

Determination of sedimentation constant and molar masses from sedimentation velocity experiments

At high enough rotor speed a sedimentation front is formed in the centrifuge cell and the progression of this front with time is recorded by absorbance or interference optics. The relation between sedimentation velocity  $dr/dt$  and centrifugation field  $\omega^2 r$  is defined as sedimentation coefficient  $s$ :

$$s = \frac{dr/dt}{\omega^2 r} = \frac{d \ln r}{d \omega^2 t}$$

Due to hydrodynamic and interaction phenomena  $s$  depends on concentration. Therefore measurements are performed at different concentrations with subsequent extrapolation to infinite dilution according to:

$$\frac{I}{s_{app}} = \frac{I}{s_0} + \frac{k_s}{s_0} \cdot c_0$$

$s_0$  - sedimentation constant,  
Unit: 1 Svedberg =  $10^{-13}$  s

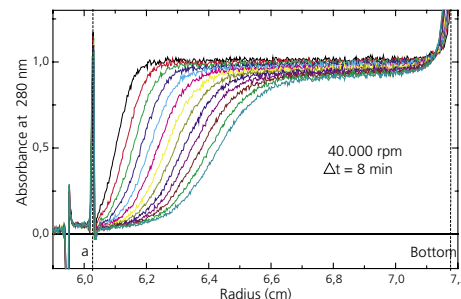
By means of  $s_0$  the molar mass of the sedimenting species, which is in case of polydisperse systems close related to the weight average  $M_w$ , can be calculated by one of the following methods:

- using experimentally obtained calibration relations of the type  $s_0 = K M^b$
- combining  $s_0$  with diffusion constant  $D$  by Svedberg's equation

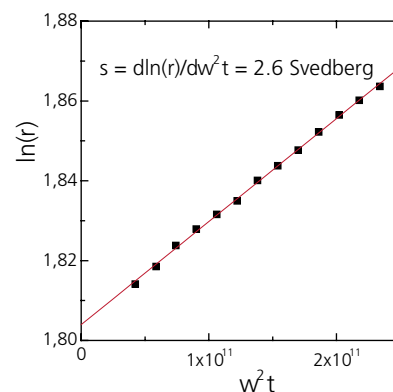
$$M = s_0 RT / D(1 - \bar{v}\rho)$$

- combining  $s_0$  with intrinsic viscosity  $[\eta]$  e.g. by a modified Flory/Mandelkern/Scheraga equation

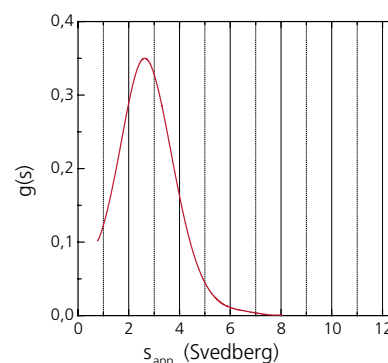
$$M_{s,\eta} = 2,407 \cdot 10^{25} \left( \frac{[\eta]s_0}{1 - \bar{v}\rho_0} \right)^{3/2} \cdot (k_{SB}[\eta])^{1/2}$$



**Figure 1**  
Set of sedimentation curves for a vegetable protein from UV-absorbance data



**Figure 2**  
Determination of the average sedimentation coefficient from data of Figure 1



**Figure 3**  
Distribution of sedimentation coefficients calculated from data of Figure 1