Table D – Inorganic and Organic Solutes in Nonaqueous Solutions

A record of inorganic and organic solute reactions with Mu in solvents other than water

The data presented refers to ambient temperatures (293-298K) and normal pressure unless otherwise specified.

Code	Ion	Reaction	Type of Reaction	k_M (in $dm^3mol^{-1}s^{-1}$)	Notes about measurement	Reference	k_H (in $dm^3mol^{-1}s^{-1}$)	Notes about measurement	Reference	KIE = k_M / k_H
D1	Iodine (I_2) in n-hexane	$I_2 + Mu \rightarrow MuI + I$ (possibly $\mu^+ + I_2^-$)	probably abstraction but possibly reduction – electron transfer	$(2.9 \pm 1.0) \times 10^{11}$	N/A	Jean, Y.C., Ng, B.W., Ito, Y., Nguyen, T.Q. and Walker, D.C. *Hyperfine Interact.,* 1981, **8**, 351.	N/A			
D2	Iodine (I_2) in n-heptane	$I_2 + Mu \rightarrow MuI + I$ (possibly $\mu^+ + I_2^-$)	probably abstraction but possibly reduction – electron transfer	$(5.7 \pm 2.2) \times 10^{11}$	N/A	Stadlbauer, J.M., Venkateswaran, K., Porter, G.B. and Walker, D.C. *J. Phys. Chem.,* 1997**,** **101**, 4741.				
D3	Iodine (I_2) in methanol	$I_2 + Mu \rightarrow MuI + I$ (possibly $\mu^+ + I_2^-$)	probably abstraction but possibly reduction – electron transfer	$(7.0 \pm 1.2) \times 10^{10}$	N/A	Stadlbauer, J.M., Venkateswaran, K., Porter, G.B. and Walker, D.C. *J. Phys. Chem.,* 1997**,** **101**, 4741.				
D4	Nitrate ion NO^-_3 in methanol	$NO^-_3 + Mu \rightarrow N(OMu)O^-_2$ (?)	combination	$(1.1 \pm 0.3) \times 10^9$	N/A	Karolczak, S., Gillis, H.A., Porter, G.B. and Walker, D.C. Can. J. Chem., 2003 (in press)				
D5	Nitrite ion NO^-_2 in methanol	$NO^-_2 + Mu \rightarrow MuNO^-_2$ (?)	combination	$(5.3 \pm 1.5) \times 10^9$	N/A	Karolczak, S., Gillis, H.A., Porter, G.B. and Walker, D.C. Can. J. Chem., 2003 (in press)				
D6	Acetone in n-heptane	$(CH_3)_2C{=}O + Mu \rightarrow (CH_3)_2C(OMu)$	addition to carbonyl C=O bond with Mu attached to O atom (by analogy to reaction of Mu in aqueous solution)	$(1.05 \pm 0.2) \times 10^9$	N/A	Stadlbauer, J.M., Venkateswaran, K. and Walker, D.C. *Can. J. Chem.,* 1997, **75**, 74.				
D7	Aniline in h-hexane	$C_6H_5NH_2 + Mu \rightarrow MuC_6H_5NH_2$	addition into benzene ring	$(6.7 \pm 0.8) \times 10^9$	N/A	Louwrier, P.W.F., Brinkman, G.A. and Roduner, E. *Hyperfine Interact.,* 1986, **32**, 831.				
D8	Benzene - neat	$C_6H_6 + Mu \rightarrow MuC_6H_6$	addition into benzene ring	$(8.9 \pm 0.6) \times 10^9$ *(deduced indirectly)*	N/A	Roduner, E. *Hyperfine Interact.,* 1984, **17-19**, 785.				

