Temperature and Pressure Tuneable Swollen Bicontinuous Cubic Phases Approaching Natures Length-scales

Electronic Supplementary Information


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Lattice parameter results for MO:DOPG 95:5 mol%

Figure S1. Effects of temperature and pressure on the lattice parameter of a swollen bicontinuous cubic phase Im3m composed of MO:DOPG 95:5 mol% shown at 35°C (○), 45°C (●), 55°C (□). Error bars are approximately the size of the data points.

Lattice parameter results for MO:chol:DOPS 75:15:10 mol%

Figure S2. Effects of temperature and pressure on the lattice parameter of a swollen bicontinuous cubic phase Im3m composed of MO:chol:DOPS 75:15:10 mol% shown at 25°C (■), 35°C (●), 46°C (○), 55°C (□), 65°C (□). Error bars are approximately the size of the data points.
Calculation of water content of Im3m cubic phases

The constant mean curvature model\(^1\) (eq. 1) can be used to calculate the water volume fraction from the measured lattice parameter. This can then be converted to obtain a \(w/w\) hydration (eq. 2)

\[
a = 2 \sum_{i=0}^{\infty} \frac{\sigma_i \left( \frac{v_n}{V} (1-\phi_w)^{2i} \right)}{\left( \frac{A_n}{V} (1-\phi_w) \right)}
\]

\[
\phi_w = \frac{c_w \rho_w}{c_w + (1-c_w) \rho_L}
\]

Where:
- \(a\) is the lattice parameter
- \(v_n\) is the molecular volume between the minimal surface and the pivotal surface
- \(A_n\) is the molecular area at the pivotal surface
- \(V\) is the molecular volume
- \(\phi_w\) is the water volume fraction
- \(\sigma_i\) are coefficients tabulated for Im3m in reference 2.
- \(c_w\) is the water content (by weight)
- \(\rho_w\) is the density of water
- \(\rho_L\) is the density of the lipid

We have directly measured the lattice parameter \(a\) for all of the mixtures described in this paper and have used values for \(v_n\) (465 Å\(^3\)), \(A_n\) (33 Å\(^2\)) and \(V\) (612 Å\(^3\)) taken from the literature for monoolein\(^2\) to calculate the water content of our highly swollen cubic samples as a first approximation. Results were obtained by expanding the coefficients of eq 1. and using a polynomial solver function in Matlab.

References