Typical Refractive Index Increment (dñ/dC) Values

The refractive index increment is strongly dependent on the properties of the sample system, in that it depends not only on the material of the "particle" but also on the dispersant or "solvent". The refractive index increment is an indication of the contrast, and describes how much the refractive index changes when the concentration is changed.

In light scattering, dñ/dc is a component of the optical constant (K) in the Rayleigh expression used for small molecule absolute molecular weight (M) measurements, where R_θ is the Rayleigh ratio of scattered to incident light intensity, C is the sample concentration, λ is the wavelength, N_A is Avogadro's constant, and $ñ_o$ is the solvent refractive index.

$$\frac{KC}{R_\theta} = \frac{1}{M} + 2A_2C$$

$$K = \frac{2\pi^2}{\lambda^4 N_A}\left(ñ_o \frac{dñ}{dc}\right)^2$$

Knowledge of the specific refractive index increment is therefore required and important since the scattering intensity is dependent on the square of dñ/dc. Further complexity is added with the knowledge that the refractive index increment is also wavelength and temperature dependent. Representative values for a collection of analyte-solvent pairs are given in the table below. A more exhaustive collection of values can be found in:

Theisen, A.; Johann, C.; Deacon, M.P.; Harding, S.E. "Refractive Increment Data-Book for Polymer and Biomolecular Scientists", Nottingham University Press, Nottingham UK, 2000. ISBN: 1-897676-29-8

Representative dn/dC Values

Material	Dispersant	dn/dC (ml/g)*
Biomolecules	Aqueous buffer	~0.185
Proteins	Aqueous buffer	0.16 - 0.20
DNA	Aqueous buffer	0.17
RNA	Aqueous buffer	0.17 - 0.19
Polysaccharides	Aqueous buffer	~0.15
Chitosan	Aqueous buffer	0.16 - 0.18
Dextran	Aqueous buffer	0.14 - 0.15
Hyaluronic acid	Aqueous buffer	0.16 - 0.18
Pullulan	Aqueous buffer	0.14 - 0.16
Starch	Aqueous buffer	0.15
Liposomes		
Phospholipid	Water	0.16
Polymers		
Polyacrylic Acid	PBS	0.143
Polymethyl methacrylate	THF	0.09
Polymethyl methacrylate	Toluene	0.01 - 0.02
Polystyrene	THF	0.18 - 0.19
Polystyrene	Toluene	0.10 - 0.11
Polystyrene	Cyclohexane	0.16 - 0.17
Polystyrene	Decaline	0.12
Polystyrene	MEK	0.21
Polystyrene sulfonate	Water	0.189
Polyvinyl chloride	Cyclohexanone	0.08
Polyvinyl chloride	DMF	0.08
Polyvinyl chloride	THF	0.10

*At 633 nm and 25 C

Malvern Instruments Ltd

Enigma Business Park • Grovewood Road • Malvern • Worcestershire • UK • WR14 1XZ
Tel: +44 (0)1684 892456 • Fax: +44 (0)1684 892789

Malvern Instruments Worldwide

Sales and service centers in over 50 countries for details visit www.malvern.com/contact