

Metastable zone width and crystal morphology of 1,3-dipalmitoyl-2-oleoylglycerol and tripalmitoylglycerol and their mixtures crystallised from acetone

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A solvent fractionation process is particularly useful to isolate sharp-melting fractions suitable for use in confectionery fats from raw materials such as palm oil. This process provides the necessary solid-liquid separation efficiency that can be difficult to achieve using dry fractionation. The viability and profitability of the fractionation process is dependent on the ease and efficiency of this separation, which is, in turn, dependent on the type of crystals present in the slurries.

The work reported here examines the influence of the metastable zone width on the crystal morphology. The metastable zone width has been determined for the crystallisation of 1,3-dipalmitoyl-2-oleoylglycerol (POP), tripalmitoylglycerol (PPP) and their mixtures from acetone. The metastable zone width was found to be relatively insensitive to cooling rate for POP but PPP metastable zone width demonstrated a slight dependence on concentration.

The spherulitic POP crystals had a more open structure at slower cooling rates. PPP had more plate-like crystals but produced powdery, amorphous crystals at high cooling rates.

In pure POP systems, onset of crystallisation was quickly followed by rapid crystal growth. While the presence of PPP in POP greatly raised the crystallisation onset temperature (by 17°C at 8% PPP), the temperature at which the main crystal growth occurred did not increase to the same extent.

Although the clear point of the pure systems was not dependent on previous cooling rate, it decreased with increasing cooling rate in the mixed system, suggesting that a greater proportion of PPP-rich phase separated during slower cooling.

The morphology of the crystals from the mixed system shifted from spherulitic (in the pure POP system) to a more lamellar structure with as little as 2% PPP.

These changes in structure, although relatively minor, nevertheless may be crucially important in relation to palm olein processing, where the presence of trisaturated triacylglycerols can help to reduce the degree of undercooling necessary prior to crystallisation and thereby improve the ease of washing of the resulting precipitate.