D9	Benzene in n-hexane	$C_6H_6 + Mu \rightarrow MuC_6H_6$	addition into benzene ring	$(3.7 \pm 0.08) \times 10^9$	$E_a = (2 \pm 2)$ kJ mol^{-1}	Louwrier, P.W.F., Brinkman, G.A. and Roduner, E. *Hyperfine Interact.,* 1986, **32**, 831.	N/A
D10	Benzene in isopentane	$C_6H_6 + Mu \rightarrow MuC_6H_6$	addition into benzene ring	4.51×10^9	$E_a = (6.0 \pm 1.0)$ kJ mol^{-1} for T = 136.4 K to 295.0 K	Ganti, R. and Jean, Y.C. *Hyperfine Interact.,* 1986, **32**, 819.	
D11	Benzene in methanol	$C_6H_6 + Mu \rightarrow MuC_6H_6$	addition into benzene ring	$(8.51 \pm 1.3) \times 10^9$	N/A	Louwrier, P.W.F., Brinkman, G.A. and Roduner, E. *Hyperfine Interact.,* 1986, **32**, 831.	
D12	Carbon tetrachloride in methanol	$CCl_4 + Mu \rightarrow MuCl + CCl_3$	most likely abstraction	$\approx 5 \times 10^8$	N/A	Roduner, E. *Hyperfine Interact.,* 1984, **17-19**, 785.	
D13	1,4-Difluorobenzene in n-hexane	$p\text{–}C_6H_4F_2 + Mu \rightarrow p\text{-}C_6H_4F_2Mu$	addition into benzene ring	$(2.5 \pm 0.5) \times 10^9$	N/A	Louwrier, P.W.F., Brinkman, G.A. and Roduner, E. *Hyperfine Interact.,* 1986, **32**, 831.	
D14	2,3-Dimethylbutadiene-1,3 (DMBD) in n-hexane	$CH_2 = C(CH_3)\text{–}(CH_3)C=CH_2 + Mu \rightarrow MuCH_2(CH_3)\text{–}(CH_3)C=CH_2$	addition across C=C bond (formation of 1,1,2-trimethyl allyl radical)	$(1.4 \pm 0.2) \times 10^{11}$	T = 288 K $E_a = (6.5 \pm 1.7)$ kJ mol^{-1} for T = 185 K to 333 K	Roduner, E., Louwrier, P.W.F., Brinkman, G.A., Garner, D.M., Reid, D., Arseneau, D.J., Senba, M. and Fleming, D.G. Ber. Bunsenges. Phys. Chem., 1990, 94, 1224.	
D15	2,3-Dimethylbutadiene-1,3 in acetone	$CH_2 = C(CH_3)\text{–}(CH_3)C=CH_2 + Mu \rightarrow MuCH_2\text{–}C(CH_3)\text{–}(CH_3)C=CH_2$	addition across C=C bond (formation of 1,1,2-trimethyl allyl radical)	$(9.1 \pm 1.9) \times 10^{10}$ *(deduced indirectly)*	N/A	Roduner, E. *Radiat. Phys. Chem.,* 1986, **28**, 75	
D16	2,3-Dimethylbutadiene-1,3 (DMBD) in methanol	$CH_2 = C(CH_3)\text{–}(CH_3)C=CH_2 + Mu \rightarrow MuCH_2C(CH_3)\text{–}(CH_3)C=CH_2$	addition across C=C bond (formation of 1,1,2-trimethyl allyl radical)	$(7.4 \pm 0.1) \times 10^{10}$	T = 289 K	Roduner, E., Louwrier, P.W.F., Brinkman, G.A., Garner, D.M., Reid, D., Arseneau, D.J., Senba, M. and Fleming, D.G. Ber. Bunsenges. Phys. Chem., 1990, 94, 1224.	

D17	2,3-Dimethylbutadiene-2,3 (DMBD) in n-octane	CH_2 = $C(CH_3)$–$(CH_3)C=CH_2$ + Mu → $(Mu)CH_2C(CH_3)$–$(CH_3)C=CH_2$ + Mu	addition across C=C bond (formation of 1,1,2-trimethyl allyl radical)	$(8.8 \pm 1.1) \times 10^{10}$	T = 294 K	Roduner, E., Louwrier, P.W.F., Brinkman, G.A., Garner, D.M., Reid, D., Arseneau, D.J., Senba, M. and Fleming, D.G. Ber. Bunsenges. Phys. Chem., 1990, 94, 1224.	N/A
D18	Dimethylsulfoxide (DMSO) - neat	(CH_2)SO + Mu → $(CH_3)_2SOMu$	probably addition to S=O bond	$\approx 3 \times 10^8$ *(value estimated)*	N/A	Roduner, E. *Hyperfine Interact.,* 1986, **32**, 741.	
D19	2,2,4,4-Tetramethyl-3-pentanone in n-heptane (di-tert-butyl ketone – DTBK)	$(CH_3)_3C(=O)(CH_3)_3$ + Mu → $(CH_3)_3C(OMu)(CH_3)_3$	addition across C=O bond with Mu attached to O atom	$(6.6 \pm 1.5) \times 10^8$	N/A	Stadlbauer, J.M., Venkateswaran, K. and Walker, D.C. *Can. J. Chem.,* 1997, **75**, 74.	
D20	TEMPO-2,2,6,6-tetramethyl-1-piperidinyloxy (free radical) in n-hexane	TEMPO + Mu → TEMPO(Mu) TEMPO +Mu (↑↑)→ TEMPO + Mu(↑↓)	combination and spin (?) exchange	$(8.0 \pm 2.0) \times 10^{10}$	N/A	Karolczak, S., Gillis, H.A., Porter, G.B. and Walker, D.C. *Can. J. Chem.*, 2003, **81**, 175	
D21	TEMPO-2,2,6,6-tetramethyl-1-piperidinyloxy (free radical) in n-methanol	TEMPO + Mu → TEMPO(Mu) TEMPO +Mu (↑↑) → TEMPO + Mu(↑↓)	combination and spin (?) exchange	$(4.8 \pm 0.7) \times 10^{10}$	N/A	Karolczak, S., Gillis, H.A., Porter, G.B. and Walker, D.C. *Can. J. Chem.*, 2003, **81**, 175	
D22	TEMPO-OH 2,2,6,6-tetramethyl-4-hydroxy-1-piperidinyloxy (free radical) in n-hexane	TEMPO-OH + Mu → OH-TEMPO-Mu TEMPO-OH +Mu (↑↑) → OH-TEMPO + Mu(↑↓)	combination and spin (?) exchange	$(6.0 \pm 2.0) \times 10^{10}$	N/A	Karolczak, S., Gillis, H.A., Porter, G.B. and Walker, D.C. *Can. J. Chem.*, 2003, **81**, 175	

