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U.S. DEPARTMENT OF COMMERCE/National Bureau of Standards

Ozone Reactions in Aqueous Solutions -- A Bibliography

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[2]Some divisions within the center are located at Boulder, CO 80303.

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OZONE REACTIONS IN AQUEOUS SOLUTIONS

-- A BIBLIOGRAPHY

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A reaction oriented list of references is provided for published papers and reports containing rate data or information on mechanism for reactions of ozone with various substrates in aqueous solutions. Catalyzed, as well as uncatalyzed, reactions are included. One hundred and sixty-four papers are listed. The period covered extends from 1913 to 1981.

Key words: aqueous solution; bibliography; chemical kinetics; decomposition; mechanism; oxidation; ozone; rate constant; reaction.

This bibliography lists papers and reports on the reactions of ozone with various substrates in aqueous solutions. Catalyzed reactions, as well as uncatalyzed reactions, are included.

The first study of ozone reactions in aqueous solutions was performed in 1913 by V. Rothmund and A. Burgstaller, who studied the rate of decomposition of ozone in water. In 1917 the same authors studied the reaction between ozone and hydrogen peroxide. The study of ozone decomposition in water was continued by F. Kawamura (1932), K. Sennewald (1933), F. Weiss (1935), W. C. Bray (1938), and H. Taube and W. C. Bray (1940). H. Taube examined the reactions of ozone with formic acid (1941), with bromide ion (1942) and chloride ion (1949). Ozone decomposition was studied again by M. C. Alder and G. R. Hill (1950), W. Stumm (1954), E. Abel (1955), and Kilpatrick et al. (1956), while E. Abel studied also the reaction of ozone with hydrogen peroxide. Since 1970 there has been a large increase in the number of papers published in this subject area. The present bibliography includes 164 papers and reports dealing with such reactions. The period covered extends from 1913 to 1981.

ARRANGEMENT OF THE REPORT

This bibliography is in two parts:

Part I. Guide to data contained in references. Each entry consists of a reference code and a property code. These are discussed below.

Part II. References

Ordering of Entries

In both parts of this report, entries are ordered chronologically beginning with the earliest papers and within each year alphabetically by author's name.

Reference Code

Each paper or report included in Part I is indicated by a brief reference code consisting of a string of characters showing:

1) Year of publication (last two digits)
2) Author or first two authors, using the first three letters of each last name (patronymic). When two names are present they are separated by a slash.
3) If necessary, a digit is added to distinguish among papers that would have the same code according to rules (1) and (2).

Examples:

42 TAU
70 SHA/KOZ
72 IVA/NIK
72 IVA/NIK2

The total length of the string, including the digit, may be no longer than 11 characters. A code without added digit has, implicitly, the digit 1 associated with it.

Property Code

The property code follows the reference code for each entry in Part I. The code consists of abbreviations which are used for data flagging. In this publication only the following listed four abbreviations are used for data flagging:

Dec	(Decomposition)
Mec	(Mechanism)
RR	(Reaction Rate Data as: Rate constant, relaxation time, etc.)
Rxn with:	(Reaction with other compounds)

References

Part II includes the same reference codes (or "short references") as Part I, in the same order, followed by the complete reference which gives: the name of author(s), the full title of the paper, and the name of the journal followed by the volume number, page, and year of publication. The full reference format is demonstrated below:

50 ALD/HIL Alder, M. G., and Hill, G. A., "The Kinetics and Mechanism of Hydroxide Ion Catalyzed Ozone Decomposition in Aqueous Solution," J. Am. Chem. Soc. 72, 1884 (1950).

Part I. Guide to Data Contained in References.
For explanation of reference codes and property codes used see Guidelines for the User.

