Formulation studies of innovative topic systems with N-acetyl-D-glucosamine and Quercetin

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Introduction

- ✓ The skin is the largest organ of the human body and two of its main functions are protection and thermoregulation [1]. With ageing, skin loses its structural and morphological characteristics, and therefore its functions. Both quercetin and N-Acetyl-D-Glucosamine (GlcNAc) have been extensively studied regarding their potential to prevent skin ageing.

- ✓ Quercetin is a powerful anti-oxidant and anti-inflammatory already proven to be effective against extrinsic skin aging factors [2]. GlcNAc, is a monosaccharide derived from glucose [3] and has shown promising skincare properties, such as increasing skin hydration, wrinkle reduction and anti-ageing [4].

- ✓ Oil-in-water (O/W) and water-in-oil (W/O) emulsions have been widely used due to their efficacy in delivering compounds topically and their stability is very important: an emulsion with smaller oil droplets is empirically known to be more stable [5,6].

Materials and Methods

Emulsions were prepared with three different equipment: EUROSTAR 60 digital (helix stirrer), T25 digital ULTRA-TURRAX® and Turbotest evo (defocculator) and their droplet size was characterised. The final formulations were prepared using T25 digital ULTRA-TURRAX® and characterised according to the following methods:

- ✓ **Droplet size**: determined with a Malvern Mastersizer 2000 (Malvern Instruments, UK), coupled with a Hydro S accessory;

- ✓ **Rheological profile**: measured with an RVTDV II Brookfield® viscometer (Brookfield Engineering Laboratories, USA);

- ✓ **pH and Conductivity:** determined with the S20 SevenEasy™ pH (Mettler Toledo, USA);

- ✓ **Microscopy:** the emulsions were observed under a light microscope (Olympus BX51, Japan) with 10x objectives with normal light.

Conclusions

- ✓ Homogenisation by ULTRA-TURRAX® was the most effective to obtain smaller droplets.
- ✓ The emulsions obtained so far suggest promising results with regard to their efficacy as innovative anti-ageing quercetin and GlcNAc topical systems.

Acknowledgments

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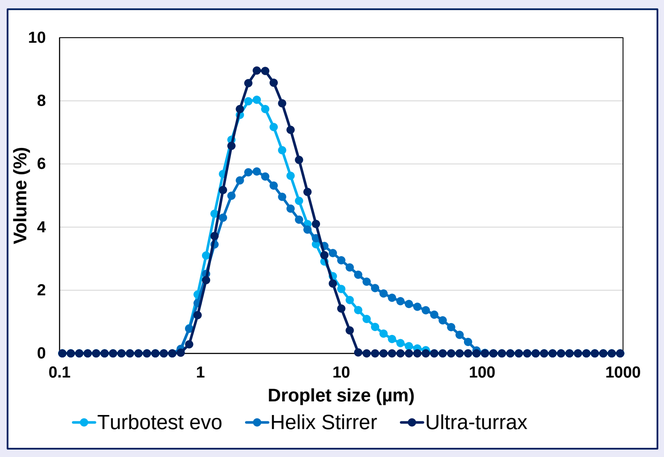
Aim

The aim of this work was to develop and characterise two topical emulsions, one containing quercetin (lipophilic compound) and another with GlcNAc (hydrophilic compound).

Results

- The best droplet size distribution was obtained with ULTRA-TURRAX®: the average droplet diameter corresponding to percentile 90 was 6.954 µm, 9.396 µm and 26.793 µm for the ULTRA-TURRAX®, TURBOTEST evo and EUROSTAR 60 digital, respectively, as shown in **Figure 1**.



The emulsion prepared with ULTRA-TURRAX® was the one with the best droplet size distribution and the most effective in obtaining smaller droplets.

Figure 1. Droplet size distribution profile of the topical emulsion without drugs and using different equipments.

- The formulation obtained with the ULTRA-TURRAX® showed a shear-thinning behaviour and the addition of quercetin and GlcNAc neither altered this profile (Figure 2), nor the droplet size distribution (Figure 3) nor pH and conductivity (Table 1).

- The oil/water ratio was also studied and the results showed that smaller droplets were obtained with the highest volume fraction of water, as well as the highest conductivity and the lowest viscosity.

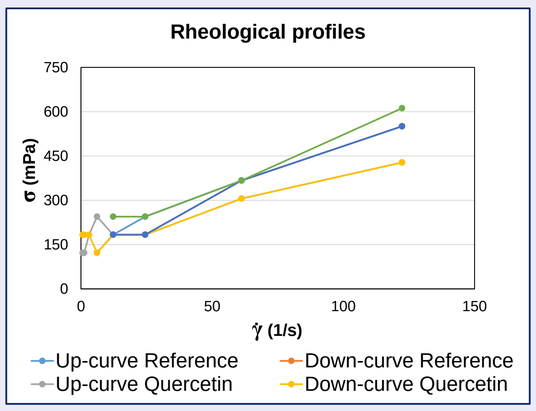


Figure 2. Rheological profile of final formulations.

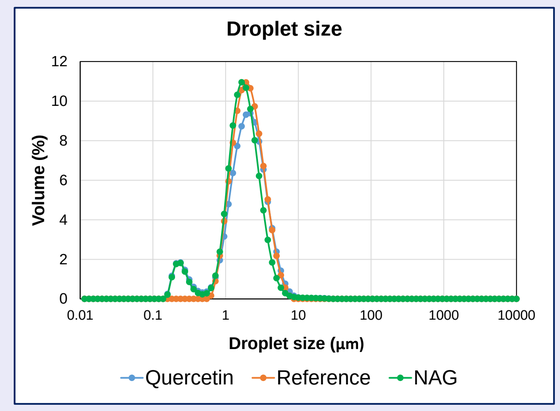


Figure 3. Droplet size distribution profile of final formulations.

Table 1. pH and conductivity values of final formulations (mean ± SD, n = 3).

	Reference	Quercetin	GlcNAc
pH (20ºC)	5.78 ± 0.05	5.97 ± 0.04	5.56 ± 0.04
Conductivity (mV)	74.30 ± 3.00	63.70 ± 2.00	87.00 ± 1.00

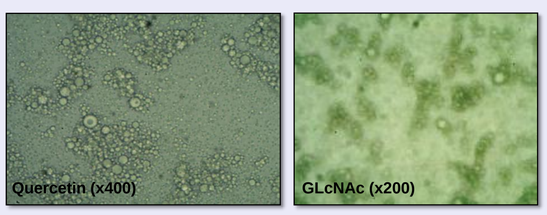


Figure 4. Microscopical structure – final formulations containing quercitin and GLcNAc.

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