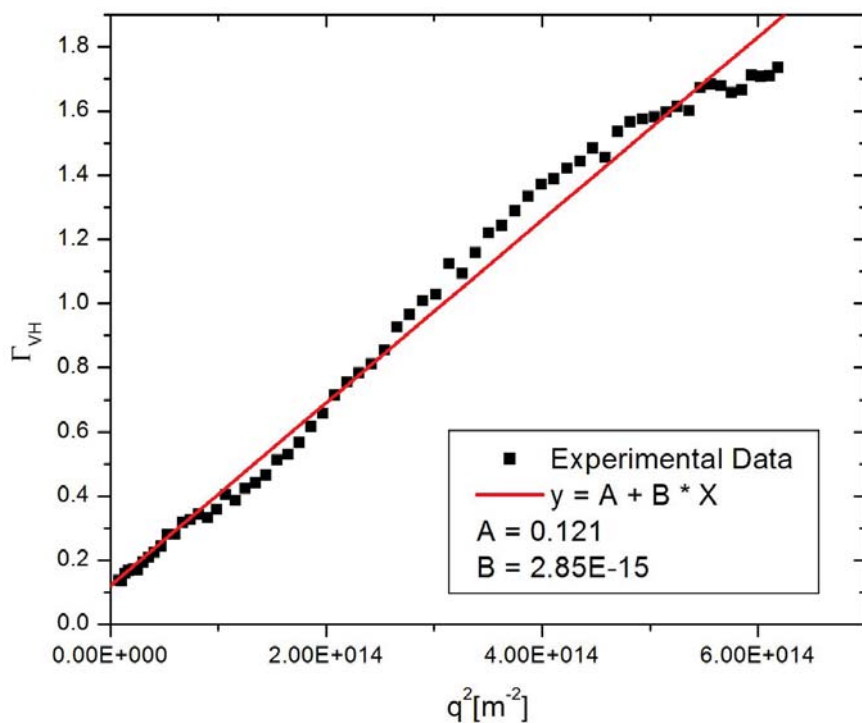


**Figure S1:** DLS measurements in normal (VV) mode for Sample 1 (liposomes with no internal sucrose).  $\Gamma_{VV}$  is the decay rate of the field correlation function ( $g_1^{VV}(t)$ ).  $\Gamma_{VV}$  was determined from the correlation function by cumulant expansion. Each data point represents a DLS measurement.  $\Gamma_{VV}$  increases with  $q^2$  (characteristic for rod-like particles).



**Figure S2:** Sample 1 (liposomes with no internal sucrose) measured in depolarized (VH) mode. In DDLS the scattering is due to optically anisotropic particles. Here, decay rate of the field correlation function is given by  $\Gamma_{VH} = q^2 D_T + 6D_R$ ,  $\Gamma_{VH}$  is the decay rate of the depolarized field correlation function ( $g_I^{VH}(t)$ ).  $\Gamma_{VH}$  was determined from the correlation function by cumulant expansion. The resulting values for plotted versus  $q^2$  and  $D_T$  and  $D_R$  for the anisotropic particles are evaluated by linear regression.

**Table S1:** Similarity Factor Analysis ( $f_2$ ) for the liposomes containing 17.1 mg/mL internal sucrose (Intermediate) before (control) and after freeze-thaw (nanocrystal) versus the control liposomes without internal sucrose. Shaded cells indicate lack of similarity.

Test	Reference		
	No sucrose control	Intermediate sucrose control	Intermediate sucrose nanocrystal
No sucrose control	100	68.0	32.6
Intermediate sucrose control	68.0	100	36.5
Intermediate sucrose nanocrystal	32.6	36.5	100

**Table S2:** Similarity Factor Analysis ( $f_2$ ) for the liposomes containing 51.3 mg/mL internal sucrose (High) before (control) and after freeze-thaw (nanocrystal) versus the control liposomes without internal sucrose. Shaded cells indicate lack of similarity.

Test	Reference		
	No sucrose control	High sucrose control	High sucrose nanocrystal
No sucrose control	100	71.7	46.2
High sucrose control	71.1	100	41.3
High sucrose nanocrystal	46.2	41.3	100