13 ROT/BUR Dec, RR

17 ROT/BUR Rxn with: H_2O_2; RR

32 KAW Dec, RR

33 SEN Dec, RR

34 KAW Dec, RR

35 WEI Dec, Rxn with: H_2O_2; RR

37 VAS/KAS Rxn with: $SO_2 + H_2O$; Mec, RR

38 BRA Rxn with: H_2O_2; RR

40 TAU/BRA Rxn with: H_2O_2; Mec, RR

41 TAU Rxn with: HCOOH; Mec, RR

42 TAU Rxn with: Br^-, Mec, RR

48 HIL Rxn with: CO^{2+}; Mec, RR

49 YEA/TAU Rxn with: Cl^-; RR

50 ALD/HIL Dec, Mec, RR

54 STU Dec, RR

55 ABE Dec, Mec

55 ABE2 Rxn with: H_2O_2; Mec, RR

56 KIL/HER Dec, RR

58 KLE/NAL Rxn with: CH_3OOH; RR

59 KHA/BAR Rxn with: CN^-; RR

61 SON/DOD Rxn with: CN^-; Mec

62 RAU/SII Dec, RR

65 CON/HAM Rxn with: Fe^{+2}; RR

67 LUN/KUS Rxn with: NO_2^-, SeO_3^{2-}, AsO_3^{3-}, PO_3^{3-}, Ag^+, Mn^{2+}; Mec

67 WAG/ECK Rxn with: Cu^{2+}

68 CZA/SAM Dec, RR

68 EIS Rxn with: C_6H_5-OH; Mec

68 GRI/SHA Rxn with: $N_2H_5^+$ salts; Mec

68 ILN/KHE Rxn with: Pyrenes and Anthracenes

68 SEN/IKE Rxn with: Mn^{2+}

70 LUN/FRA Rxn with: NO_2^-, HPO_3^{2-}, SeO_3^{2-}; Mec

70 KAN/MOK Rxn with: cy-C_6H_{12}; Mec

70 ROG Dec, RR

70 SHA/KOZ Rxn with Np(VI); RR

71 EIS Rxn with: C_6H_5OH; Mec

71 HEW/DAV Dec, RR

71 MER/LOV Dec, RR

71 ROG Rxn with: $(CH_3)_2NH$

71 SHE/MAR Rxn with: Phosphamide

71 VYA/DAV Rxn with: Pu(IV)

72 BAL/SEL Rxn with: CN^-; RR

72 DON/EHR Rxn with: Carbon black; Mec

72 GOU Rxn with: C_6H_5OH; RR, Mec

72 IVA/NIK Dec, RR, Mec

72 IVA/NIK2 Rxn with: Ce^{3+}, Ag^+; RR, Mec

72 KRI/MUR Rxn with: $[Re(en)_2O_2]^+$; RR

72 PEN Rxn with: SO_2, NO_2, H_2S; RR

72 RAZ/GLO Rxn with: C_6H_5OH; RR

72 VYA/DAV Rxn with: Pu(IV); RR

73 DUD Rxn with: Br^-

73 GOR/BAS Rxn with: CH_3COCH_3

73 GOR/GOR Rxn with: CH_3COCH_3; Mec

73 GOR/KOZ Dec, RR, Mec

73 GOR/KOZ2 Dec, RR, Mec

73 GOR/VOD Dec, Rxn with: RH, ROH, RCHO, R_2CO, etc.

73 KAN/MOK Rxn with: cy-C_5H_{10}

73 SHA/VYA Rxn with: Ce^{3+}; RR, Mec

73 SHE Rxn with: I^-

73 TAK/OKU Rxn with: $Na_2S_2O_3$; Mec

74 GER/KUR Rxn with: $CH_3CH_2COCH_3$; RR

74 GIL Rxn with: mono-, and poly-Chlorophenols

74 GOR/BAS Rxn with: Ag^+; RR, Mec

74 GOR/KOZ Dec, RR, Mec

74 KOM/GER Rxn with: $CH_3CH_2COCH_3$; RR, Mec

74 PAK/KRA Rxn with: CH_3OH, CH_3CH_2OH, C_4H_9OH, $C_8H_{17}OH$

74 SHU/NIK Rxn with: Ru(III), Ru(IV)

74 ZAM/KUN Rxn with: C_6H_5OH

75 CHT/AKO Rxn with: W, WS_2

75 CHU/KOK Rxn with: $Pb(NO_3)_2$

75 GOR Dec

75 KOC/MEJ Rxn with: Sulfonates and Sulfates

75 KUR/SAK Rxn with: Tryptophan

75 LYS/ATY Rxn with: $(CH_3)_2NNH_2$; Mec

75 MAT/FUJ Rxn with: CN^-; RR

75 NIK/IVA Rxn with: Np^{4+}, Pu^{4+}; RR, Mec

75 TAR/MAR Rxn with: α-Naphthol

75 TYU/YAK Rxn with: Sulfates, Pyridines, Pyrazoles, Nicotinic Acid; RR, Mec

75 VEB/GAE Rxn with: Acrylonitrile

76 CHU Rxn with: Sn^{2+}

76 CHU/MAS Rxn with: NCS^-

76 HOI/BAD Rxn with: Benzene, o-Xylene, Styrene, Aniline, Phenols, Alcohols; RR

76 JOY Rxn with: Arylsulfonic acids

76 KHE/DUD Rxn with: Br^-

76 PEL Dec

76 TOZ/NIS Rxn with: As(III)

77 CHE/LEB Rxn with: Ce(III), Bk(III)

77 ERI/YAT Rxn with: SO_2; RR, Mec

77 GAL/GAL Rxn with: 1-(p-Nitrophenyl)-2-acetylamino-1,3-propanediol

77 GIL Rxn with: Maleic acid, Fumaric acid, Glyoxylic acid, Formic acid, Oxalic acid

77 GLA/TOM Rxn with: aromatic amines, sulfanilic acid

77 GOB/CHU Rxn with: Br^-, I^-; RR, Mec

77 GOR/SIM Rxn with: $CH_3CH_2COCH_3$; Mec

77 KOV/YAV Rxn with: Na_2S; RR

77 KUO/LI Dec, RR

77 PRE/MAU Rxn with: C_6Cl_5OH, $C_6H_4Cl_2$, $C_4H_8Cl_2$, $CHCl_3$, Chlorinated biphenyls

77 RIZ/AUG Rxn with: C_6H_5OH; RR

77 SHA/YAK Rxn with: Cumene

77 TAR/MAR Rxn with: S-ethyl-N,N-di-n-propylthiocarbamate

77 TAR/MAR2 Rxn with: Zinc dimethyldithiocarbamate and tetramethylthiuram disulfide

77 TYU Rxn with: Alkylpyridines

77 TYU/YAK Rxn with: Alkylpyridines and Alkylpyrazoles; Mec

77 YOC Rxn with: Styrene

78 AUG/RIZ Rxn with: C_6H_5OH; RR

78 AUG/RIZ2 Rxn with: C_6H_5OH; RR, Mec

78 CHU Rxn with: Pd^{2+}, Pt^{2+}

78 GIL Rxn with: aliphatic and aromatic acids, cresols, glyoxal

78 HOI/BAD Rxn with: NH_3; RR

78 ISH/DOB Rxn with: Alcohols, Phenols, Cyanohydrins, Amines, Aromatic amines, Benzothiazole

78 JOY/GIL Rxn with: Alkylbenzenesulfonic acids

78 KAS/MAT Rxn with: CN^-; RR

78 LAR/HOR Rxn with: SO_2; RR, Mec

78 MOR/IKE Dec, RR

78 OEH Rxn with: Organic compounds (Review)

78 ONA Rxn with: Azo Dyes; RR, Mec

78 PRA Rxn with: Br^-

78 PRE/MAV Rxn with: Pesticides (Malathion, Baygon, Vapam, DDT)

78 SHA/KOL Rxn with: Caffeine

78 SKU Rxn with: Sodium Alkylbenzenesulfonates

78 SKU2 Rxn with: Sodium Alkylnaphthalenesulfonates

78 SUZ/IIZ Rxn with: Polyacrylamide

78 YAK/DNE Rxn with: I^-, Mn^{2+}; RR

78 YOC Rxn with: Styrene, Bromobenzenesulfonic acid

79 BEL Dec, RR

79 GOR/BAS Rxn with: CH_3COCH_3

79 HEA Rxn with: 2-amino-2-(hydroxymethyl)-1,3-propanediol
and 2-(N-morpholino)-ethanesulfonic acid

79 LI/KUO Rxn with: C_2H_6OH; RR, Mec

79 MAR/OBO Rxn with: Ethylenediamine

79 NAK/NAK Dec, RR

79 RAZ/OVE Rxn with: OH^-; RR, Mec

79 STE/BEN Rxn with: Water-soluble organic substances, Nitroaniline

79 SUL/ROT Dec, RR

79 SUZ/TAU Rxn with: Water-soluble polymers; RR

79 YAK Rxn with: C_6H_5OH, Hydroquinone, Na 1-anthraquinone, Na Benzenesulfonate, Phthalic acid, Bromobenzenesulfonic acid

80 DUG/JAU Rxn with: Glycine; RR

80 GIL Rxn with: trans-trans Muconic acid; RR, Mec

80 HUA Rxn with: 2,2',4,4',6,6'-Hexachlorobiphenyl; RR, Mec

80 JOY/GIL Rxn with: p-Toluenesulfonic acid; Mec

80 KER/TAR Rxn with: Azobenzene

80 KIR/LIT Rxn with: Ethyl mercaptan

80 LIB/BOS Rxn with: I^-

80 RUT/SZK Rxn with: HCHO

80 SUL Dec, RR

80 SUL/ROT Dec, RR

80 SUZ/MIY Rxn with: Poly(oxyethylene); RR

80 TYU Rxn with: Benzimidazole, Benzotriazole, Benzopyrazole; RR

80 TYU/BER Rxn with: Alkylpyridines; RR

80 TYU/YAK Rxn with: Mn^{2+}, Mn^{3+}; RR, Mec

80 ZEE/VIS Rxn with: CN^-; RR, Mec

81 GUR Dec; Rxn with: C_6H_5OH; RR, Mec

81 HAR/TAK Rxn with: Br^-; RR, Mec

81 LEG/LAN Rxn with: C_6H_5OH, Hydroquinone, Phenoxyacetic acid, Aniline

81 MAR/DAM Rxn with: SO_2

81 MAT/TAK Rxn with: NCO^-; RR, Mec

81 MBA/MAN Rxn with: Lignin

81 PAN/CHE Rxn with: Methyl β-D-gluocopyranoside; RR

81 REU/OVE Rxn with: C_6H_5OH; RR

81 SIE/COW Rxn with: NH_2NH_2, CH_3NHNH_2, $(CH_3)_2NNH_2$

81 TAK/KAT Dec, RR

81 TER/SUG Rxn with: CN^-; RR

81 TYU Rxn with: Fe^{2+}; RR, Mec

81 TYU/DNE Rxn with: Fe^{2+}; RR, Mec

81 YAK Rxn with: CH_3OH, HCHO, HCOOH; Mec

1913

13 ROT/BUR Rothmund, V., and Burgstaller, A., "Über die Geschwindigkeit der Zersetzung des Ozons in Wasseriger Lösung," Monatsh. Chem. 34, 665 (1913)

1917

17 ROT/BUR Rothmund, V., and Burgstaller, A., "Die Reaktion zwischen Ozon und Wasserstoff-peroxyd," Monatsh. Chem. 38, 295 (1917)

1932

32 KAW Kawamura, F., "Investigation of Ozone. I. The Solubility of Ozone in Water and in Dilute Sulfuric Acid," Nippon Kagaku Kaishi 53, 783 (1932); Chem. Abstr. 26:5477 (1932)