D23	TEMPO-OH-2,2,6,6-tetramethyl-4-hydroxy-1-piperidinyloxy (free radical) in n-methanol	TEMPO-OH + Mu → OH-TEMPO (Mu) TEMPO-OH +Mu (↑↑) → TEMPO-OH + Mu(↑↓)	combination and spin (?) exchange	$(5.0 \pm 1.0) \times 10^{10}$	N/A	Karolczak, S., Gillis, H.A., Porter, G.B. and Walker, D.C. *Can. J. Chem.*, 2003, **81**, 175	N/A
D24	Ethylene in methane	$CH_2=CH_2 + Mu \rightarrow (Mu)CH_2–CH_2$	addition across olefinic bond	2.1×10^{10}	T = 110 K $A = 1.9 \times 10^{11}$ $dm^3mol^{-1}s^{-1}$ $E_a = (1.7 \pm 0.4)$ kJ mol^{-1} for T = 83 K to 110 K	Jean, Y.C., Ganti, R.L., Cheng, K.L., Venkateswaran, K. and Walker, D.C. *Hyperfine Interact.*, 1986, **32**, 813.	
D25	Ethylene in 2-methylbutane	$CH_2=CH_2 + Mu \rightarrow (Mu)CH_2–CH_2$	addition across olefinic bond	2.6×10^{10}	T = 295 K $A = 1.5 \times 10^{11}$ $dm^3mol^{-1}s^{-1}$ $E_a = (4.3 \pm 0.7)$ kJ mol^{-1} for T = 133 K to 298 K	Jean, Y.C., Ganti, R.L., Cheng, K.L., Venkateswaran, K. and Walker, D.C. *Hyperfine Interact.*, 1986, **32**, 813.	
D26	Hexafluorobenzene in n-hexane	$C_6F_6 + Mu \rightarrow MuC_6F_6$	addition into benzene ring	$(6 \pm 4) \times 10^7$	N/A	Louwrier, P.W.F., Brinkman, G.A. and Roduner, E. *Hyperfine Interact.*, 1986, **32**, 831.	
D27	Naphthalene in n-hexane	$C_{10}H_8 + Mu \rightarrow MuC_{10}H_8$	addition	$(1.3 \pm 0.2) \times 10^{11}$	N/A	Jean, Y.C., Ng, B.W., Stadlbauer, J.M. and Walker, D.C. *J. Chem. Phys.*, 1981, **75**, 2879.	
D28	Nitrobenzene in n-hexane	$C_6H_5NO_2 + Mu \rightarrow MuC_6H_5NO_2$	addition	$(1.3 \pm 0.15) \times 10^{10}$	N/A	Karolczak, S., Gillis, H.A., Porter, G.B. and Walker, D.C. *Can. J. Chem.*, 2003, **81**, 175	
D29	Phenol in n-hexane	$C_6H_5OH + Mu \rightarrow MuC_6H_5OH$	addition into benzene ring	$(7 \pm 1.0) \times 10^9$	N/A	Ito, Y., Ng, B.W., Jean, Y.C. and Walker, D.C. *Can. J. Chem.*, 1980, **58**, 2395.	
D30	Phenol in methanol	$C_6H_5OH + Mu \rightarrow MuC_6H_5OH$	addition into benzene ring	$(3.3 \pm 1.0) \times 10^{10}$	N/A	Jean, Y.C., Ng, B.W., Stadlbauer, J.M. and Walker, D.C. *J. Chem. Phys.*, 1981, **75**, 2879.	

D31	2-Propanol in n-hexane	$CH_3CH(OH)CH_3 + Mu \rightarrow CH_3C(OH)CH_3$	H-abstraction	7×10^6	N/A	Venkateswaran, K., Barnabas, M.V., Wu, Z., Stadlbauer, J.M., Ng, B.W. and Walker, D.C. *Chem. Phys. Lett.,* 1988, **143**, 313.	N/A
D32	Styrene in n-hexane	$C_6H_5–CH=CH_2 + Mu \rightarrow C_6H_5–CH\text{-}CH_2\ Mu$	addition mainly to vinyl bond	$(6.0 \pm 0.6) \times 10^{10}$	N/A	Louwrier, P.W.F., Brinkman, G.A. and Roduner, E. *Hyperfine Interact.,* 1986, **32**, 831	