

Table 1 Some common expressions for interaction potential $U(y)$ between a solute molecule and a flat surface

Interaction	Potential ^a	Note(s)
Coulombic	$U(y) = ze\zeta e^{-y/\lambda_D}$	Low potential ^b (Debye–Hückel)
	$U(y) = 2k_B T \ln \left(\frac{1+\gamma e^{y/\lambda_D}}{1-\gamma e^{y/\lambda_D}} \right)$	z:z electrolyte (Gouy–Chapman)
Dipolar	$U(y) = k_B T \left\{ 1 - \frac{4\mu}{ze\lambda_D} \cdot \frac{\gamma e^{-y/\lambda_D}}{1-\gamma^2 e^{-2y/\lambda_D}} \cdot \coth \left(\frac{4\mu}{ze\lambda_D} \cdot \frac{\gamma e^{-y/\lambda_D}}{1-\gamma^2 e^{-2y/\lambda_D}} \right) \right\}$	z:z supporting electrolyte
Steric	$U(y) = \left(\frac{R}{y} \right)^n$	$n \rightarrow \infty$ for hard repulsion
		$n \approx 9-16$ for soft repulsion
Van der Waals	$U(y) = -\frac{\pi C \rho}{6y^3}$	

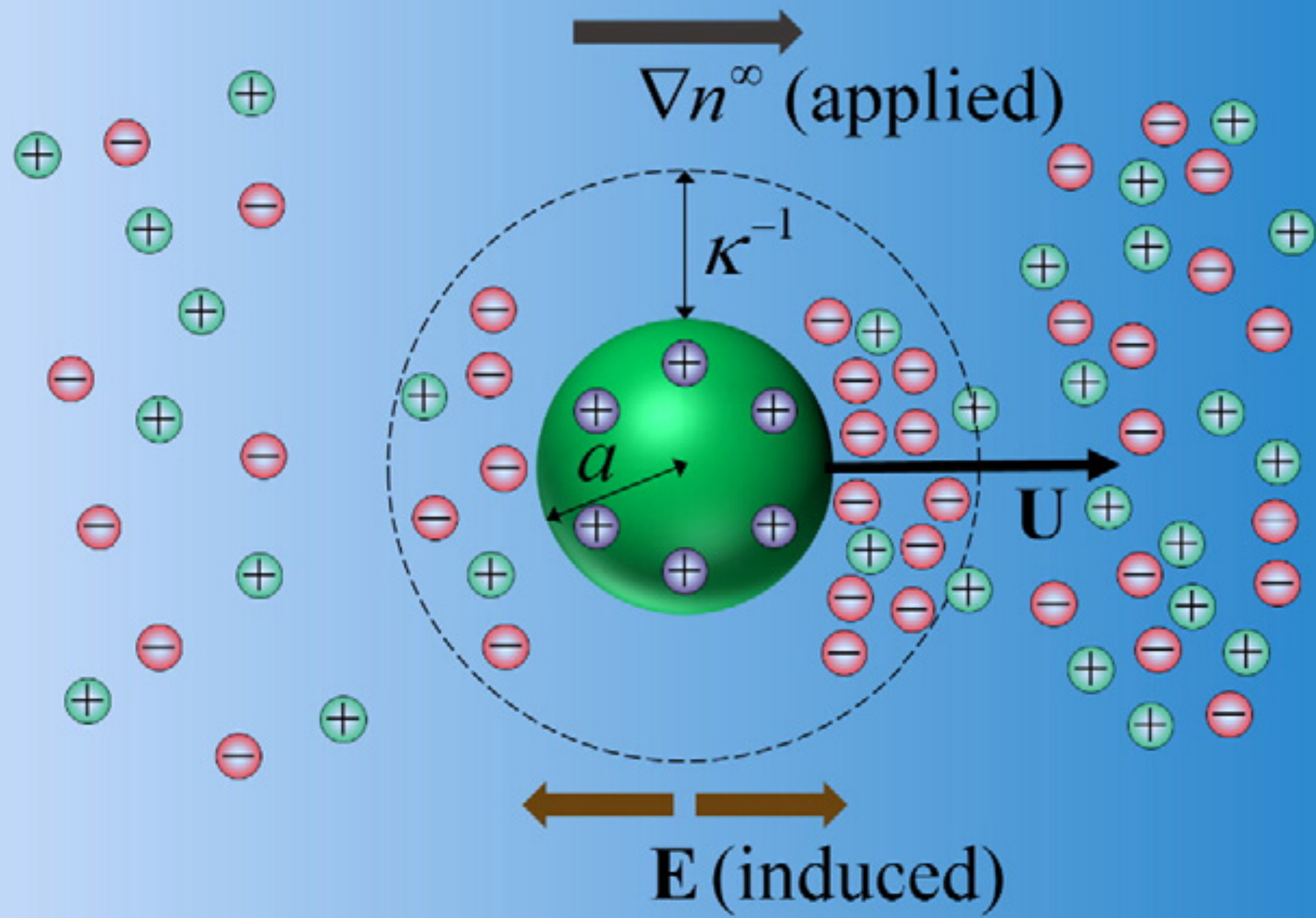
^aHere z is the charge number; e the elementary charge; $\lambda_D = \sqrt{\frac{\epsilon k_B T}{e^2 \sum_i c_i z_i^2}}$ the Debye screening length; ϵ the permittivity of the solution; ζ the zeta potential; $\gamma = \tanh\left(\frac{ze\zeta}{4k_B T}\right)$; μ the solute dipole moment; R the solute radius; C the coefficient in the atom-atom pair potential; and ρ the molecular number density of the wall.

^b $\zeta < \frac{k_B T}{ze}$.

Table 2 Some analytical solutions for the diffusiophoretic velocities in the limit of vanishingly thin interfacial layer ($a/\lambda \rightarrow \infty$)

Solute	Particle velocity	Key assumption(s)	Reference(s)
Ionic	$\mathbf{u}_p = \frac{\epsilon}{\eta} \left(\frac{k_B T}{ze} \right)^2 \left\{ \beta \frac{ze\zeta}{k_B T} + 4 \ln \cosh \left(\frac{ze\zeta}{k_B T} \right) \right\} \nabla \ln c_\infty$	$z:z$ electrolyte	Derjaguin et al. 1961, Prieve et al. 1984
	$\mathbf{u}_p = \frac{\epsilon}{\eta} \left(\frac{\sum_i z_i^2 \nabla c_{i,\infty}}{\sum_i z_i^2 c_{i,\infty}} \frac{\zeta^2}{8} + \frac{k_B T}{e} \frac{\sum_i z_i D_i \nabla c_{i,\infty}}{\sum_i z_i^2 D_i c_{i,\infty}} \zeta \right)$	Small zeta potential	Chiang & Velegol 2014, Gupta et al. 2019
Polar	$\mathbf{u}_p = \frac{k_B T}{3\eta} \left(\frac{2\mu\gamma}{ze} \right)^2 \left[1 + \frac{\gamma^2}{2} \left\{ 1 + \frac{4}{5} \left(\frac{\mu}{ze\lambda_D} \right)^2 \right\} \right] \nabla c_\infty$	$z:z$ supporting electrolyte	Anderson 1989
Neutral	$\mathbf{u}_p = -\frac{k_B T}{2\eta} R^2 \nabla c_\infty$	Hard sphere	Anderson 1989, Staffeld & Quinn 1989

a



b