

Introduction

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Master of Chemistry

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Curcumin, a natural coloring agent contained in turmeric, has many potential applications in the pharmaceutical as a tumor reducer, antioxidant and anti-inflammatory.^[1] However, curcumin is inherently poorly soluble in water, which limits its potential usage. Hence, techniques to improve the water solubility of curcumin have been extensively studied. One of these techniques, Amorphous Solid Dispersion (**ASD**), can disperse and entrap a poorly water-soluble substance in a water-soluble amorphous carrier at the molecular level. The aqueous reconstitution of the ASD exhibits highly increased solubility of the hydrophobic substance in water. We recently developed an alternative ASD technique, in which hydrophobic substance and sugar (disaccharide, as a wall material) are "dissolved" in an alcohol solvent and then dried into a solid powder, termed as Sole-Amorphous-Sugar-based Solid Dispersion (**SAS-SD**).^[2] Herein, the SAS-SDs of curcumin was water-solubilized in the presence of pyrrolidine, a volatile basic substance, and then Freeze-Dried (**FD**) into a [c] cake form of ASD. The three samples ([a] SD-, [b] VFD-based-SAS-SD, and [c] FD-based ASDs) were compared for the aqueous dissolution profiles of



* The following experiments were carried out at Okayama University, in the Bioprocess Engineering Group, laboratory led by Prof. Imamura Koreyoshi, during the IMaC Okayama international program.

curcumin. The influence of the type of disaccharide on the curcumin dissolution behavior was also investigated.

[References] [1] Sharma, R. A. et al., Eur. J. Cancer, 41, 1955-1968 (2005) [2] Sekitoh, T. et al., Dry. Technol., 39, 2065-2074 (2020)

Materials and Methods Model drug and sugar Preparation of amorphous sugar Preparation of SAS-SD by SD Preparation of SAS-SD by VFD Preparation of ASD by FD Dissolution behavior study Dissolution of Transfer of a $100 \,\mu$ L aliquot of the Preparation of a **Dissolution** of amorphous sugar and Preparation of a solution to a 1.5 mL-Eppendorf tube water solution amorphous TRE, Curcumin (CUR) curcumin in a water solution containing 100 CUR and PYR in methanol containing 100 µg/mL of curcumin water (TRE: 100 (Sugar: 50~100 mg/mL of a sugar mg/mL, CUR: 1 mg/mL, CUR: 1~2 (MAL, TRE, PAL) Pyrrolidine (**PYR**) Vacuum foam drying mg/mL, PYR: mg/mL) **(** for 1 h under reduced 0.25~2 mg/mL Sampling of a 0.5 mL aliquot and pressure of ~1 torr and preparation of a water solution centrifugated at $25\pm1^{\circ}C$ containing 10 µg/mL of curcumin Spray drying Freezing of the solution with liquid Centrifugal Freezing of the



Results and Discussion



This internship enabled me to deepen my knowledge of materials chemistry, thanks to the numerous articles I analyzed and presented to the students and teachers in my research group. I was able to learn and practice various analysis techniques adapted to my research project. Given that I had only carried out short internships prior to my placement, I was able to have the time to redo and improve the conditions of experiments whose results were not satisfactory. Finally, during my internship, I was able to meet and discuss with many professionals working in research, notably by taking part in academic conferences where I was able to present my work.

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