Curcumin-loaded hyaluronic acid nanoparticles for topical delivery

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INTRODUCTION

Curcumin is a polyphenol derived from turmeric, that has been extensively studied due to its anti-oxidant and anti-inflammatory activity. Due to those properties, curcumin has been used as an active ingredient in topical formulations with efficient action against wrinkles, damage caused by UV radiation, ageing and skin water loss (1). Through nanotechnology, curcumin permeability and hence action can be improved. In this study, hyaluronic acid (HA) nanoparticles were exploited as carriers for curcumin for topical drug delivery application. Figure 1 shows a schematic of turmeric. Figure 2 shows an abstract of the methods used.

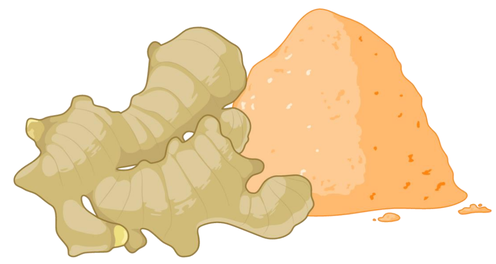

Figure 1. A schematic of turmeric and curcumin; drawn on BioRender.com.

METHODS

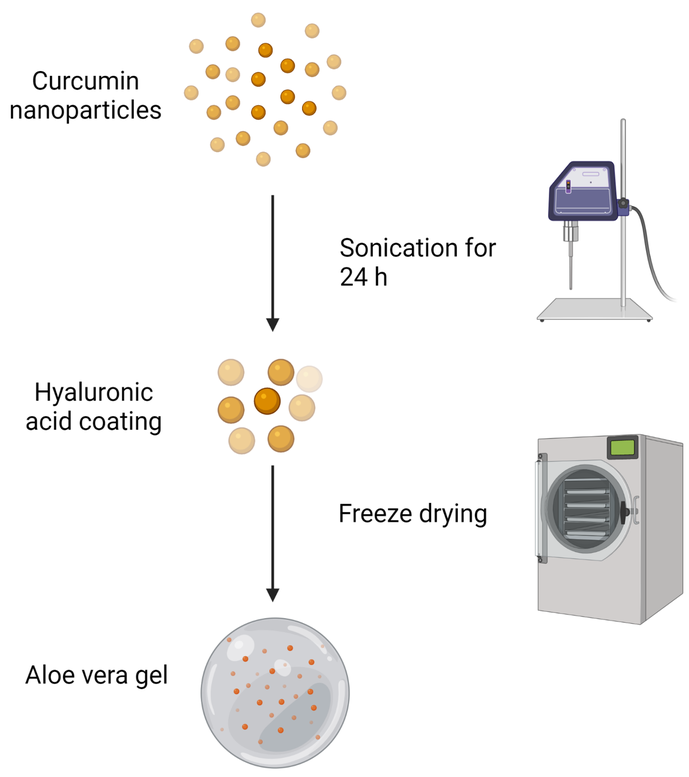

Figure 2. Curcumin-loaded Eudragit E100 nanoparticles were prepared via antisolvent precipitation method .The educt solutions were stirred for 1 hr . The nanoparticles were then further coated with hyaluronic acid via homogenization and/ or sonication for 15 minutes followed by mixing for 24 hrs. The freeze- dried HA particles were then suspended in Aloe Vera gel. Drawn on BioRender.com

RESULTS AND DISCUSSION

Curcumin Nanoparticles

Six formulations were prepared, which composed of different amounts of organic and aqueous phase excipients; F6 showed the most optimal results. The average particle size was 122.87 ± 0.93 nm and PDI was 0.13 ± 0.01 which represents well-distributed homogeneous nanoparticles. Particle size analysis of the formulations and an SEM image of the curcumin nanoparticles are shown in **Figure 3.**

