

REFERENCES

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1. Strigle, R.F., "Random Packings and Packed Towers Design and Applications", (1987), Gulf Publishing Company, Houston.
2. Doraiswamy, L.K. and Sharma, M.M., "Heterogeneous Reactions : Analysis, Examples, and Reactor Design", (1984), John Wiley and Sons, New York.
3. Danckwerts, P.V. and Sharma, M.M., The Chem. Engr., (1966) CE 244.
4. Sengupta, R. and Puranik, S.A., "Proceedings of the 10th National Heat and Mass Transfer conference", (Srinagar India. 1989), P 495.
5. Shulman, H.L. and DeGouff, J.J., Ind. Engng Chem., (1952) 44, 1915.
6. Shulman, H.L. and DeGouff, J.J., Document No.3644, A D I, Library of Congress, Washington, D.C.
7. Shulman, H.L., Ullrich, C.F., Proulx, A.Z. and Zimmerman, J.O., A.I.Ch.E.J, (1955), 1, 253.
8. Grimley, S.S., Trans. Inst. Chem. Engrs.,(1945), 23, 228.
9. Mayo, F., Hunter, T.G. and Nash, A.W., J. Soc. Chem. Ind. (1935) 54, T-375.
10. Fujita, S. and Sacuma, S., Chem. Engng Japan,(1954), 18, 64.
11. Hikita, H. and Kataoka, T., Chem. Engng Japan (1956), 20,528
12. Onda, K., Takeuchi, H. and Koyama, Y., Kagaku Kogaku (1967), 31, 126.
13. Fellingner's data : Shulman, H.L., et al., A.I.Ch.E.J. (1955) 1, 257.

14. Yoshida, F. and Koyanagi, T., Indust. Engng Chem., (1958) 50, 365.
15. Hikita, H., Kataoka, T., and Nakanishi, K., Chem. Engng Japan, (1960), 24, 2.
16. Yoshida, F. and Koyanagi, T., A.I.Ch.E.J., (1962), 8, 309.
17. Yoshida, F. and Koyanagi, T., Document No. 7078, A.D.I., Library of Congress, Washington, D.C.
18. Sharma, M.M. and Danckwerts, P.V., Br. Chem. Engng. (1970) 15, 522.
19. Danckwerts, P.V., Kennedy, A.M. and Roberts, D., Chem. Engng Sci., (1963), 18, 63.
20. Vassilatos, G., Trass, O. and Johnson, A.I., Can. J. Chem. Engng, (1963), 7.
21. Richards, G.M., Ratcliff, G.A. and Danckwerts, P.V., Chem. Engng Sci., (1964), 19, 325.
22. Danckwerts, P.V. and Gillham, A.J., Trans. Inst. Chem. Engrs. (1966), 44, T 42.
23. Gehlawat, J.K. and Sharma, M.M., Unpublished work.
24. Vidwans, A.D. and Sharma, M.M., Chem. Engng. Sci., (1967) 22, 673.
25. Jhaveri, A.S. and Sharma, M.M., Chem. Engng Sci., (1968) 23, 669.
26. Jhaveri, A.S., "Kinetics of Oxidation in Heterogeneous Systems", Ph.D. Thesis, University of Bombay, (1968).
27. Danckwerts, P.V., and Rizvi, S.F., Trans. Inst. Chem. Engrs., (1971), 49, 134.
28. Onda, K., Takeuchi, H. and Maeda, Y., Chem. Engng Sci. (1972), 27, 449.

