TRANSPORT PROPERTIES OF β-D GALACTOSE PENTAACETATE AND SUPERCRITICAL CARBON DIOXIDE AND PHASE BEHAVIOR OF THE BINARY SYSTEM

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Abstract

Supercritical carbon dioxide dissolution of β-D-Galactose Pentaacetate is demonstrated as an application of binder removal from β-D-Galactose Pentaacetate-candidate binder compound bound sand plug in a high-pressure variable volume sapphire cell. The experiment demonstrated the important processing advantages of supercritical CO_2 debinding over conventional solvent extraction, as well as environmental advantages. During the dissolution a transient liquid phase was formed which showed that bulk drainage of the liquid was an important binder removal mechanism. To have an understanding of the thermodynamics of the system behavior phase envelope of the binary system was obtained by dew and bubble point experiments. The results showed that the system had a lower critical solution temperature system behavior. In a temperature range of 35-50 ^{o}C, solubilities up to 30 wt % β-D galactose pentaacetate were obtained, and single phase systems were attained at pressures ranging from 9-16 MPa.

To achieve a better understanding of the mechanisms of β-D-Galactose Pentaacetate debinding in supercritical carbon dioxide, measurements determining the transport properties of the binder-supercritical carbon dioxide binary system have been performed. The viscosities of the single phase binary system with different compositions were measured in a falling cylinder variable volume high pressure cell. The viscosity measurements showed that the binary system had very similar viscosities with the pure carbon dioxide at those conditions. The capillary tube experiments in the high pressure variable volume sapphire cell are conducted to understand the mechanisms and the process parameters of the sugar acetate dissolution in carbon dioxide while forming the carbondioxide swollen β-D-Galactose Pentaacetate lower liquid phase and then diffusing into the carbon dioxide rich upper phase forming a single phase binary system.