1933

33 SEN Sennewald, K., "Über den Zerfall des Ozons in Wässeriger Lösung," Z. Phys. Chem. Abt. A 164, 305 (1933)

1934

34 KAW Kawamura, F., "Investigation of Ozone. III. The Decomposition of Ozone in Aqueous Solution," Nippon Kagaku Kaishi 55, 849 (1934); Chem. Abstr. 29:27 (1935)

1935

35 WEI Weiss, J., "Investigations on the Radical HO_2 in Solution," Trans. Faraday Soc. 31, 668 (1935)

1937

37 VAS/KAS Vasil'ev, S. S., Kashtanov, L. I., and Kastorskaya, T. L., "The Kinetic Mechanism of the Chain Oxidation of Sulfur Dioxide in Solution by Ozonized Air," Zh. Fiz. Khim. 10, 330 (1937); Chem. Abstr. 32:414 (1938)

1938

38 BRA Bray, W. C., "The Interaction of Ozone and Hydrogen Peroxide in Aqueous Solution," J. Am. Chem. Soc. 60, 82 (1938)

1940

40 TAU/BRA Taube, H., and Bray, W. C., "Chain Reactions in Aqueous Solutions Containing Ozone, Hydrogen Peroxide and Acid," J. Am. Chem. Soc. 62, 3357 (1940)

1941

41 TAU Taube, H., "II. Chain Reactions of Ozone in Aqueous Solution. The Interaction of Ozone and Formic Acid in Aqueous Solution," J. Am. Chem. Soc. 63, 2453 (1941)

1942

42 TAU Taube, H., "Reactions in Solutions Containing O_3, H_2O_2, H^+ and Br^-. The Specific Rate of the Reaction $O_3 + Br^- \longrightarrow$," J. Am. Chem. Soc. 64, 2468 (1942)

1948

48 HIL Hill, G. R., "Kinetics, Mechanism, and Activation Energy of the Cobaltous Ion Catalyzed Decomposition of Ozone," J. Am. Chem. Soc. 70, 1306 (1948)

1949

49 YEA/TAU Yeatts, L. B., Jr., and Taube, H., "The Kinetics of the Reaction of Ozone and Chloride Ion in Acid Aqueous Solution," J. Am. Chem. Soc. 71, 4100 (1949)

1950

50 ALD/HIL Alder, M. G., and Hill G. R., "The Kinetics and Mechanism of Hydroxide Ion Catalyzed Ozone Decomposition in Aqueous Solution," J. Am. Chem. Soc. 72, 1884 (1950)

1954

54 STU Stumm, W., "Der Zerfall von Ozon in Wässriger Lösung," Helv. Chim. Acta 37, 773 (1954)

1955

55 ABE Abel, E., "Über die Selbstzersetzung von Ozon in Wässriger Lösung," Monatsh. Chem. 86, 44 (1955)

55 ABE2 Abel, E., "Über die Reaktion zwischen Ozon und Wasserstoffsuperoxyd in Wässriger Lösung," Monatsh. Chem. 86, 193 (1955)

1956

56 KIL/HER Kilpatrick, M. L., Herrick, C. C., and Kilpatrick, M., "The Decomposition of Ozone in Aqueous Solution," J. Am. Chem. Soc. 78, 1784 (1956)

1958

58 KLE/NAL Kleimenov, N. A., and Nalbandyan, A. B., "The Interaction of Ozone with Methyl Hydroperoxide," Dokl. Akad. Nauk SSSR 118, 125 (1958); Chem. Abstr. 52:19369d (1958)

1959

59 KHA/BAR Khandelwal, K. K., Barduhn, A. J., and Grove, C. S., Jr., "Kinetics of Ozonation of Cyanides," Adv. Chem. Ser. 21, 78 (1959); also published in "Ozone Chemistry and Technology" which were presented at the Proceedings of the Intern. Ozone Conference, Chicago, November 1956.

1961

61 SON/DOD Sondak, N. E., and Dodge, B. F., "Oxidation of Cyanide-Bearing Plating Wastes by Ozone. I.," Plating (Paris) 48, 173 (1961)

1962

62 RAU/SII Raukas, M. M., Siirode, E. K., and Kyulm, S. R., "Rate of Ozone Decomposition in Different Waters," Jr. Tallinsk. Politekhn. Inst. Ser. A 198, 219 (1962); Chem. Abstr. 60:2633e (1964)

1965

65 CON/HAM Conocchioli, T. J., Hamilton, E. J., Jr., and Sutin, N., "The Formation of Iron(IV) in the Oxidation of Iron(II)," J. Am. Chem. Soc. 87, 926 (1965)

1967

67 LUN/KUS Lunenok-Burmakina, V. A., Kusakovskaya, T. M., and Miroshnichenko, A. G., "Use of Isotopes for Studying the Oxidation of Inorganic Ions by Hydrogen Peroxide and Ozone," Isotopenpraxis 3, 146 (1967) (Russ); Chem. Abstr. 70:102648e (1969)

67 WAG/ECK Wagnerova, D. M., Eckschlager, K., and Veprek-Siska, J., "Ozonbestimmung in Wässrigen Lösungen," Collect. Czech. Chem. Commun. 32, 4032 (1967)

1968

68 CZA/SAM Czapski, G., Samuni, A., and Yelin, R., "The Disappearance of Ozone in Alkaline Solution," Isr. J. Chem. 6, 969 (1968)

68 EIS Eisenhauer, H. R., "Ozonization of Phenolic Wastes," J. Water Pollut. Contr. Fed. 40, 1887 (1968)

68 GRI/SHA Grinberg, A. A., Shashukov, E. A., and Popova, N. N., "Oxidation by Ozone of the Hydrazinium Salts $N_2H_4.HNO_3$ and $N_2H_4SO_4$ in Aqueous Solutions," Russ. J. Inorg. Chem. 13, 1055 (1968); tr. of Zh. Neorg. Khim. 13, 2039 (1968)

68 ILN/KHE Il'nitskii, A. P., Khesina, A. Ya., Cherkinskii, S. N., and Shabad, L. M., "Effect of Ozonation Upon Aromatic Hydrocarbon, Including Carcinogens," Hyg. Sanit. (USSR) 33 (1-3), 323 (1968); tr. of Gig. Sanit. 33 (3), 8 (1968) (Russ.)

68 SEN/IKE Senzaki, T., and Ikehata, A., "Oxidation of Manganese(II) in Aqueous Solution by Ozone," Kogyo Yosui, 46 (1968) (Japan) Chem. Abstr. 60:100209t (1968)

1970

70 LUN/FRA Lunenok-Burmakina, V. A., and Franchuk, T. M., "Mechanism of the Ozone Oxidation of Oxy Anions," Ukr. Khim. Zh. 36, 1020 (1970) (Russ); Chem. Abstr. 74:80282j (1971)

70 KAN/MOK Kandzas, P. F., Mokina, A. A., Marchanko, R. F., and Savina, L. A., "Oxidation of Cyclohexane in an Aqueous Solution Under the Action of Ozone," Tr. Vses. Nauch.-Issled. Inst. Vodosnabzh., Kanaliz., Gidrotekh. Sooruzhenii Inzh. Gidrogeol. 28, 18 (1970) (Russ); Chem. Abstr. 75:91146q (1971)

70 ROG Rogozhkin, G. I., "Kinetics of Ozone Absorption by Alkaline Solutions," Tr. Vses. Nauchno-Issled. Inst. Vodosnabzh Kanaliz. Gidrotekh. Sooruzh. Inzh. Gidrogeol., 25, 76 (1970) (Russ); Chem. Abstr. 73:811086 (1970)

70 SHA/KOZ Shashukov, E. A., and Kozlov, A. A., "Kinetics of the Ozone Oxidation of Neptunium(VI) to Neptunium(VII) in Alkaline Solutions," Radiokhimiya 12, 237 (1970) (Russ); Chem. Abstr. 73:29404c (1970)