29. Dewaal, K.J.A. and Beek, W.J., Chem. Engng Sci., (1967) 22, 585.
30. Puranik.S.A., Post Doctoral Work, Univ. of Karlsruhe Germany, (1973).
31. Sahay, B.N. and Sharma, M.M., Chem.-Engng Sci., (1973), 28, 41.
32. Andrieu, J. and Claudel, B., Chem. Engng Sci., (1974), 29, 1263.
33. Linek, V., Stoy, V., Machon, V. and Krivsky. Z., Chem. Engng Sci., (1974), 29, 1955.
34. Andrieu, J., Chem. Engng Sci., (1975), 30, 217.
35. Linek, V., Krivsky. Z. and Hudec, P., Chem. Engng Sci. (1977), 32, 323.
36. Alper, E., Chem. Engng Sci., (1979), 34, 1091.
37. Rizzuti, L., Augugliaro, V. and Locascio, G., Chem. Engng Sci., (1981), 36, 973.
38. Rizzuti, L., Istituto di Ingegneria Chimica, Universita di Palermo, Italy, Personal Communication, Nov. 1990.
39. Augugliaro, V., Majo, I. and Rizzuti, L., Lat. Am. J. Heat Mass transf., (1985), 9, 185.
40. Hikita, H., Kataoka, T. and Nakanishi, K., Chem. Engng Japan (1960) 24, 2.
41. Sahay, B.N., "Mass Transfer studies in Packed and Packed bubble columns", Ph.D. Thesis, University of Bombay, (1973).
42. Joosten. G.E.H. and Danckwerts, P.V., Chem. Engng Sci. (1973), 28, 453.

43. Mangers, R.J. and Ponter, A.B., Chem. Engng J., (1980), 19, 139.
44. Mangers, R.J. and Ponter, A.B., Ind. Engng Chem. Proc. Des., Dev., (1980), 19, 530.
45. Onda. K., Sada, E. and Murase, Y., A.I.Ch.E.J. (1959), 5, 235.
46. Onda.K., Sada, E. and Murase, Y., Document No. 5784, A.D.I. Library of Congress, Washington, D.C.
47. Houston, R.W. and Walker, C.A., Indust. Engng Chem., (1950) 42, 1105.
48. Zabban, W. and Dodge, B.F., Chem. Engng Prog. Symp. Ser. No. 10, (1954), 50, 61.
49. Hutchings, L.E., Stutzman, L.F. and Koch, H.A., Chem. Engng Prog., (1949), 45, 253.
50. Dyer, O.E. and Dodge, B.F., Indust. Engng Chem., (1941), 33, 485.
51. Molstad, M.C., McKinney, J.F. and Abbey, R.G., Trans. A.I.Ch.E., (1943) 39, 605.
52. "Fellinger's Data", Courtesy Mr. W. L. Bolles, Senior Engineering Fellow, Monsanto Chemical Company, St. Louis, Missouri, U.S.A., Personal Communication (1986).
53. Vidwans, A.D., "Mass Transfer in Packed Columns", M. Sc. (Tech) Thesis., University of Bombay (1967).
54. Surosky, A.E. and Dodge, B.F., Indust. Engng Chem., (1950) 42, 1112.
55. Lynch, E.J. and Wilke, C.R., A.I.Ch.E.J., (1955), 1, 9.

56. Rizzuti, L. and Brucato, A., Chem. Engng J., (1989), 41, 49.
57. Tepe, J.B. and Dodge, B.F., Trans. A.I.Ch.E., (1943), 39, 255
58. Blum, H.H., Stutzman, L.F. and Dodds, W.S., Ind. Engng Chem., (1952), 44, 2969.
59. Blum, H.H., Stutzman, L.F. and Dodds, W.S., Document No. 3722, A.D.I., Library of Congress, Washington, D.C.
60. Leva, M., A.I.Ch.E.J., (1955), 1, 224.
61. Leva, M., Document No. 4564, A.D.I., Library of Congress Washington, D.C.
62. Teller, A.J. and Ford, H.E., Indust. Engng Chem., (1958) 50, 1201.
63. Vassilatos, G., Trass, O., and Johnson, A.I., Document No. 7410, A.D.I., Library of Congress, Washington, D.C.
64. Yoshida, F. and Miura, Y., A.I.Ch.E.J., (1963), 9, 331.
65. Cryder, Y. and Maloney, J.O., Trans. A.I.Ch.E., (1941), 37, 827.
66. Onda, K., Sada, E. and Takeuchi, H., J. Chem. Engng Japan (1968), 1, 62.
67. Yoshida, F. and Miura, Y., Document No. 7419, A.D.I. Library of Congress, Washington, D.C.
68. Scott, A.H., Trans.Inst. Chem. Engrs., (1935), 13, 211.
69. Tour, R.S. and Lerman, F., Trans. A.I.Ch.E., (1939) 34, 719.
70. Cihla, Z. and Schmidt, O., Coll. Czech, Chem. Comm., (1957) 22, 896.
71. Porter, K.E., and Jones, M.C., Trans. Inst. Chem. Engrs. (1963), 41, 240.

