

Critical Review of Rate Constants for Reactions of Hydrated Electrons, Hydrogen Atoms and Hydroxyl Radicals ($\cdot\text{OH}/\cdot\text{O}^-$) in Aqueous Solution

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Kinetic data for the radicals $\text{H}\cdot$ and $\cdot\text{OH}$ in aqueous solution, and the corresponding radical anions, $\cdot\text{O}^-$ 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.

Contents

| | | | |
|------------------------------------------------------------------------------------------------------------------|-----|------------------------------------------------------------------------------|-----|
| 1. General Introduction | 514 | 4. Reaction Rates for the Hydrated Electron.. | 520 |
| 1.1. Properties of e_{aq}^- , $\text{H}\cdot$, $\cdot\text{OH}$ and $\cdot\text{O}^-$ | 514 | 4.1. Methods | 520 |
| 1.1.1. The Hydrated Electron..... | 514 | 4.1.1. Direct Method | 520 |
| 1.1.2. The Hydrogen Atom..... | 516 | 4.1.2. Competition Kinetics..... | 520 |
| 1.1.3. The Hydroxyl Radical | 516 | 4.2. Evaluation of the Data..... | 521 |
| 2. Method of Generation of e_{aq}^- , $\text{H}\cdot$, $\cdot\text{OH}$ and $\cdot\text{O}^-$ | 517 | 4.2.1. Selected Rate Constants for e_{aq}^- | 521 |
| 2.1. Radiolysis of Water | 517 | 4.2.2. Ionic Strength Effects..... | 521 |
| 2.2. Other Methods..... | 517 | 5. Reaction Rates for the Hydrogen Atom.... | 521 |
| 2.2.1. Photolysis | 517 | 5.1. Methods | 521 |
| 2.2.2. High Frequency Electric Discharge | 518 | 5.1.1. Direct Method | 521 |
| 2.2.3. Sonolysis | 518 | 5.1.2. Competition Kinetics..... | 521 |
| 2.2.4. Fenton-Type Reactions..... | 518 | 5.2. Evaluation of the Data..... | 522 |
| 3. Kinetic Features of Reactions of Transient Species..... | 518 | 5.2.1. Selected Rate Constants for $\text{H}\cdot$ | 522 |
| 3.1. Direct Method..... | 518 | 6. Reaction Rates for the Hydroxyl Radical and the Oxide Radical Ion..... | 522 |
| 3.1.1. Sources of Error | 518 | 6.1. Methods | 522 |
| 3.2. Competition Kinetics | 519 | 6.1.1. Direct Method | 522 |
| 3.2.1. Sources of Error | 519 | 6.1.2. Competition Kinetics..... | 522 |
| 3.3. Steady-State Method | 519 | 6.1.3. Steady-State Method..... | 523 |
| 3.3.1. Sources of Error | 520 | 6.2. Evaluation of the Data..... | 523 |
| | | 6.2.1. Selected Rate Constants for $\cdot\text{OH}$ | 523 |
| | | 6.2.2. Selected Rate Constants for $\cdot\text{O}^-$ | 523 |
| | | 6.2.3. Comments on Data for $\cdot\text{O}^-$... | 523 |
| | | 7. Data Fitting and Statistical Analysis | 524 |
| | | 8. Activation Energies | 525 |