1971

71 EIS Eisenhauer, H. R., "Increased Rate and Efficiency of Phenolic Waste Ozonization," J. Water Pollut. Control Fed. 43, 200 (1971)

71 HEW/DAV Hewes, C. G., and Davison, R. R., "Kinetics of Ozone Decomposition and Reaction with Organics in Water," AIChE J. 17, 141 (1971)

71 MER/LOV Merkulova, V. P., Lovchikov, V. S., and Ivanovskii, M. D., "Kinetics of the Breakdown of Ozone in Sulfate Solutions," Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 14, 818 (1971) (Russ); Chem. Abstr. 75:155282r (1971)

71 ROG Rogozhin, G. I., "Oxidation of Dimethylamine by Ozone in Aqueous Solutions," Tr. Vses. Nauchno-Issled. Inst. Vodosnabzh., Kanaliz. Gidrotekh. Sooruzh. Inzh. Gidrogeol. 33, 54 (1971) (Russ); Chem. Abstr. 75:130380z (1971)

71 SHE/MAR Shevchenko, M. A., Marchenko, P. V., Taran, P. N., Kas'yanchuk, R. S., Lavrukhina, Zh. M., and Kovalenko, G. I., "Reaction of Dilute Aqueous Solutions of Fosfamid (Dimethoate) with Chlorine and Ozone," Sov. Prog. Chem. 37, 91 (1971); tr. of Ukr. Khem. Zh. 37, 727 (1971)

71 VYA/DAV Vyatkin, V. E., Davydov, Yr. P., and Shashchukov, E. A., "Role of Hydrolysis During the Oxidation of Plutonium(IV) by Ozone in Nitrate Solutions," Radiokhimiya 13, 469 (1971) (Russ); Chem. Abstr. 75:91800y (1971)

1972

72 BAL/SEL Balyanskii, G. V., Selin, M. E., and Kolychev, V. B., "Ozonization of Simple Cyanides in Water," J. Appl. Chem. USSR 45, 2251 (1972); tr. of Zh. Prikl. Khim. 45, 2152 (1972)

72 DON/EHR Donnet, J. B., Ehrburger, P., and Voet, A., "Mechanism of the Oxidation of Carbon Black by Ozone in Aqueous Solution," Carbon 10, 737 (1972) (Fr); Chem. Abstr. 78:91888v (1973)

72 GOU Gould, J. P., "Kinetics and Mechanism of the Oxidation of Phenol by Gaseous Ozone in Dilute Aqueous Solutions," Diss. Abstr. Int. B. 32, 6730 (1972) Chem. Abstr. 77:113562t (1972)

72 IVA/NIK Ivanov, Yr. E., Nikitina, G. P., Pushienkov, M. F., and Shumkov, V. G., "Ozone in Aqueous Solutions. I. Kinetics and Mechanism of the Decomposition of Ozone in Water and in Nitric Acid Solutions," Russ. J. Phys. Chem. 46, 1240 (1972); tr. of Zh. Fiz. Khim. 46, 2163 (1972) (Russ)

72 IVA/NIK2 Ivanov, Yu. E., Nikitina, G. P., Pushienkov, M. F., and Shumkov, V. G., "Ozone in Aqueous Solutions. II. Kinetics and Mechanism of the Oxidation of Cerium(III) and Silver(I) by Ozone," Russ. J. Phys. Chem. 46, 1231 (1972); tr. of Zh. Fiz. Khim. 46, 2149 (1972) (Russ)

72 KRI/MUR Kriege, L. B., and Murmann, R. K., "Oxygen-18 Tracer Studies with the trans-Dioxobis(ethylenediamine)Rhenium(V) Ion ($[Re(en)_2O_2]^+$)," J. Am. Chem. Soc. 94, 4557 (1972)

72 PEN Penkett, S. A., "Reactions with SO_2, H_2S and NO_2 in Solution," Nature Phys. Sci. 240, 105 (1972)

72 RAZ/GLO Razumovskii, S. D., Globenko, G. M., Nikiforov, G. A., Gurvich, Ya. A., and Karelin, Ya. A., "Kinetics of the Reaction of Phenols with Ozone in Aqueous Solutions," Neftekhimiya 12, 65 (1972) (Russ); Chem. Abstr. 77:24520K (1972)

72 VYA/DAV Vyatkin, V. E., Davydov, Yu. P., and Shashukov, E. A., "Kinetics of the Oxidation of Multiply Charged Ions," Radiokhimiya 14, 289 (1972) (Russ); Chem. Abst. 77:25328r (1972)

1973

73 DUD Dudnikov, V. I., "Effect of Depth of Floating of Bubbles on the Rate of Oxidation of Bromide Ions by Ozone in Aqueous Solutions," Tr. Novocherk. Inst., 96 (1973) (Russ); Chem. Abstr. 81:127241g (1974)

73 GOR/BAS Gorbenko-Germanov, D. S., and Baskova, N. K., "Oxidation of Acetone by Ozone in Acid Aqueous Solutions," Tezisy Dokl. Vses. Soveshch. Khim. Neorg. Perekisnykh. Soedin., 131 (1973) (Russ); Chem. Abstr. 82:139216m (1975)

73 GOR/GOR Gorbenko-Germanov, D. S., Gorodnov, M. M., Vodop'yanova, N. M., and Kharina, N. M., "Oxidation of Acetone by Ozone in Alkaline Aqueous Solutions," Tezisy Dokl. Vses. Soveshch. Khim. Neorg. Perekisnykh Soedin, 129 (1973) (Russ); Chem. Abstr. 82:139215k (1975)

73 GOR/KOZ Gorbenko-Germanov, D. S., and Kozlova, I. V., "Spectrophotometric Study of the Mechanism of Ozone Decomposition in Alkaline Aqueous Media," Tezisy Dokl. Vses. Soveshch. Khim. Neorg. Perekisnykh Soedin., 112 (1973) (Russ); Chem. Abstr. 83:103901n (1975)

73 GOR/KOZ2 Gorbenko-Germanov, D. S., and Kozlova, I. V., "Mechanism of the Decomposition of Ozone in Basic Aqueous Media," Dokl. Chem. 210, 456 (1973); tr. of Dokl. Akad. Nauk SSSR, Ser. Khim. 210, 851 (1973)

73 GOR/VOD Gorbenko-Germanov, D. S., Vodop'yanova, N. M., Kharina, N. M., and Gordonov, M. M., "Oxidation of Some Saturated Organic Compounds, Initiated by the Catalytic Decomposition of Ozone in Alkaline Aqueous Solutions," Dokl. Phys. Chem. 210, 472 (1973); tr. of Dokl. Akad. Nauk SSSR, Ser. Fiz. Khim. 210, 1121 (1973)

73 KAN/MOK Kandzas, P. F., Mokina, A. A., Marchenko, R. F., and Savina, L. A., "Oxidation of Cyclopentane in an Aqueous Solution Under the Effect of Ozone," Ochistka Proizvod. Stochn. Vod., 135 (1973) (Russ); Chem. Abstr. 80:99940t (1974)

73 SHA/VYA Shashukov, E., A., Vyatkin, V. E., and Kozlov, A., "Redox Processes During the Ozonolysis of Aqueous Solutions. I. Reaction of Cerium with Ozone in Aqueous Nitric Acid Solutions," Radiokhimiya 15, 772 (1973) (Russ); Chem. Abstr. 80:66307p (1974)

73 SHE Shechter, H., "Spectrophotometric Method for Determination of Ozone in Aqueous Solutions," Water Res. 7, 729 (1973); Chem. Abstr. 79:23460v (1973)

73 TAK/OKU Takizawa, M., Okuwaki, A., and Okabe, T., "The Chemical Behavior of Low Valence Sulfur Compounds. VIII. The Oxidation of Sodium Thiosulfate with Ozone," Bull. Chem. Soc. Japan 46, 3785 (1973)

