State diagrams for binary monoglyceride mixtures.

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Organogels or oleogels are a unique type of gel formed by trapping an organic solvent within a supramolecular network. In a system like this, a three-dimensional structure occurs from the spontaneous self-assembly of low molecular weight gelator molecules (typically <3000 Da), this usually happen at temperatures below the solubility limit of the gelator in the chosen solvent (i.e. mineral or vegetable oil). Monoglycerides (MG) have been previously studied and recognized for their ability to act as organogelator molecules. In the present study, state diagrams were constructed for binary mixtures of 1-stearoyl glycerol (C18) with 1-myristoyl (C14), 1-palmitoyl (C16), or 1-monobehenin glycerol (C22) in both vegetable and mineral oils. In all cases the total monoglyceride (MG) concentration was held constant at 8% (wt/wt), while varying the molar ratios of the components. Across all systems, a mixed lamellar (Lα) phase was observed, with a transition temperature not affected by changes in the C18 molar fraction, regardless of oil type or MG pairing. On the other hand, the sub-α crystalline phase showed a clear eutectic point at a specific MG molar fraction common to both oils for each MG pair. This eutectic composition, might suggest that the disparity in alkyl chain lengths within the lamellar structures led to inefficient molecular packing, compared to the compositions outside the eutectic range. After a designed thermal threatment, MG oleogels formed at these eutectic compositions demonstrated significantly higher elasticity (G′ at 5 °C) than those formed at other ratios. This behavior is attributed to the sub-α phase's disordered packing, which likely facilitates greater oil entrapment within the gel network. The results highlight specifically that reduced chain packing efficiency at the eutectic point correlates with improved oil retention and mechanical strength, offering insights into optimizing gel formulations using MG binary systems in various oil media.