72. Dutkai, E. and Ruckenstein, E., Chem. Engng Sci., (1968) 23, 1365.
73. Onda, K., Takeuchi, H., Maeda, Y. and Takeuchi, N., Chem. Engng Sci., (1973), 28, 1677.
74. Le Goff, P. and Lesinasse, B., Revue I.F.P., (1962), 17, 21.
75. Wijffels, J.B., Verloop, J. and Zuiderweg, F.J., Adv. Chem. Ser., (1974), 133, 151.
76. Bemmer, G.G. and Zuiderweg, F.J., Chem. Engng Sci., (1978) 33, 1637.
77. Sherwood, T.K., Shipley, G.H. and Holloway, F.A.L., Indust. Engng Chem., (1938), 30, 765.
78. Lobo, W.E., Friend, L., Hashmall, F. and Zenz, F., Trans. A.I.Ch.E., (1945), 41, 693.
79. Leva, M., Chem. Engng Prog., (1954), 50 (10), 51.
80. Eckert, J.S., Chem. Engng Prog. (1961), 57 (9) 54.
81. Eckert, J.S., Foote, E.H., and Walter, L.F., Chem. Engng Prog. (1966), 62 (1), 59.
82. Billet, R. and Schultes, M., I.Chem.E. Symp. Ser. 104, (1988), B 255.
83. Bemmer, G.G. and Kalis, G.A.J., Trans. Inst. Chem. Engrs (1978) 56, 200.
84. Takahashi, T., Akagi, Y. and Ueyama, K., J. Chem. Engng Japan., (1979), 12, 1979.
85. Shulman, H.L., Ullrich, C.F. and Wells, N., A.I.Ch.E.J. (1955), 1, 247.
86. Shulman, H.L., Ullrich, C.F., Wells, N. and Proulx, A.Z., A.I.Ch.E.J., (1955), 1, 259.

87. Otake, T. and Okada, K., Soc. Chem. Engrs. Japan, (1953) 17, 271.
88. Mohunta, D.M. and Laddha, G.S., Chem. Engng Sci., (1965) 20, 1069.
89. Buchanan, J.E., Indust. Engng Chem. Fundam., (1967), 6, 400.
90. Buchanan, J.E., A.I.Ch.E.J., (1988), 34, 870.
91. Standish, N., Chem. Engng Sci., (1968), 23, 51.
92. Gelbe, H., Chem. Engng Sci., (1968), 23, 1401.
93. Bennet, A. and Goodridge, F., Trans. Inst. Chem. Engrs. (1970), 48, T 232.
94. Schubert, C.N., Lindner, J.R. and Kelly, R.M., A.I.Ch.E.J. (1986), 32, 1920.
95. Kushalkar, K.B. and Pangarkar, V.G., Chem. Engng Sci. (1990), 45, 759.
96. Van Krevelen, D.W. and Hofstijzer, P.J., Chem. Engng Prog. (1948), 44(7), 529.
97. Onda, K., Takeuchi, H. and Okumoto, Y., J. Chem. Engng Japan., (1968), 1, 56.
98. Kolev, N., Verfahrenstechnik, (1973), 7, 71.
99. Gnielinski, V., Verfahrenstechnik, (1970), 4, 29.
100. Weisman, J. and Bonilla, C.F., Indust. Engng Chem., (1950) 42, 1099.
101. Mada. J., Shinohara, H. and Tsubahara, M. Kogaku Kagaku (1964), 2, 111.
102. Semmelbauer, R., Chem. Engng Sci., (1967), 22, 1237.
103. Jackson, G.S. and Marchello, J. M., J. Chem. Engng Japan (1970), 3, 263.