1974

74 GER/KUR Gerchikov, A. Ya., Kuramshin, E. M., Komissarov, V. D., and Denisov, E. T., "Kinetics of Methyl Ethyl Ketone Oxidation by Ozonized Oxygen in Aqueous Solutions," Kinet. Catal. 15, 197 (1974); tr. of Kinet. Katal. 15, 230 (1974)

74 GIL Gilbert, E., "Degradation of Noxious Organic Substances in Water Using Ozone," Vom Wasser 43, 275 (1974); Chem. Abstr. 82:175088e (1975)

74 GOR/BAS Gorbenko-Germanov, D. S., and Baskova, N. K., "The Oxidation of Silver(I) Ions by Ozone and the Kinetics of the Decomposition of Silver(II) Ions in Aqueous Perchloric Acid Solutions," Russ. J. Phys. Chem. 48, 1318 (1974); tr. of Zh. Fiz. Khim. 48, 2225 (1974)

74 GOR/KOZ Gorbenko-Germanov, D. S., and Kozlova, I. V., "A Spectrophotometric Study of the Mechanism of the Decomposition of Ozone in Aqueous Alkaline Solutions," Russ. J. Phys. Chem. 48, 1179 (1974); tr. of Zh. Fiz. Khim. 48, 1998 (1974)

74 KOM/GER Komissarov, V. D., Gerchikov, A. Ya., and Denisov, E. T., "Chain Oxidation of Methyl Ethyl Ketone with Ozone in Aqueous Solutions," Bull. Acad. Sci. USSR, Div. Chem. Sci. 23, 2524 (1974); tr. of Izv. Akad. Nauk SSSR, Ser. Khim., 2616 (1974)

74 PAK/KRA Pakul', D. L., Krasnov, B. P., and Sazhina, A. M., "Oxidation of Alcohols in Dilute Aqueous Solutions by Ozone," J. Appl. Chem. USSR 47, 34 (1974); tr. of Zh. Prikl. Khim. 47, 36 (1974)

74 SHU/NIK Shumkov, V. G., Nikitina, G. P., Ivanov, Yu. E., Egorova, V., P., and Pushlenkov, M. F., "Oxidation-Reduction Reactions of Ruthenium(III), Ruthenium(IV), and Nitrosyl Ruthenium in Aqueous Solutions," Jad. Energ. 20, 315 (1974) (Russ); Chem. Abstr. 81:177098m (1974)

74 ZAM/KUN Zamelin, V. I., Kunin, A. M., Silant'eva, N. S., and Zolotukhin, V. S., "Oxidation of Phenols by Ozone in Aqueous Solutions," V sb., Khim. Tekhnol. i Khim. Mashinostr., 63 (1974) (Russ); Chem. Abstr. 84:155276c (1976)

1975

75 CHT/AKO Chtyan, G. S., Akopyan, S. Z., and Babyan, G. C., "Extraction of Tungsten Into An Aqueous Solution from Disulfide in the Presence of Ozone," Mezhvùz. Sb. Nauch. Tr. Erevan. Politekhn. In-t. Khim. Tekhnol., 33 (1975) (Russ); Chem. Abstr. 86:61166f (1977)

75 CHU/KOK Chudnov, A. F., and Kokhno, G. V., "Precipitation of Lead from Aqueous Solutions by Ozone," Izv. Vyssh. Uchebn. Zaved., Tsvetn. Metcll., 151 (1975) (Russ); Chem. Abstr. 84:111216d (1976)

75 GOR Gorbenko-Germanov, D. S., "Decomposition and Oxidation Effect of Ozone in Aqueous Solutions," Neorg. Perekisnve Soedin., Dokl. Vses. Soveshch., 161 (1975) (Russ); Chem. Abstr. 84:9306w (1976)

75 KOC/MEJ Koczorowski, J., and Mejbaum, Z., "Oxidation of Some Anionic Surface Active Agents by Ozone in Aqueous Solutions," Gaz. Woda Tech. Sanit. 49, 237 (1975) (Pol); Chem. Abstr. 84:126411n (1976)

75 KUR/SAK Kuroda, M., Sakiyama, F., and Narita, K., "Oxidation of Tryptophan In Lysozyme by Ozone in Aqueous Solution," J. Biochem. 78, 641 (1975) (Toyko)

75 LYS/ATY Lysenko, T. F., Atyaksheva, L. F., Strakhov, B. V., and Emel'yanova, G. I., "Kinetics and Mechanism of the Oxidation by Ozone of 1,1-Dimethylhydrazine in Aqueous Solution," Russ. J. Phys. Chem. 49, 1849 (1975); tr. of Zh. Fiz. Khim. 49, 3131 (1975)

75 MAT/FUJ Matsuda, Y., Fujisawa, T., Fujikawa, S., Takasu, Y., Tanaka, Y., and Niroshi, I., "Oxidation of Cyanide Ion in Aqueous Alkaline Solution by Ozone," Nippon Kagaku Kaishi 8, 579 (1975)

75 NIK/IVA Nikitina, G. P., Ivanov, Yu. E., Shumkov, V. G., and Egorova, V. P., "Oxidation of Variable Valence Cations by Ozone," Report, RI-48 (1975) (Russ); Chem. Abstr. 86:194274m (1977)

75 TAR/KAS Taran, P. N., and Kas'yanchuk, R. S., "Deodorization of Indole Aqueous Solutions by Oxidants," Nauchn. Osn. Tekhnol. Obrab. Vody 2, 74 (1975) (Russ); Chem. Abstr. 88:78855u (1978)

75 TAR/MAR Taran, P. N., and Marchenko, V. M., "Reaction of Sevin and α-Naphthol with Chlorine and Ozone in Dilute Aqueous Solutions," Nauchn. Oxn. Tekhnol. Obrab. Vody 2, 65 (1975) (Russ): Chem. Abstr. 88:33170a (1978)

75 TYU/YAK Tyupalo, N. F., Yakobi, V. YA., Bernashevskii, N. V., and Stepanyan, A. A., "Liquid-Phase Catalytic Oxidation of Alkyl Derivatives of N-Heterocyclic Compounds by Ozone," J. Appl. Chem. USSR 48, 1132 (1975); tr. of Zh. Prikl. Khim. 48, 1086 (1975)

75 VEB/GAE Veber, N. V., Gaeva, N. N., and Kashkov, V. K., "Oxidation of Acrylonitrile with Ozone in Aqueous Solutions," Tr. VNII Vodosnabzh., Kanaliz. Gidrotekhn. Sooruzh. i Inzh. Gidrogeol., 61 (1975) (Russ); Chem. Abstr. 86:21526s (1977)

1976

76 CHU Chudnov, A. F., "Preparation of Hydrated Tin Dioxide with Aid of Ozone," Russ. J. Inorg. Chem. 21, 774 (1976); tr. of Zh. Neorg. Khim. 21, 1415 (1976)

76 CHU/MAS Chudnov, A. F., Mashenkov, O. N., and Bulaevskaya, L. N., "Oxidation of Thiocyanates in Aqueous Solutions by Ozone," Koks Khim., 38 (1976); Chem Abstr. 85:166084k (1976)

76 HOI/BAD Hoigné, J., and Bader, H., "The Role of Hydroxyl Radical Reactions in Ozonation Processes in Aqueous Solutions," Water Res. 10, 377 (1976)

76 JOY Joy, P., "Reaction of Ozone with p-Toluene Sulfonic Acid and Nonylbenzene Sulfonic Acid in Aqueous Solutions," Kernforschungszentrum Karlsruhe, [Ber.], KFK 2339 (1976) (Ger); Chem. Abstr. 86:71394t (1977)