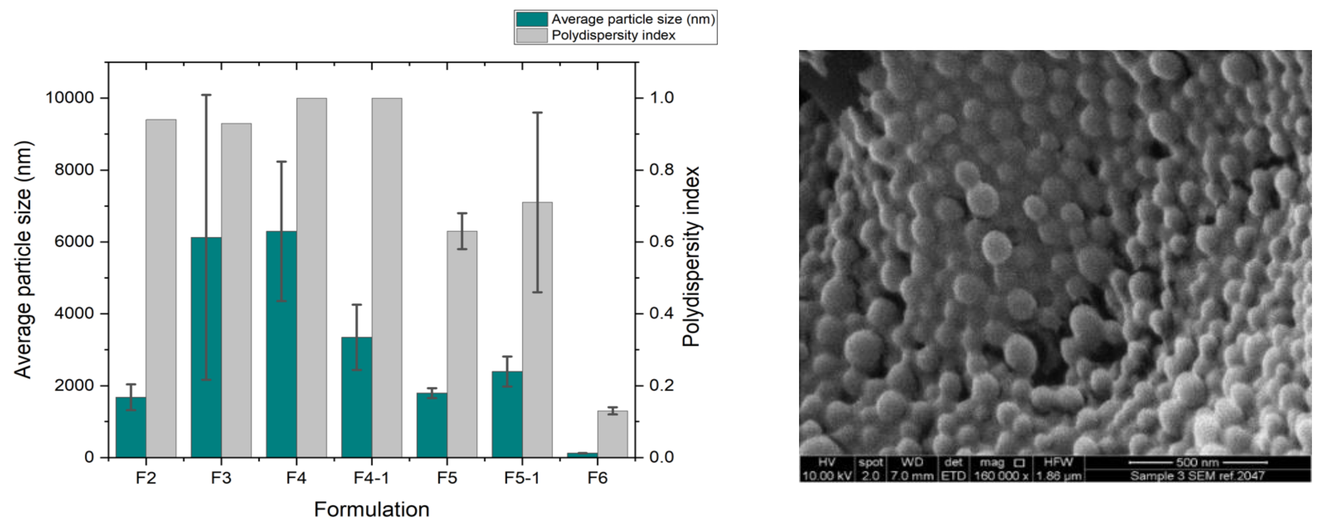

Figure 3. Average particle size results and PDI results of obtained particles (F2-6) and SEM image of F6.

Curcumin-loaded Hyaluronic acid Nanoparticles

The FTIR data confirms that the curcumin had been encapsulated by Eudragit E 100. The DSC data shows that those F6 nanoparticles have been further encapsulated by HA following homogenization. The TGA data shows that the HA loaded nanoparticles did not have residual solvent, making it suitable for further cosmeceutical formulating. Data shown in Figure 4.

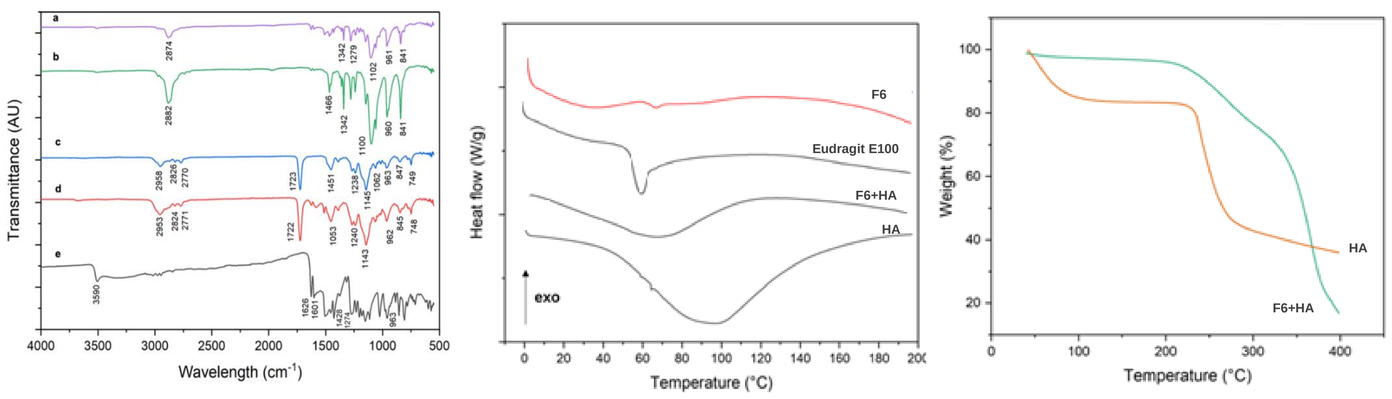

Figure 4. Left to right: TGA thermogram of HA-F6 nanoparticles and HA; FT-IR spectra of (a) physical mixture of poloxamer 188, Eudragit E100 and curcumin, (b) poloxamer 188, (c) Eudragit E100, (d) F6 nanoparticles, and (e) curcumin; DSC thermogram of F6, E100, F6+HA and HA alone.

CONCLUSIONS

HA nanoparticles contained curcumin at an encapsulation efficiency of 94%, indicating a high amount of the drug was retained in the manufacturing process. The freeze-dried nanoparticles were added into an Aloe Vera gel as a final presentation of the topical formulation. There are currently a limited number of studies combing both curcumin and hyaluronic acid for this cosmeceutical application, therefore, this study can provide a starting point for future research. Future work would include a permeation study and anti-oxidant assay.

REFERENCES

1. Zia, A; Farkhondeh, T; Pourbagher-shahri, A. and Samarghandian,S. The role of curcumin in aging and senescence: Molecular mechanisms. Biomedicine & Pharmacotherapy, 134, 111119 (2021).