104. Zech, J.B. and Mersmann, A.B., I.Chem.E Symp. Ser. No.56, (1979), 2.5/39.
105. Billet, R. and Schultes, M., A.I.Ch.E Annual Meet., Washington, D.C. (1988).
106. Puranik, S.S. and Vogelpohl, A., Chem. Engng Sci., (1974) 29, 501.
107. Linek, V., Petricek, P., Benes, P. and Braun, R., Chem. Engng Res. Des., (1984), 62, 13.
108. Dharwadkar, S.W. and Sawant, S.B., Chem. Engng J., (1985) 31, 15.
109. Au-Yeung, P.H. and Ponter, A.B., Can. J. Chem. Engng (1983), 61, 481.
110. Sherwood, T.K. and Halloway, F.A.L., Trans. A.I.Ch.E. (1940), 36, 39.
111. Norman, W.S., "Absorption, Dislillation and Cooling Towers" (1961), Longmans, Green and Co. Ltd., London.
112. Mohunta, D.M., Vaidyanathan, A.S. and Laddha, G.S., Indian Chem. Engr., (1969), 11, 73.
113. Taecker, R.G., and Hougen. O.A., Chem. Engng Prog., (1949) 45, 188.
114. Shulman, H.L. and Margoilis, J.E., A.I.Ch.E.J., (1957), 3, 157.
115. Shulman, H.L. and Delaney, L.J., A.I.Ch.E.J., (1959) 5, 290.
116. Bolles, W.L. and Fair, J.R., I.Chem.E. Symp. Ser., No. 56, (1979), 3.3, 35.
117. Bolles, W.L. and Fair, J.R., London Data Bank, (1979) Instn. Chem. Engrs. UK.
118. Billet, R., I.Chem.E. Symp. Ser. No. 32, (1969), 4, 42.

119. Clump, C.W., Ph.D. Thesis, Carnegie Institute of Technology
Pittsburg, (1953).
120. Kirschbaum, E., "Distillation and Rectification", (1948)
Chemical Publishing Co. Inc., New York.
121. Silvey, F.C. and Keller, G.J., I.Chem.E. Symp. Ser. No. 32,
(1969), 4, 18.
122. Draper, N. and Smith, H. "Applied Regression Analysis" 2nd
Edition, (1981), John Wiley and Sons, New York.
123. Dorn, W.S. and McCracken, D.D., "Numerical Methods with
Fortran IV case studies", (1972), John Wiley and Sons,
New York.
124. Chapra, S.C. and Canale, R.P., "Numerical Methods for
Engineers" 2nd Edition, (1989), McGraw-Hill Book Company,
New York.
125. Constantinides, A., "Applied Numerical Methods with Personal
Computers", (1987), McGraw-Hill Book Company, New York.
126. Swann, W.H., "Direct search methods" in "Numerical Methods
for Unconstrained Optimization (Ed. W.Murray), (1972)
Academic Press, London.
127. Hooke, R. and Jeeves, T.A., J.Assoc. Comput. Mach., (1961)
8, 212.
128. Rosenbrock, H.H., Computer J., (1950), 3, 175.
129. Swann, W.H., "Report on the development of a new direct
search method of optimization", ICI Ltd. Central Instr. Lab.
Res. Note 64/3, (1964).
130. Fletcher, R., Computer J., (1965), 8, 33.
131. Fletcher, R., "Practical Methods of Optimization" 2nd
Edition, (1987), John Wiley and Sons., New York.