76 KHE/DUD Khentov, V. Ya., and Dudnikov, V. I., "Intensification of Oxidation of Bromide Ions in Aqueous Solutions by Ozone," J. Appl. Chem. USSR 49, 1178 (1976); tr. of Zh. Prikl. Khim. 49, 1141 (1976)

76 PEL Peleg, M., "The Chemistry of Ozone in the Treatment of Water," Water Res. 10, 361 (1976); Chem. Abstr. 85:148740s (1976)

76 RIZ/AUG Rizzuti, L., Augugliaro, V., and Marrucci, G., "Ozone Absorption in Alkaline Solutions," Chem. Engr. Sci. 31, 877 (1976)

76 TOZ/NIS Tozawa, K., and Nishimura, T., "Oxidation of Arsenic(III) in Aqueous Solution," Nippon Kogyo Kaishi 92, 809 (1976) (Japan); Chem. Abstr. 89:15967g (1978)

1977

77 CHE/LEB Chepovoi, V. I., Lebedev, L. A., and Myasoedov, B. F., "Study of the Ozone Oxidation of Berkelium(III) and Cerium(III) in Aqueous Solutions," Radiokhimiya 19, 478 (1977) (Russ); Chem. Abstr. 87:161011r (1977)

77 ERI/YAT Erickson, R. E., Yates, L. M., Clark, R. L., and McEwen, D., "The Reaction of Sulfur Dioxide with Ozone in Water and Its Possible Atmospheric Significance," Atmos. Environ. 11, 813 (1977)

77 GAL/GAL Galstyan, G. A., Galstyan, T. M., and Yakobi, V. A., "The Investigation of the Oxidation Process of 1-(p-Nitrophenyl)-2-Acetylamino-1,3-Propanediol with an Ozone-Air Mixture," Sov. Prog. Chem. 43, 64 (1977); tr. of Ukr. Khim. Zh. 43, 738 (1977)

77 GIL Gilbert, E., "Über die Wirkung von Ozon auf Maleinsaure, Fumarsaure und deren Oxidationsprodukte in Wässriger Lösung," Zeit. Naturforsch. Teil B 32, 1308 (1977)

77 GLA/TOM Glabisz, U., and Tomaszewska, M., "Studies of the Decomposition of Aromatic Amines with Ozone in Dilute Aqueous Solutions," Przem. Chem. 56, 426 (1977) (Pol); Chem. Abstr. 88:94349n (1978)

77 GOB/CHU Gobov, S. L., Chusova, L. L., and Oskolkov, Yu. A., "Kinetics of Iodine and Bromine Ions Oxidation by Ozone in Aqueous Solutions," Mater. - Vses. Mezhvuz. Konf. Ozonu, 2nd, 7 (1977) (Russ); Chem. Abstr. 89:204821r (1978)

77 GOR/SIM Gorbenko-Germanov, D. S., Simazhina, E. A., Vodop'yanova, N. M., and Gorodnov, M. M., "Realization of Ozone Oxidative Action in Alkaline and Aqueous Media as

Exemplified by Methyl Ethyl Ketone," Mater. - Vses. Mezhvuz. Konf. Ozonu, 2nd, 36 (1977) (Russ); Chem. Abstr. 89:146376m (1978)

77 KOV/YAV Koval'skii, I. O., and Yavorskii, V. T., "Kinetics of the Reaction of Sodium Sulfide with Ozone in Aqueous Solutions," Mater. - Vses. Mezhvuz. Konf. Ozonu, 2nd, 11 (1977) (Russ); Chem. Abstr. 89:200373b (1978)

77 KUO/LI Kuo, C. H., Li, K. Y., Wen, C. P., and Weeks, J. L., Jr., "Absorption and Decomposition of Ozone in Aqueous Solutions," AIChE Symp. Ser. 73, 230 (1977); Chem. Abstr. 88:65569d (1978)

77 PRE/MAU Prengle, H. W., Jr., Mauk, C. E., and Payne, J. E., "Ozone/UV Oxidation of Chlorinated Compounds in Water," Proc. - Forum Ozone Disinfect, 286 (1976); Chem. Abstr. 87:141028y (1977)

77 RIZ/AUG Rizzuti, L., Augugliaro, V., and Marrucci, G., "Ozone Absorption in Aqueous Phenol Solutions," Chem. Eng. J. (Lausanne) 13, 219 (1977); Chem. Abstr. 87:183820f (1977)

77 SHA/YAK Shaboldo, P. I., Yakovlev, V. A., Zaporozhets, A. G., Ishmukhametova, L. I., Yakobi, V. A., Ponomarev, B. A., Shpak, L. P., Skorik, V. P., and Trunova, L. P., "Liquid-Phase Oxidation of Cumene by Ozone," Mater. - Vses. Mezhvuz. Konf. Ozonu, 2nd, 103 (1977) (Russ); Chem. Abstr. 89:163188u (1978)

77 TAR/MAR Taran, P. N., Marchenko, V. M., Lizunov, V. V., and Kas'yanchuk, R. S., "Oxidation of Eptam in Diluted Aqueous Solutions," Sov. Prog. Chem. 43, 60 (1977); tr. of Ukr. Khim. Zh. 43, 505 (1977) (Russ)

77 TAR/MAR2 Taran, P. N., and Marchenko, V. M., "The Oxidation of Certain Dialkyldithiocarbamates in Dilute Aqueous Solutions," Sov. Prog. Chem. 43, 22 (1977); tr. of Ukr. Khim. Zh. 43, 1030 (1977)

77 TYU Tyupalo, N. F., "Catalytic Oxidation of Alkyl Homologs of Pyridine by Ozone," Tezisy Dokl. - Ukr. Resp. Konf. Fiz. Khim., 12th, 163 (1977) (Russ); Chem. Abst. 93:46358w (1980)

77 TYU/YAK Tyupalo, N. F., Yakohi, V. A., Stepanyan, A. A., and Bernashevskii, N. V., "Mechanism of the Liquid-Phase Catalytic Oxidation of Homologs of N-Heteroaromatic Compounds with Ozone," Katal. Katal. 15, 32 (1977) (Russ); Chem. Abstr. 89:5684y (1978)

77 YOC Yocum, F. H., II, "Oxidation of Styrene with Ozone in Aqueous Solution," Diss. Abstr. Int. B 38, 1316 (1977)

1978

78 AUG/RIZ Augugliaro, V., and Rizzuti, L., "Temperature Dependence of the Ozone Absorption Kinetics in Aqueous Phenol Solutions," Chem. Eng. Commun. 2, 219 (1978); Chem. Abstr. 88:157979r (1978)

78 AUG/RIZ2 Augugliaro, V., and Rizzuti, L., "The pH Dependence of the Ozone Absorption Kinetics in Aqueous Phenol Solutions," Chem. Eng. Sci. 33, 1441 (1978)

78 CHU Chudnov, A. F., "Precipitation of Palladium and Platinum from Aqueous Solutions by Ozone," Izv. Vyssh. Uchebn. Zaved., Tsvetn. Metall., 80 (1978); Chem. Abstr. 90:44329s (1979)

78 GIL Gilbert, E., "Reactions of Ozone with Organic Compounds in Dilute Aqueous Solution: Identification of Their Oxidation Products," Ozone/Chlorine Dioxide Oxid. Prod. Org. Mater., Proc. Conf., 227 (1976) (Pub. 1978); Chem. Abstr. 90:11756k (1979)

78 HOI/BAD Hoigné, J., and Bader, H., "Ozonation of Water: Kinetics of Oxidation of Ammonia by Ozone and Hydroxyl Radicals," Environ. Sci. Technol. 12, 79 (1978)

78 ISH/DOB Ishizaki, K., Dobbs, R. A., and Cohen, J. M., "Ozonization of Hazardous and Toxic Organic Compounds in Aqueous Solution," Ozone/Chlorine Dioxide Oxid. Prod. Org. Mater., Proc. Conf., 210 (1976) (Pub. 1978); Chem. Abstr. 89:152476k (1978)

