Temperature Effects on Threshold Counterion Concentration to Induce Aggregation of fd Virus

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We seek to determine the mechanism of like-charge attraction by measuring the temperature dependence of critical divalent counterion concentration ($C_c$) for the aggregation of fd viruses. We find that an increase in temperature leads to a decrease in the dielectric constant ($\varepsilon$) of the solvent, thus causing $C_c$ to decrease. At a constant $\varepsilon$, $C_c$ is found to increase as temperature increases. The effect of $T$ and $\varepsilon$ on $C_c$ is combined to that of one parameter: Bjerrum length ($l_B$). $C_c$ decreases exponentially as $l_B$ increases. The exponential decay of $C_c$ suggests that entropic effect of counterions plays an important role at the onset of bundle formation.

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