Critical Review of Rate Constants for Reactions of Hydrated Electrons, Hydrogen Atoms and Hydroxyl Radicals (·OH/·O⁻) in Aqueous Solution

George V. Buxton

University of Leeds, Cookridge Radiation Research Centre, Leeds, LS16 6QB, England

Clive L. Greenstock

Medical Biophysics Branch, Whiteshell Nuclear Research Establishment, Atomic Energy of Canada Limited Research Company, Pinawa, Manitoba, Canada, ROE 1LO

and

W. Phillip Helman and Alberta B. Ross

Radiation Chemistry Data Center, Radiation Laboratory, University of Notre Dame, Notre Dame, Indiana 46556

Received June 23, 1987; revised manuscript received October 29, 1987

Kinetic data for the radicals H· and ·OH in aqueous solution, and the corresponding radical anions, ·O⁻ and e_{aq}^-, have been critically reviewed. Reactions of the radicals in aqueous solution have been studied by pulse radiolysis, flash photolysis and other methods. Rate constants for over 3,500 reactions are tabulated, including reactions with molecules, ions and other radicals derived from inorganic and organic solutes.

Key words: aqueous solution; chemical kinetics; critical review; data compilation; hydrated electron; hydrogen atom; hydroxyl radical; rate constants.

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TABLE 8. Rate constants for reactions of hydroxyl radicals in aqueous solution—Continued

No.	Reaction	pH	k (L mol^{-1} s^{-1})	Comment	Ref.
586	***N,N*-Dimethylaniline**—Continued				
		9	1.4×10^{10}	p.r.; P.b.k.; adduct obs. at 380 nm and gives radical cation (465 nm), H abstr. product obs. at 330 nm in ratio of 1:2 with radical cation.	771126
			1.3×10^{10}	p.r.; P.b.k. at 455 and 330 nm in unbuffered soln.	720289
587	***N,N*-Dimethylanilinium ion** $\cdot OH + C_6H_5NH(CH_3)_2^+ \rightarrow$	1	2.2×10^9	Fenton; C.k.; rel. to $k(\cdot OH + Fe^{2+})$.	490003
588	**2,3-Di-*O*-methyl-L-ascorbic acid** $\cdot OH + 2,3\text{-}(CH_3)_2A \rightarrow$ 2,3-$(CH_3)_2$A-OH	6.5-6.8	4.2×10^9	p.r.; P.b.k. at 335 nm.	84A095
589	**1,1'-Dimethyl-4,4'-bipyridinium ion** $\cdot OH + MV^{2+} \rightarrow MV(OH)^{2+}$	7	2.5×10^8	p.r.; P.b.k. at 470 nm in soln. contg. 5.4×10^{-4} mol L^{-1} methyl viologen and 2.8×10^{-2} mol L^{-1} N_2O.	85A099
590	**3,3-Dimethylbutyrate ion** $\cdot OH + (CH_3)_3CCH_2CO_2^- \rightarrow$	9	1.7×10^9	γ-r.; C.k. with RNO; rel. to $k(\cdot OH + EtOH)$.	660423
591	**2,2-Dimethyl-1,3-dioxolane** $\cdot OH + \text{-}OC(CH_3)_2O(CH_2)_2\text{-} \rightarrow H_2O +$ $\text{-}OC(CH_3)_2O\dot{C}HCH_2\text{-}$		2.1×10^9	p.r.; rel. to $k(\cdot OH + SCN^-)$.	80A441
592	**Dimethyl disulfide** $\cdot OH + CH_3SSCH_3 \rightarrow OH^- +$ $[CH_3SSCH_3]\cdot^+$	~4	1.7×10^{10}	p.r.; P.b.k.; obs. radical cation formn. (~50% OH addn.); same rate constant by c.k. with SCN^-.	751089
593	**Dimethyl ether** $\cdot OH + CH_3OCH_3 \rightarrow H_2O +$ $\cdot CH_2OCH_3$		1.0×10^9	p.r.; rel. to $k(\cdot OH + SCN^-)$.	80A441
594	***N,N*-Dimethylformamide** $\cdot OH + HCON(CH_3)_2 \rightarrow$ $HCON(CH_3)\dot{C}H_2 + H_2O$	5.5	1.7×10^9	p.r.; C.k.; rel. to $k(\cdot OH + SCN^-)$.	700098
595	**2,5-Dimethyl-3-hexyne-2,5-diol** $\cdot OH + HOC(CH_3)_2C{\equiv}CC(CH_3)_2OH \rightarrow$	1	3.3×10^9	Fenton; C.k.; $k(\cdot OH + MeOH)/k(\cdot OH + Fe^{2+}) = 4.3$; rel. to $k(\cdot OH + MeOH)$.	739350
596	**1,1-Dimethylhydrazine** $\cdot OH + (CH_3)_2NNH_2 \rightarrow$ $\cdot CH_2N(CH_3)NH_2 + (CH_3)_2\dot{N}NH +$ H_2O	9.7	1.6×10^{10}	p.r.; C.k.; rel. to $k(\cdot OH + SCN^-)$.	720003
597	**1,2-Dimethylhydrazine** $\cdot OH + CH_3NHNHCH_3 \rightarrow$ $\cdot CH_2NHNHCH_3 + CH_3\dot{N}NHCH_3 +$ H_2O	10.1	1.4×10^{10}	p.r.; C.k.; rel. to $k(\cdot OH + SCN^-)$.	720003
598	**1,1-Dimethylhydrazinium ion** $\cdot OH + (CH_3)_2NNH_3^+ \rightarrow$	3.5	8.1×10^8	p.r.; C.k.; $pK_a = 7.21$; rel. to $k(\cdot OH + SCN^-)$.	720003
599	**1,2-Dimethylhydrazinium ion** $\cdot OH + CH_3NHNH_2CH_3^+ \rightarrow$	3.5	7.2×10^8	p.r.; C.k.; $pK_a = 7.52$; rel. to $k(\cdot OH + SCN^-)$.	720003
600	**1,2-Dimethylindole** $\cdot OH + 1,2\text{-}(CH_3)_2In \rightarrow$	9.0	1×10^{10}	γ-r.; C.k.; rel. to $k(\cdot OH + TrpH)$.	710556
601	**1,3-Dimethylindole** $\cdot OH + 1,3\text{-}(CH_3)_2In \rightarrow$	9.0	1.1×10^{10}	γ-r.; C.k.; rel. to $k(\cdot OH + TrpH)$.	710556
602	**2,3-Dimethylindole** $\cdot OH + 2,3\text{-}(CH_3)_2In \rightarrow$	9.0	1.3×10^{10}	γ-r.; C.k.; rel. to $k(\cdot OH + TrpH)$.	710556
603	***N,N*-Dimethyl-4-nitrosoaniline** $\cdot OH + Me_2NC_6H_4NO \rightarrow$ $Me_2NC_6H_4\dot{N}O_2^-$		**1.25×10^{10}**	**Selected value.**	