78 JOY/GIL Joy, P., Gilbert, E., and Eberle, S. H., "Investigations on the Effects of Ozone on Alkylbenzenesulfonic Acids and Detergents in Aqueous Solutions," Org. Verunreinig. Umwelt: Erkennen, Bewerten, Vermindern, [Tag.], 164 (1978) (Ger); Chem. Abstr. 91:62493a (1979)

78 KAS/MAT Kashtanov, S. A., Matrozov, V. I., Stepanov, A. M., and Tregobov, B. A., "Kinetics of the Reaction of Ozone with Cyanide Ions in Aqueous Solutions," Sov. Prog. Chem. 44, 56 (1978); tr. of Ukr. Khim. Zh. 44, 1285 (1978)

78 LAR/HOR Larson, T. V., Horike, N. R., and Harrison, H., "Oxidation of Sulfur Dioxide by Oxygen and Ozone in Aqueous Solution: A Kinetic Study with Significance to Atmospheric Rate Processes," Atmos. Environ. 12, 1597 (1978)

78 MOR/IKE Morooka, S., Ikemizu, K., and Kato, Y., "The Decomposition of Ozone in Aqueous Solution," Kagaku Kogaku Rombunshu 4, 377 (1978) (Japan); Chem. Abstr. 89:221607t (1978)

78 OEH Oehlschlaeger, H. F., "Reactions of Ozone with Organic Compounds," Ozone/Chlorine Dioxide Oxid. Prod. Org. Mater., Proc. Conf., 20 (1976) (Pub. 1978); Chem. Abstr. 89:135317 (1978)

78 ONA Onari, Y., "Reactions of Ozone with Azo Dyes in an Aqueous Solution," Nippon Kagaku Kaishi, 1570 (1978)

78 PRA Prater, W. W., "Chlorine and Ozone-Induced Bromination of Activated Aromatic Nucleii in Aqueous Solution," Diss. Abstr. Int. B 38, 5255 (1978)

78 PRE/MAU Prengle, H. W., Jr., and Mauk, C. E., "Ozone/UV Oxidation of Pesticides in Aqueous Solution," Ozone/Chlorine Dioxide Oxid. Prod. Org. Mater., Proc. Conf., 302 (1976) (Pub. 1978); Chem. Abstr. 90:126916e (1979)

78 SHA/KOL Shapiro, R. H., Kolonko, K. J., Greenstein, P. M., Barkley, R. M., and Sievers, R. E., "Ozonization Products from Caffeine in Aqueous Solution," Ozone/Chlorine Dioxide Oxid. Prod. Org. Mater., Proc. Conf., 284 (1976) (Pub. 1978); Chem. Abstr. 90:141759z (1979)

78 SKU Skucinski, S., "Oxidation of Anionic Surfactants by Ozone in Aqueous Solutions," Gaz. Wada Tech. Sanit. 52, 201 (1978) (Pol); Chem. Abstr. 90:60694x (1979)

78 SKU2 Skucinski, S., "Influence of Alkyl Chain Length and Branching on the Decomposition of Anionic Detergents in Aqueous Solutions Under Ozone Action," Gaz. Wada Tech. Sanit. 52, 234 (1978) (Pol); Chem. Abstr. 91:59221e (1979)

78 SUZ/IIZ Suzuki, J., Iizuka, S., and Suzuki, S., "Ozone Treatment of Water-Soluble Polymers. III. Ozone Degradation of Polyacrylamide in Water," J. Appl. Polym. Sci. 22, 2109 (1978)

78 YAK/DNE Yakobi, V. A., and Dneprovskii, Yu. A., "Oxidation Kinetics of Iodide-Ions and Manganese(II) by Ozone in the Diffusion-Kinetic Region," Dopov. Akad. Nauk Ukr. RSR, Ser. B, Geol. Khim. Biol. Nauki, 736 (1978) (Ukrain); Chem. Abstr. 89:204836z (1978)

78 YOC Yocum, F. H., "Oxidation of Styrene with Ozone in Aqueous Solution," Ozone/Chlorine Dioxide Oxid. Prod. Org. Mater., Proc. Conf., 243 (1976) (Pub. 1978); Chem. Abstr. 89:203603j (1978)

1979

79 BEL Bell, R. D., "A Study of the Absorption and Decomposition of Ozone," CHEMSA 5, 106 (1979); Chem. Abstr. 92:117153t (1980)

79 GOR/BAS Gorbenko-Germanov, D. S., Baskova, N. K., and Vodop'yanova, N. M., "Oxidation of Acetone by Ozone in Aqueous Acid Solutions," Khim. Kinet. i Kataliz, M., 40 (1979) (Russ); Chem. Abstr. 91:192515v (1979)

79 HEA Heath, R. L., "Breakdown of Ozone and Formation of Hydrogen Peroxide in Aqueous Solutions of Amine Buffers Exposed to Ozone," Toxicol. Lett. 4, 449 (1979); Chem. Abstr. 92:70584s (1980)

79 LI/KUO Li, K. Y., Kuo, C. H., and Weeks, J. L., Jr., "A Kinetic Study of Ozone-Phenol Reaction in Aqueous Solutions," AIChE J. 25, 583 (1979)

79 MAR/OBO Marchenko, P. V., and Obolonchik, V. V., "Interaction of Ozone with Ethylenediamine in Aqueous Solutions," Khim. Tekhnol. Vody 1, 32 (1979) (Russ); Chem. Abstr. 93:244732b (1980)

79 NAK/NAK Nakamura, H, Nakanishi, H., Hara, Y., and Osada, H., "Decomposition of Ozone in Aqueous Solution," Kyushu Kogyo Daigcku Kenkyu Hokoku, Kogaku, 197 (1979); Chem. Abstr. 92:83283t (1980)

79 RAZ/OVE Razumovskii, S. D., Ovechkin, V. S., Konstantinova, M. L., and Zaikov, G. E., "The Kinetics of the Reaction of Ozone with Hydroxyl Ions in Aqueous Solution," Bull. Acad. Sci. USSR, Div. Chem. Sci. 28, 264 (1979); tr. of Izv. Akad. Nauk SSSR, Ser. Khim., 289 (1979)

79 STE/BEN Stephenson, P., Benedek, A., Malaiyandi, M., and Lancaster, E. A., "The Effect of Ozone on the Biological Degradation and Activated Carbon Adsorption of Natural and Synthetic Organics in Water. Part I. Ozonation and Biodegradation," Ozone: Sci. Eng. 1, 263 (1979); Chem. Abstr. 93:210011a (1980)

79 SUL/ROT Sullivan, D. E., and Roth, J. A., "Kinetics of Ozone Self-Decomposition in Aqueous Solution," AIChE Symp. Ser. 76, 142 (1979); Chem. Abstr. 93:54886g (1980)

79 SUZ/TAU Suzuki, J., Taumi, N., and Suzuki, S., "Ozone Treatment of Water-Soluble Polymers. IV. Ozone Degradability of Water-soluble Polymers," J. Appl. Polym. Sci. 23, 3281 (1979)

79 YAK Yakobi, V. A., "Kinetics and Mechanism of Aromatic Compound Oxidation by Ozone in Aqueous Solutions," Dopov. Akad. Nauk Ukr. RST, Ser. B, Geol. Khim. Biol. Nauki, 744 (1979) (Ukrain); Chem. Abstr. 92:5845p (1980)

1980

80 DUG/JAU Duguet, J. P., Jaulin, L., Aurelle, Y., Rogues, H., and Legeron, J. P., "Experimental Study of Ozone Action on Glycine," Ozone: Sci. Eng. 2, 105 (1980); Chem. Abstr. 94:140139t (1981)

