Supporting information

The different time regions $\Delta t_1$, $\Delta t_2$, $\Delta t_3$ found by SAXS data analysis can be preliminarily distinguished upon inspection of the integrated intensity given by $\int_0^{\infty} I(q) dq$ as a function of time.

We observe a different power law behavior in each of the three time ranges, as indicated by lines in Fig. 1; furthermore, we find the same power exponent 1.2 in the nucleation regions $\Delta t_1$ and $\Delta t_3$, and a different power exponent 3.9 in the growth region $\Delta t_2$.

The log-normal distribution $P(R)$ of particle size used in Eq. 4, is defined by

$$P(R) = \frac{1}{R_s \sqrt{2\pi}} \exp \left( -\frac{(\ln R - \rho)^2}{2s^2} \right), \text{ with } \int_0^{\infty} P(R) dR = 1 \quad (1)$$

where $\rho$ and $s$ are the mean and the standard deviation values, respectively, of the distribution of the variable’s natural logarithm; so, the mean and the standard deviation $R_m$ and $\sigma$ of the $R$ distribution are given by

$$R_m = \exp\left(\rho + 12s^2\right) \text{ and } \sigma = R_m \left(e^{2s^2} - 1\right) \quad (2)$$

The interference term $S(q, R_{HS}, \eta)$ for a hard sphere model in monodisperse approximation was calculated with the Percus-Yevick equation:

$$S(q, R_{HS}, \eta) = \frac{1}{[1 + 24 \eta A(2qR_{HS})]} \quad (3)$$

with

$$A(x) = \int_0^1 y^2 (a + by + cy^3) \frac{\sin(yx)}{yx} dy \quad (4)$$

and

$$a = \frac{(1 + 2\eta)^2}{(1 - \eta)^3}; b = -\frac{6\eta(1 + \eta^2)^2}{(1 - \eta)^4}; c = \frac{a\eta}{2} \quad (5)$$

$R_{HS}$ and $\eta$ are the hard sphere radius hard sphere volume fraction, respectively.
In Fig. 2 the reduced standard deviations (rds) $\frac{\Delta N}{N}$, $\frac{\Delta R_m}{R_m}$, $\frac{\Delta \sigma}{\sigma}$, $\frac{\Delta R_{HS}}{R_{HS}}$, $\frac{\Delta \eta}{\eta}$, $\frac{\Delta P_E}{P_E}$, $\frac{\Delta P_C}{P_C}$ of all estimated parameters are plotted as a function of the time. For $t < t_0$, $\frac{\Delta N}{N}$, $\frac{\Delta R_m}{R_m}$, $\frac{\Delta \sigma}{\sigma}$, $\frac{\Delta R_{HS}}{R_{HS}}$ and $\frac{\Delta \eta}{\eta}$ are quite large and assume values larger than 1 indicating that the model of Eq. 2 cannot be applied to the analysis of the SAXS profiles before the addition of ascorbic acid. In this time range fitting procedure converges taking as a model the power law background $I_B(q)$; indeed, only $\frac{\Delta P_E}{P_E}$ and $\frac{\Delta P_C}{P_C}$ rds assume small reasonable values as indicated in Fig. 2. As the reaction takes place, all the rds reach the small value of 0.1 in the $\Delta t_1$ range and thus the model of Eq. 2 takes to work in SAXS patterns analysis; in particular the fitting procedure converge when $t > t^*$. We also stress here that Eq. 2 has been derived considering the interference effects due to monodisperse hard spheres; in our case this is verified since reduced standard deviation of $R_{HS}$ assumes sufficiently small values as the reaction takes place and goes on. Finally, we note that at $t \approx 170$ s our main interference peak falls outside the measured $q$ range; anyway the higher order maxima and minima falling in our range, joint to the use of constrains setting a lower limit for $R_{HS}$ values, allow us to yield converging fits of experimental data with rds of $R_{HS}$ and $\eta$ that remain less than 0.1, as shown in Fig. 2.

In Fig. 3 we show the $I_B(q)$ and $I_P(q)$ obtained from the optimization procedure, while all different contributions in the model (Eq. 2) are reported in the Fig. 4, where also the log-normal size distributions at two different time intervals are illustrated.
Figures:

**Figure 1:** Log-Log plot of integrated intensity vs. time; different power law behaviours (continuous lines) characterize the different time regions $\Delta t_1=[t_1-t_0]$, $\Delta t_2=[t_2-t_1]$ and $\Delta t_3=[t_3-t_2]$.

**Figure 2:** Plot of reduced standard deviations, $rds$, of variable parameters in the fitting procedure; for $t<t^*$, we find large uncertainties of $N$, $R_m$, $\sigma$, $R_{R_m}$ and $\eta$ variable parameters, meaning the failure of Eq. 2 in modelling experimental data; here the only power law term of Eq 2 gives small $rds \Delta P_\text{PE}/P_E$ and $\Delta P_\text{PC}/P_C$. After $t^*$, the $rds$ oscillate around reasonable small values.
Figure 3: SAXS normalized profiles (dots) collected at the time intervals indicated; solid lines show the best-fitted curves obtained by Eq. 2, while dashed and dotted lines represent the calculated $I_0(q)$ and $I_0(q)$ respectively.

Figure 4: SAXS experimental profiles (red dots) collected at the time intervals indicated along the best-fitted curves solid lines) obtained by Eq. 1. We also represent: the Percus-Yevick structure factor, the power law contribution $I_0(q)$ and the integral $I_0(q)/S = \int_0^\infty P(R)[V(R)\Phi(q,R)]^2 dR$. The log-normal size distributions, are reported in the insets.