

Increasing Resveratrol's Bioavailability Via Polymeric Micro-Carrier Encapsulation

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1 Introduction

Resveratrol (RSV), a polyphenol and phytoalexin found in large amounts in red wine, has gained increasing interest in the health and cosmetic sector due to its multifactorial health-promoting effects, including its anti-inflammatory, antioxidant, anti-ageing, and antimicrobial properties [1]. In dermal research, RSV has been shown to promote proliferation of skin cells, enhance the production of extracellular matrix (collagen type I, II and III) and reduce the levels of pro-inflammatory cytokines and free radicals, hence possessing great potential to interfere with skin aging and irritation [1]. Additionally, RSV loaded systems have shown potential in the treatment of ischemic wounds [2]. Despite the great potential of RSV, its clinical and cosmetic use has been hampered by its low bioavailability and pronounced degradation. In this project, we thus aim to fabricate polymeric micro-carriers to increase RSV's bioavailability and stability, without affecting its biological properties.

2 Materials & Methods

Polycaprolactone (PCL) was electro-sprayed and collect in a stainless-steel petri dish filled with 1% (w/v) polyvinyl alcohol (PVA). The contents of the petri dish were ultracentrifuged at 16,000 x g for 20 minutes and then washed with distilled water and then subsequently lyophilized. The micro-carriers were sprayed at four different weight percentages of RSV, 0%, 2.5%, 5%, and 10 %w/w (0RSV, 2.5RSV, 5RSV, 10RSV). The micro-carriers were characterized using scanning electron microscopy (SEM) in conjuncture with ImageJ to determine carrier size. Fourier-transform infrared spectroscopy (FT-IR) and Differential Scanning Calorimetry (DSC) were used to characterize the chemical properties of the fabricated micro-carriers. The Loading Capacity (LC) and Encapsulation Efficiency (EE) were used to determine the quantitative contents of the fabricated micro-carriers.

3 Results

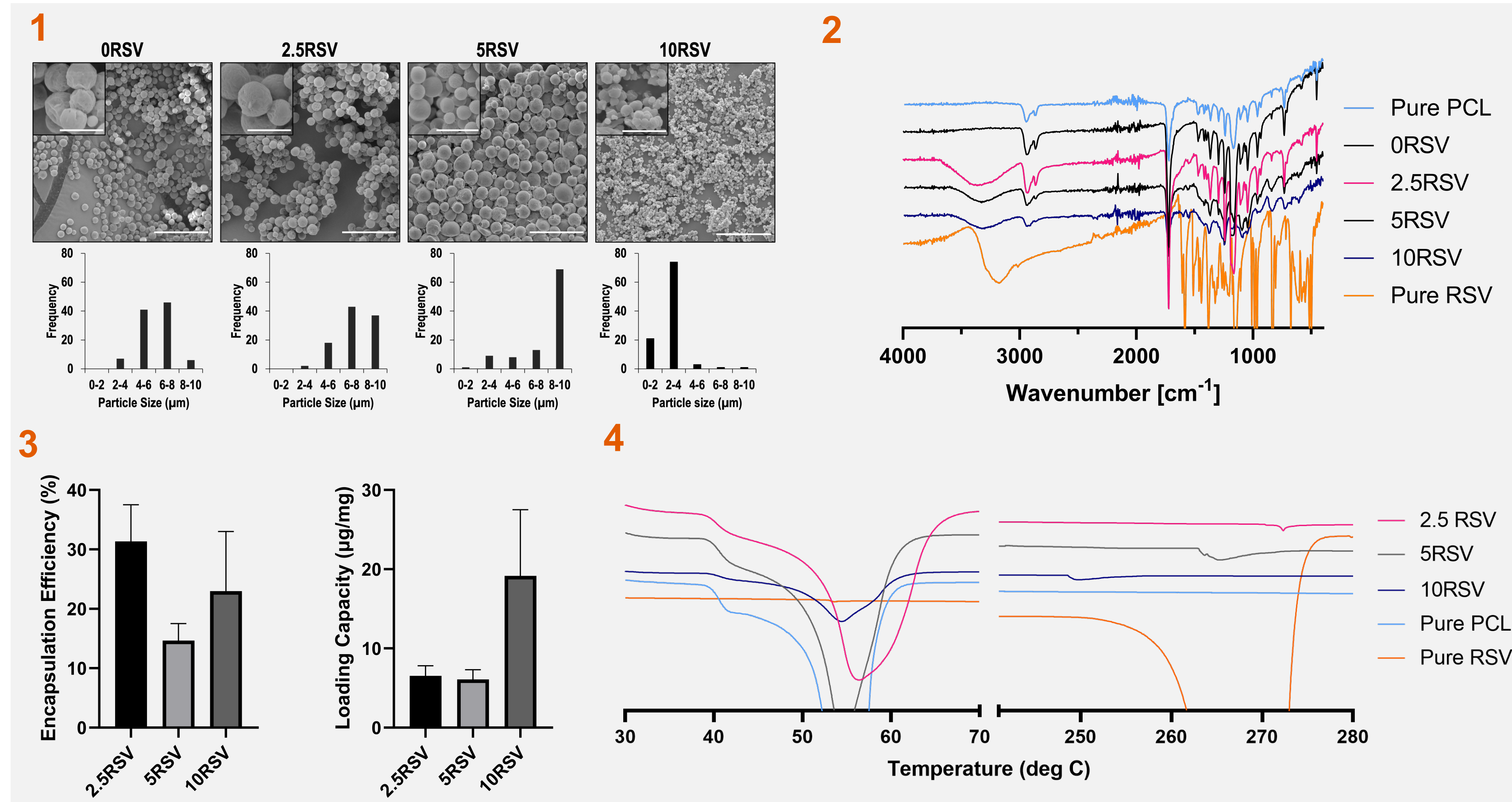


Figure 1. SEM images of the micro-carriers. Scale bars of the larger images is 50µm and the smaller images have a scale bar of 5µm.

Figure 2. FT-IR for pure samples of PCL and RSV and micro-carriers at all four concentrations. The samples containing RSV have broad hydroxyl group peaks at around 3200 cm⁻¹ and all PCL containing samples have a sharp carbonyl peak around 1700 cm⁻¹.

Figure 3. The encapsulation efficiency and loading capacity of the micro-carriers containing RSV. The 2.5RSV micro-carriers yield higher encapsulating efficiency, while the 10RSV micro-carriers yield the greatest loading capacity.

Figure 4. DSC curves for pure samples and micro-carriers. The melting point of PCL is around 58°C and the melting point of RSV is higher, around 254°C.

4 Conclusion

- The polymeric micro-carriers fabricated via the electrospraying process possess the capability to encapsulate RSV as demonstrated in the DSC and FT-IR data; which allows for increased bioavailability of RSV.
- Due to the slow degradation rate of PCL, the micro-carriers can serve as sustained release drug delivery systems for RSV as well as other drugs.
- Applications of this drug delivery system is not limited to the dermal fields; any application in which injections are used for drug delivery could also leverage this capability such as in the treatment of joint pain or diabetes.

References

- [1] Ratz-Łyko A, Journal of Cosmetic and Laser Therapy, 2019; 21: 84-90.
- [2] Lakshmanan R, International Journal of Pharmaceutics, 2019; 558: 177-186