80 GIL Gilbert, E., "Reaction of Ozone with Trans-Trans Muconic Acid in Aqueous Solution," Water Res. 14, 1637 (1980)

80 HUA Huang, F. Y-C., "The Photolytic Ozonation of Organics in Aqueous Solutions," Diss. Abstr. Int. B 41, 1359 (1980)

80 JOY/GIL Joy, P., Gilbert, E., and Eberle, S. H., "A Quantitative Investigation of the Reaction of Ozone with p-Toluenesulfonic Acid in Aqueous Solutions as a Model Compound for Anionic Detergents," Water Res. 14, 1509 (1980)

80 KER/TAR Kerzhner, B. K., Taran, P. N., and Shevchenko, M. A., "Oxidation of Azobenzene with Ozone in Dilute Aqueous Solutions," Khim. Tekhnol. Vody 2, 127 (1980) (Russ); Chem. Abstr. 94:52256y (1981)

80 KIR/LIT Kirchner, K., and Litzenburger, W., "Oxidation of Mercaptan with Ozone in Water and Aqueous Solutions; Significance for Air and Water Purification," DECHEMA-Monogr. 86, 87 (1980) (Ger); Chem. Abstr. 93:172787y (1980)

80 LIE/ROS Liebermann, J., Jr., Roscher, N. M., Meier, E. P., and Cooper, W. J., "Development of the FACTS Procedure for Combined Forms of Chlorine and Ozone in Aqueous Solutions," Environ. Sci. Technol. 14, 1395 (1980)

80 RUT/SZK Rutkowski, J. D., and Szklarczyk, M., "Absorption of Formaldehyde by Selected Aqueous Solutions," Int. Congr. Scand. Chem. Eng., [Proc.], 5th, 131 (1980); Chem. Abstr. 94:179837u (1981)

80 SUL Sullivan, D. E., "Self-Decomposition and Solubility of Ozone in Aqueous Solution," Diss. Abstr. Int. B 40, 4924 (1980)

80 SUL/ROT Sullivan, D. E., and Roth, J. A., "Kinetics of Ozone Self-Decomposition in Aqueous Solution," Am. Inst. Chem. Eng., AIChE Symp. Ser. 197, 142 (1980)

80 SUZ/MIY Suzuki, M., and Miyazaki, T., "Decomposition Rate of Poly(oxyethylene) by Contacting with Ozone," Suishitsu Odaku Kenkyu 3, 193 (1980)(Japan); Chem. Abstr. 95:67427z (1981)

80 TYU Tyupalo, N. F., "Study of Ozone-Benzazole Reactions," Dopov. Akad. Nauk Ukr. RSR, Ser. B: Geol., Khim. Biol. Nauki, 57 (1980) (Ukrain); Chem. Abstr. 93:25560r (1980)

80 TYU/BER Tyupalo, N. F., and Bernashevskii, N. V., "Ozonization of Pyridine Homologs in Aqueous Solution," Dokl. Chem. 253, 387 (1980); tr. of Dokl. Akad. Nauk SSSR 253, 896 (1980)

80 TYU/YAK Tyupalo, N. F., and Yakobi, V. A., "The Reactions of Ozone with Manganese(II) and Manganese(III) Ions in Sulphuric Acid," Russ. J. Inorg. Chem. 25, 865 (1980); tr. of Zh. Neorg. Khim. 25, 1557 (1980)

80 ZEE/VIS Zeevalkink, J. A., Visser, D. C., Arnaoldy, P., and Boelhouwer, C., "Mechanism and Kinetics of Cyanide Ozonation in Water," Water Res. 14, 1375 (1980)

1981

81 GUR Gurol, M. D., "Kinetic Behavior of Ozone in Aqueous Solution: Decomposition and Reaction with Phenol," Diss. Abstr. Int. B 41, 2948 (1981)

81 HAR/TAK Haruta, K., and Takeyama, T., "Kinetics of Oxidation of Aqueous Bromide Ion By Ozone," J. Phys. Chem. 85, 2383 (1981)

81 LEG/LAN Legube, B., Langlais, B., and Dore, M., "Reactions of Ozone with Aromatics in Dilute Aqueous Solution: Reactivity and Biodegradability of Oxidation Products," Water Sci. Technol. 13, 553 (1981); Chem. Abstr. 94:162529x (1981)

81 MAR/DAM Martin, L. R., Damschen, D. E., and Judeikis, H. D., "Sulfur Dioxide Oxidation Reactions in Aqueous Solutions," Aerospace Corp., Chem. Phys. Lab., El Segundo, Calif., Report 1981, R-81(7000)-1; NTIS PB81-196834; Chem. Abstr. 95:192955w (1981)

81 MAT/TAK Matsuda, Y., Takasu, Y., Fujisawa, T., and Fujikawa, S., "Ozonation of Cyanate Ion in Alkaline Solution," Plat. Surf. Finish 68, 86 (1981); Chem. Abstr. 95:155929v (1981)

81 MBA/MAN Mbachu, R. A. D., and Manley, R., St. J., "Degradation of Lignin by Ozone. I. The Kinetics of Lignin Degradation of Ozone," J. Polym. Sci. 19, 2053 (1981)

81 PAN/CHE Pan, G., Chen, C.-L., Chang. H.-M., and Gratzl, J. S., "Model Experiments on the Splitting of Glycosidic Bonds by Ozone," Ekman-Days 1981, Int. Symp. Wood Pulping Chem. 2, 132 (1981); Chem. Abstr. 95:171280g (1981)

81 REU/OVE Reutskii, V. A., Ovechkin, V. S., Sazhin, B. S., and Zhuravleva, T. Yu., "Kinetics of the Oxidation of Phenol Aqueous solutions by Ozone," Khim. Tekhnol. Vody 3, 169 (1981) (Russ); Chem. Abstr. 95:155868z (1981)

81 SIE/COW Sierka, R. A., and Cowen, W. F., "The Catalytic Ozone Oxidation of Aqueous Solutions of Hydrazine, Monomethyl Hydrazine and Unsymmetrical Dimethylhydrazine," Proc. Ind. Waste Conf. 35, 406 (1980) (Pub. 1981); Chem. Abstr. 94:214315w (1981)

81 TAK/KAT Takahashi, N., and Katsuki, O., "Solubility, Self-Decomposition and Mass Transfer Characteristics of Ozone in Aqueous Solution," Nippon Kagaku Kaishi, 477 (1981)

81 TER/SUG Teramoto, M., Sugimoto, Y., Fukui, Y., and Teranishi, H., "Overall Rate of Ozone Oxidation of Cyanide in Bubble Column," J. Chem. Eng. Japan 14, 111 (1981)

81 TYU Tyupalo, N. F., "Study of Iron(II) Oxidation by Ozone," Dokl. Akad. Nauk SSSR 256, 894 (1981); Chem. Abstr. 94:109915u (1981)

81 TYU/DNE Tyupalo, N. F., and Dneprovskii, Yu, A., "Reaction of Ozone with Iron(II) Ions in Aqueous Solution," Russ. J. Inorg. Chem. 26, 357 (1981); tr. of Zh. Neorg. Khim. 26, 664 (1981)

81 YAK Yakobi, V. A., "Free-Radical Chain Mechanism of Ozone Oxidation of Aliphatic Derivatives in Aqueous Solutions," Dopov. Akad. Nauk Ukr. RSR, Ser. B: Geol, Khim. Biol. Nauki, 64 (1981) (Ukrain); Chem. Abstr. 95:41901z (1981)

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A reaction oriented list of references is provided for published papers and reports containing rate data or information on mechanism for reactions of ozone with various substrates in aqueous solutions. Catalyzed, as well as uncatalyzed, reactions are included. One hundred and sixty-four papers are listed. The period covered extends from 1913 to 1981.

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