132. Powell, M.J.D., Computer. J., (1964), 7, 155.
133. Rekliaits, G.V., Ravindran, A. and Ragsdell, K.M.
"Engineering Optimization Methods and Applications", (1983)
John Wiley and Sons, New York.
134. Box, M.J., Davies, D. and Swann, W.H., "Nonlinear
Optimization techniques", (1969), ICI Monograph 5,
Oliver and Boyd, Edinburgh.
135. Rose, L.M., "The Application of Mathematical Modelling to
Process Development and Design", (1974), Applied Science
Publishers Ltd., London.
136. Beightler, C.S., Phillips, D.T. and Wilde, D.J.
"Foundations of Optimization", 2nd Edition, (1982),
Printice Hall of India Pvt. Ltd., New Delhi.
137. Robinson, E.R., "Time Dependent Chemical Processes", (1975)
Applied Science Publishers Ltd., London.
138. Spendley, W., Hext, G.R., and Himsworth, F.R.,
Technometrics, (1962), 4, 441.
139. Beveridge, G.S.G. and Schechter, R.S., "Optimization Theory
and Practise", (1970), McGraw-Hill Kogakusha Ltd., Tokyo.
140. Nelder, J.A. and Mead, R., Computer, J., (1965), 7, 308.
141. Parkinson, J.M., and Hutchinson, D. "An investigation into
the efficiency of variants on the simplex method" in
Numerical Methods for Non Linear Optimization
(Ed. F.A. Lootsma), (1972), Academic Press, London.
142. Press, W.H., Flannery B.P, Teukolsky, S.A. and Vetterling,
W.T., "Numerical Recipes", (1986), Cambridge University
Press, Cambridge.

143. Valko, P. and Vajda, S., "Advanced Scientific Computing in Basic with applications in Chemistry, Biology and Pharmacology", (1989), Elsevier, Amsterdam.
144. Box, M.J., Computer J., (1965), 8, 42.
145. Van Krevelen, D.W. and Hofstijzer, P.J., Int. Congr. Chim. Ind., 21st, Brussels, (1948), Special No., P 168.
146. Barrett, P.V.L., "Gas absorption on a sieve plate"., Ph.D. Thesis, Cambridge University, (1966).
147. Danckwerts, P.V., "Gas-Liquid Reactions", (1970), McGraw-Hill Book Company, New York.
148. Onda, K., Sada, E., Kobayashi, T., Kito, S. and Ito, K., J.Chem. Engng Japan, (1970), 3, 18.
149. Hikita, H., Asai, S., Katsu, Y. and Ikuno, S., A.I.Ch.E.J. (1979), 25, 793.
150. Perry, R.H. and Green, D.W., "Perry's Chemical Engineers Handbook", (1984), 6th Edition., Mc Graw Hill Book Company New York.
151. Mikhail, S.Z., and Kimel, W.R., J. Chem. Engng Data, (1961) 6, 533.
152. Mikhail, S.Z., and Kimel, W.R., J. Chem. Engng Data, (1963) 8, 323.
153. Wirges, H.P., Warnecke, H.J. and Friedrich, A., J.Chem. Engng Data, (1977), 22, 165.
154. "International Critical Tables", Volume III, (1928), McGraw-Hill Book Co. Inc., New York.

155. Weast, R.C., (Editor), CRC Handbook of Chemistry and Physics, 65th Edition, (1984), CRC Press Inc., Florida.
156. Hitchcock, L.B., and McIlhenny, J.S., Indust. Engng Chem. (1935), 27, 461.
157. Horvath, A.L., "Handbook of Aqueous Electrolyte Solutions", (1985), Ellis Horwood Limited, Chichester.
158. Maddox, R.N., "Gas and Liquid Sweetening", 2nd Edition (1977), J.M. Campbell, Oklahoma.
159. Thomas, W.J. and Furzer, I.A., Chem. Engng Sci, (1962), 17, 115.
160. "International Critical Tables", Volume V, (1929), McGraw-Hill Book Co. Inc., New York.
161. "International Critical Tables", Volume VII, (1930), McGraw-Hill Book Co. Inc., New York.
162. Guyer, E.C. (Editor), "Handbook of Applied Thermal Design" (1989), McGraw - Hill Book Company, New York.
163. "International Critical Tables", Volume IV, (1928), McGraw-Hill Book Co. Inc., New York.
164. Yaws, C.L., Yang, H.C., and Pan, X. Chem. Engng, (1991) March, 140.
165. Tamara, M., Kurata, M., and Odani, H., Bull. Chem. Soc. Japan, (1955), 28, 83.
166. Reid, R.C., Pransnitz, J.M., and Poling, B.E., "The Properties of Gases and Liquids", (1988), McGraw-Hill Book Company, New York.
167. Chatteraj, D.K. and Birdi, K.S., "Adsorption and Gibbs Surface Excess", (1984), Plenum Press., New York.

