Physical properties of CO_2 and synthetic wax systems for use in micronisation via PGSS

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The Particles from Gas Saturated Solutions (PGSS) process employs supercritical CO_2 (sc-CO_2) as plasticiser for the micronisation of materials with limited solubility in CO_2. Lipid-type compounds are easily processed via PGSS without requiring the use of organic solvents or harsh processing conditions [1,2]. Preliminary micronisation tests on Fischer-Tropsch waxes have yielded promising results regarding yield and particle sizes obtained, indicating that the ease of processing of lipid compounds via PGSS also extends to synthetic waxes. Literature information on the behaviour of Fischer-Tropsch waxes in sc-CO_2 is however limited, as well as how the phase behaviour and physical properties of wax + sc-CO_2 systems affect the final characteristics of the PGSS micronized waxes such as particle size, morphology and crystallinity.

The thermodynamic and physical properties of two commercially used synthetic waxes (average melting temperatures of 46.2 °C and 60.4 °C, respectively) with sc-CO_2 at various process conditions were determined. Solid-liquid equilibria were measured using a static high-pressure view cell. Sc-CO_2 solubility, density and dynamic viscosity of the two commercial synthetic waxes were measured concurrently via a variable volume view cell fitted with a quartz crystal resonator [3]. The experimental data was compared with predicted data as determined by the Mendez-Santiago & Teja model [4].

Ultimately the data generated will be employed to gain a better understanding of the PGSS process by considering the thermodynamic and physical properties of synthetic wax + CO_2 systems. The improved fundamental knowledge of the melting behaviour, sc-CO_2 solubility, and physical properties is foreseen to elucidate the interdependencies between sc-CO_2 process parameters and final micronized particle properties.

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