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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 | <i>N,N</i> -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 | <i>N,N</i> -Dimethylanilinium ion $\cdot\text{OH} + \text{C}_6\text{H}_5\text{NH}(\text{CH}_3)_2^+ \rightarrow$ | 1 | 2.2×10^9 | Fenton; C.k.; rel. to $k(\cdot\text{OH} + \text{Fe}^{2+})$. | 490003 |
| 588 | 2,3-Di- <i>O</i> -methyl-L-ascorbic acid $\cdot\text{OH} + 2,3-(\text{CH}_3)_2\text{A} \rightarrow$ $2,3-(\text{CH}_3)_2\text{A}\cdot\text{OH}$ | 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 $\cdot\text{OH} + \text{MV}^{2+} \rightarrow \text{MV}(\text{OH})^{2+}$ | 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 ₂ O. | 85A099 |
| 590 | 3,3-Dimethylbutyrate ion $\cdot\text{OH} + (\text{CH}_3)_3\text{CCH}_2\text{CO}_2^- \rightarrow$ | 9 | 1.7×10^9 | γ -r.; C.k. with RNO; rel. to $k(\cdot\text{OH} + \text{EtOH})$. | 660423 |
| 591 | 2,2-Dimethyl-1,3-dioxolane $\cdot\text{OH} + -\text{OC}(\text{CH}_3)_2\text{O}(\text{CH}_2)_2- \rightarrow \text{H}_2\text{O} +$ $-\text{OC}(\text{CH}_3)_2\text{OCHCH}_2-$ | | 2.1×10^9 | p.r.; rel. to $k(\cdot\text{OH} + \text{SCN}^-)$. | 80A441 |
| 592 | Dimethyl disulfide $\cdot\text{OH} + \text{CH}_3\text{SSCH}_3 \rightarrow \text{OH}^- +$ $[\text{CH}_3\text{SSCH}_3]^+$ | ~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 $\cdot\text{OH} + \text{CH}_3\text{OCH}_3 \rightarrow \text{H}_2\text{O} +$ $\cdot\text{CH}_2\text{OCH}_3$ | | 1.0×10^9 | p.r.; rel. to $k(\cdot\text{OH} + \text{SCN}^-)$. | 80A441 |
| 594 | <i>N,N</i> -Dimethylformamide $\cdot\text{OH} + \text{HCON}(\text{CH}_3)_2 \rightarrow$ $\text{HCON}(\text{CH}_3)\dot{\text{C}}\text{H}_2 + \text{H}_2\text{O}$ | 5.5 | 1.7×10^9 | p.r.; C.k.; rel. to $k(\cdot\text{OH} + \text{SCN}^-)$. | 700098 |
| 595 | 2,5-Dimethyl-3-hexyne-2,5-diol $\cdot\text{OH} + \text{HOC}(\text{CH}_3)_2\text{C}\equiv\text{CC}(\text{CH}_3)_2\text{OH} \rightarrow$ | 1 | 3.3×10^9 | Fenton; C.k.; $k(\cdot\text{OH} + \text{MeOH})/k(\cdot\text{OH} + \text{Fe}^{2+}) = 4.3$; rel. to $k(\cdot\text{OH} + \text{MeOH})$. | 739350 |
| 596 | 1,1-Dimethylhydrazine $\cdot\text{OH} + (\text{CH}_3)_2\text{NNH}_2 \rightarrow$ $\cdot\text{CH}_2\text{N}(\text{CH}_3)\text{NH}_2 + (\text{CH}_3)_2\text{NNH}\cdot +$ H_2O | 9.7 | 1.6×10^{10} | p.r.; C.k.; rel. to $k(\cdot\text{OH} + \text{SCN}^-)$. | 720003 |
| 597 | 1,2-Dimethylhydrazine $\cdot\text{OH} + \text{CH}_3\text{NHNHCH}_3 \rightarrow$ $\cdot\text{CH}_2\text{NHNHCH}_3 + \text{CH}_3\text{NNHCH}_3 +$ H_2O | 10.1 | 1.4×10^{10} | p.r.; C.k.; rel. to $k(\cdot\text{OH} + \text{SCN}^-)$. | 720003 |
| 598 | 1,1-Dimethylhydrazinium ion $\cdot\text{OH} + (\text{CH}_3)_2\text{NNH}_3^+ \rightarrow$ | 3.5 | 8.1×10^8 | p.r.; C.k.; $\text{p}K_a = 7.21$; rel. to $k(\cdot\text{OH} + \text{SCN}^-)$. | 720003 |
| 599 | 1,2-Dimethylhydrazinium ion $\cdot\text{OH} + \text{CH}_3\text{NHNH}_2\text{CH}_3^+ \rightarrow$ | 3.5 | 7.2×10^8 | p.r.; C.k.; $\text{p}K_a = 7.52$; rel. to $k(\cdot\text{OH} + \text{SCN}^-)$. | 720003 |
| 600 | 1,2-Dimethylindole $\cdot\text{OH} + 1,2-(\text{CH}_3)_2\text{In} \rightarrow$ | 9.0 | 1×10^{10} | γ -r.; C.k.; rel. to $k(\cdot\text{OH} + \text{TrpH})$. | 710556 |
| 601 | 1,3-Dimethylindole $\cdot\text{OH} + 1,3-(\text{CH}_3)_2\text{In} \rightarrow$ | 9.0 | 1.1×10^{10} | γ -r.; C.k.; rel. to $k(\cdot\text{OH} + \text{TrpH})$. | 710556 |
| 602 | 2,3-Dimethylindole $\cdot\text{OH} + 2,3-(\text{CH}_3)_2\text{In} \rightarrow$ | 9.0 | 1.3×10^{10} | γ -r.; C.k.; rel. to $k(\cdot\text{OH} + \text{TrpH})$. | 710556 |
| 603 | <i>N,N</i> -Dimethyl-4-nitrosoaniline $\cdot\text{OH} + \text{Me}_2\text{NC}_6\text{H}_4\text{NO} \rightarrow$ $\text{Me}_2\text{NC}_6\text{H}_4\text{NO}_2$ | | 1.25×10^{10} | Selected value. | |