

Table 1. Parameters of reference dye ADS084BE in THF and of blue-light adapted cofactor RetA of HKR1 in HEPES/DDM pH 7.4 buffer used for saturable absorption calculations.

Parameter	ADS084BE	RetA	Comments
M_m (g·mol ⁻¹)	674.91	34520 ^{a)}	
η (Pa s)	4.8×10^{-4}	0.001	
ρ (g cm ⁻³)	1.4	1.4	Assumed [12]
V_m (nm ³)	0.767	40.9 ^{a)}	$V_m = M_m / (N_A \rho)$
Θ (K)	293	293	Experimental
λ_p (nm)	400	400	Experimental
Δt_p (ps)	5	5	Experimental
σ_p (cm ²)	2.263×10^{-16} [5]	Best fit: $(2 \pm 0.2) \times 10^{-16}$	
σ_{ex} (cm ²)	Best fit: 4.35×10^{-17}	Best fit: $(1.29 \pm 0.32) \times 10^{-16}$	
τ_f (s)	1.5×10^{-9} [5]	3.64×10^{-11} ^{b)} [7]	
τ_{FC} (s)	5×10^{-13}	5×10^{-13}	Assumed [13]
τ_{ex} (s)	6×10^{-15}	6×10^{-15}	Assumed [14]
τ_{or} (s)	9.1×10^{-11}	9.1×10^{-8}	$\tau_{or} = \eta V_m / (k_B \Theta)$ [9]

a: of HKR1 rhodopsin. b: mean excited-state lifetime τ_m [7]. Abbreviations: M_m : molar mass. η : viscosity. ρ : mass density. V_m : molecule volume. Θ : temperature. k_B : Boltzmann constant. λ_p : pump laser wavelength. Δt_p : pump laser pulse duration (FWHM). σ_p : ground-state absorption cross-section at pump laser wavelength. σ_{ex} : excited-state absorption cross-section at pump laser wavelength. τ_f : fluorescence lifetime. τ_{FC} : Franck-Condon relaxation time. τ_{ex} : higher excited-state lifetime. τ_{or} : molecular reorientation time.

- [5] Bansal, A.K., Holzer, W., Penzkofer, A. and Kley, E.B. (2008) Spectroscopic and Lasing Characterisation of a Dicarbazovinylene-MEH-Benzene Dye. *Optics Communications*, **281**, 3806-3819. <http://dx.doi.org/10.1016/j.optcom.2008.03.032>
- [7] Penzkofer, A., Luck, M., Mathes, T. and Hegemann, P. (2014) Bistable Retinal Schiff Base Photo-Dynamics of Histidine Kinase Rhodopsin HKR1 from *Chlamydomonas reinhardtii*. *Photochemistry and Photobiology*, in print. <http://dx.doi.org/10.1111/php.12246>
- [9] Valeur, B. (2002) *Molecular Fluorescence. Principles and Applications*, Wiley-VCH, Weinheim, Germany.
- [12] Fischer, H., Polikarpov, I. and Craievich, A. (2004) Average Protein Density is a Molecular-Weight-Dependent Function. *Protein Science*, **13**, 2825-2828. <http://dx.doi.org/10.1110/ps.04688204>
- [13] Penzkofer, A., Falkenstein, W. and Kaiser, W. (1976) Vibronic Relaxation in the S₁-State of Rhodamine Dye Solutions. *Chemical Physics Letters*, **44**, 82-87. [http://dx.doi.org/10.1016/0009-2614\(76\)80414-9](http://dx.doi.org/10.1016/0009-2614(76)80414-9)
- [14] Graf, F. and Penzkofer, A. (1985) S_n-State Lifetime Determination of Dyes. *Optical and Quantum Electronics*, **17**, 53-68. <http://dx.doi.org/10.1007/BF00619994>