLNs), have been thoroughly investigated. Their use is still being hampered, nevertheless, by issues with stability and drug loading during storage[2]. Several methodologies, including the applicability of ionic liquids (ILs), may be used to improve this. These have proven to be a potential strategy due to the beneficial qualities that our group identified in earlier work, namely their capacity to enhance the colloidal stability of formulations [3].

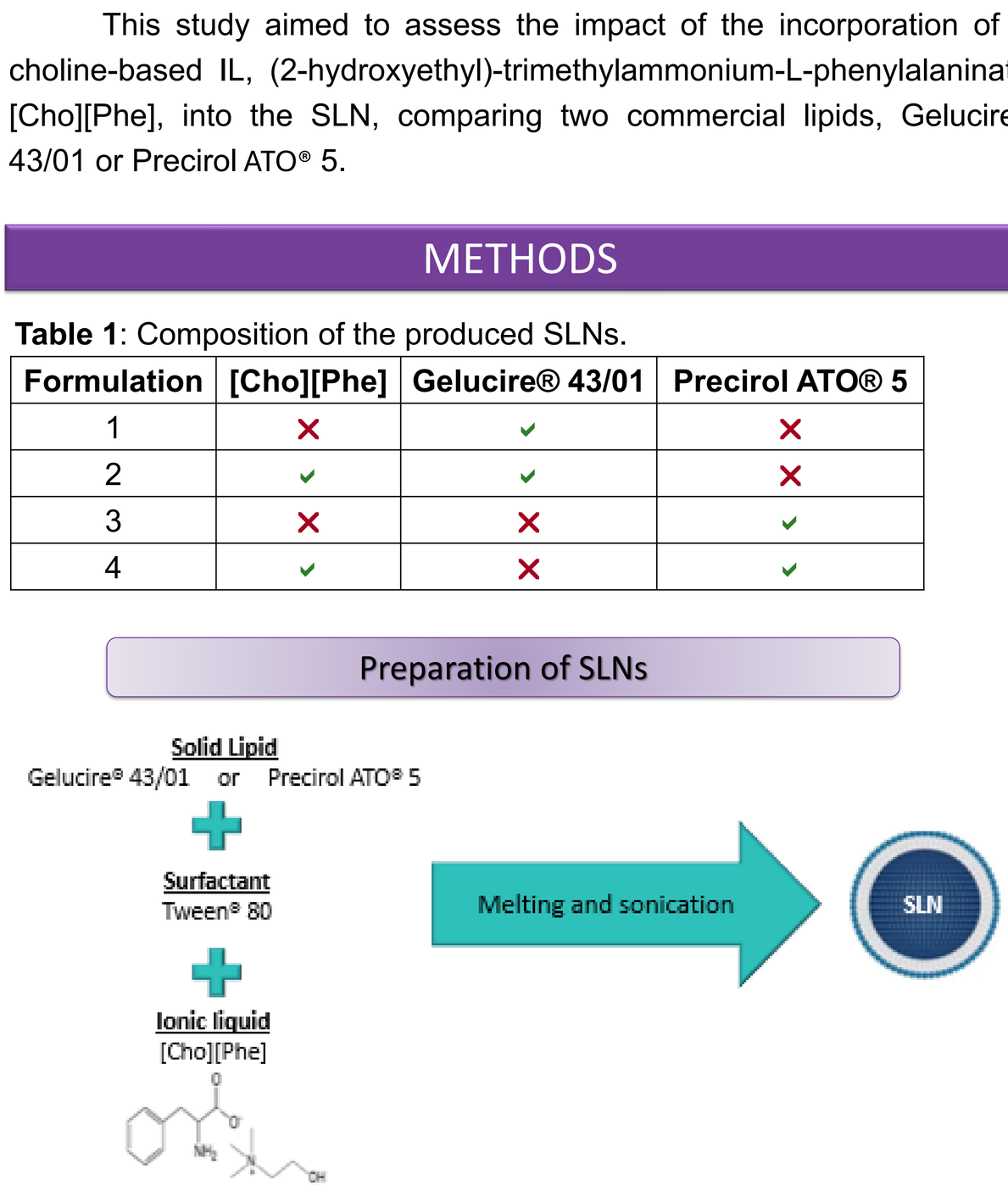
This study aimed to assess the impact of the incorporation of a choline-based IL, (2-hydroxyethyl)-trimethylammonium-L-phenylalaninate [Cho][Phe], into the SLN, comparing two commercial lipids, Gelucire® 43/01 or Precirol ATO® 5.

METHODS

Table 1: Composition of the produced SLNs.

Formulation	[Cho][Phe]	Gelucire® 43/01	Precirol ATO® 5
1	✗	✓	✗
2	✓	✓	✗
3	✗	✗	✓
4	✓	✗	✓

Preparation of SLNs



Characterization and storage stability

Particle Size | Polydispersity Index (PDI) | Zeta potential (ZP)

Storage stability - during 90 days

RESULTS & DISCUSSION

All SLNs prepared in the presence of Precirol ATO® 5 presented lower particle size compared with the formulations produced in the presence of Gelucire® 43/01 (**Table 2**). Additionally, the particle size of SLNs made of Precirol ATO® 5 are more suitable for topical application.

In the presence of [Cho][Phe], the size of the nanoparticles increased or decreased in the case of Gelucire® 43/01 or Precirol ATO® 5, respectively (**Table 2**). These data show that the impact of ionic liquid is dependent on the solid lipid used to prepare the SLNs.

Table 2: Physicochemical properties of the produced solid lipid nanoparticles in the presence of commercial lipids, Gelucire® 43/01 or Precirol ATO® 5, with and without ionic liquid (IL), (2-hydroxyethyl)trimethyl ammonium phenylalaninate [Cho][Phe]. Values presented as mean ± standard deviation, n=3.

Lipid	IL	Size (nm)	PDI	Zeta potential (mV)
Gelucire® 43/01	-	355.1 ± 2.6	0.32 ± 0.01	-30.62 ± 1.47
	[Cho][Phe]	570.1 ± 66.9	0.31 ± 0.02	-28.34 ± 0.71
Precirol ATO® 5	-	122.3 ± 0.8	0.26 ± 0.01	-15.68 ± 0.41
	[Cho][Phe]	82.3 ± 0.3	0.25 ± 0.01	-20.41 ± 2.63

The developed formulations demonstrated PDI values between 0.25 and 0.32 (**Table 2**), suggesting that all SLNs displayed a reasonable uniform size distribution, with better results using Precirol ATO® 5.

Regarding zeta potential, the values are around -29 mV for the formulations with Gelucire® 43/01, so these formulations may present higher colloidal stability than those produced with Precirol ATO® 5 (**Table 2**).

The storage stability was performed for 90 days, the data showed that all formulations produced in the presence of the IL maintained the evaluated parameters (particle size, PDI, and ZP) similar to the values at time 0. However, the particle size and ZP increased, during the storage time, for the formulations prepared without [Cho][Phe].

CONCLUSION

The findings demonstrated that ILs helped to stabilise the nanoparticles and enhance their physicochemical characteristics for topical use. All things considered, choline-based ILs in combination with the creation of novel lipid nanocarriers from sustainable and bioinspired materials appear to create a new paradigm for skin delivery. These findings demonstrate that ILs can alter SLN size, which might enhance their physicochemical characteristics for topical use.

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