168. Nelson, R.D., "Dispersing Powders in liquids", (1988) Elsevier Science Publishers B.V., Amsterdam.
169. Zisman, W. A., Indust. Engng Chem., (1963), 55, 19.
170. Scriven, J.E. and Pigford, R.L., A.I.Ch.E.J., (1958), 4, 439.
171. Scriven, L.E. and Pigford, R.L., A.I.Ch.E.J., (1959), 5, 397.
172. Vivian, J.E. and King, C.J., A.I.Ch.E.J., (1964), 10, 220.
173. Ratcliff, G.A. and Holdcroft, J.G., Trans. Inst. Chem. Engrs., (1963), 41, 315.
174. "International Critical Tables", Volume V, (1929), McGraw-Hill Book Co. Inc., New York.
175. Hirschfelder, J.O., Curtiss, C.F., and Bird, R.B., Trans, Am. Soc. Mech. Engrs., (1949), 71, 245.
176. Wilke, C.R. and Lee, C.Y., Indust. Engng Chem., (1955) 47, 1253
177. Astarita, G., Savage, D.W., and Bisio, A., "Gas Treating With Chemical Solvents", (1983), John Wiley & Sons, New York
178. Pinsent, B.R.W., Pearson, L., and Roughton, F.J.W., Trans. Faraday Soc., (1956), 52, 1594.
179. Hikita, H., Asai, S, Ishikawa, H. and Honda, M., Chem. Engng J., (1977), 13, 7.
180. Porter, K.E., Trans. Inst. Chem. Engrs, (1968), 46, T 69.
181. Groenhof, H.C., Chem. Engng J., (1977), 14, 181.
182. Hoogendoorn, C.J. and Lips, J., Can. J. Chem. Engng, (1965) 125.
183. DeWaal, K.J.A., Ph.D Thesis, University of Delft, (1965).
184. Van Swaaij, W.P.M., Charpentier, J.C. and Villermaux, J., Chem. Engng. Sci., (1969), 24, 1083.

185. Hatta, S., Tohoku Imp. Univ. Tech. Repts., (1928), 8, 1.
(Reprinted in Int. Chem. Engng. (1978), 18, 443).
186. Sengupta, R. and Puranik, S.A., "Mathematical modelling w.r.t effective interfacial area in irrigated packed beds". Paper presented at the 41st Annual Session of Indian Institute of Chemical Engineers, Dec. 16-19, 1988, Baroda.
187. Sengupta, R. and Puranik, S.A., "Proceedings of A.P.C.Ch.E 5th Congress" (Kualalumpur, Malaysia, July 1990), P 6a - 27.
188. Delaloye, M.M., Von Stockar, U. and Xiao-ping, L, Chem. Engng. J., (1991), 47, 51.
189. Sengupta, R. and Puranik, S.A., "Prediction of mass transfer coefficients in packed absorption columns". Paper presented at Chemcon 90', 43rd Annual Session of Indian Institute of Chemical Engineers, Dec. 15 - 18, 1990, Varanasi.
190. Sengupta, R. and Puranik, S.A., 'Mass transfer coefficients in packed columns : Predictions by mathematical modelling". Paper presented in the workshop on 'Distillation' at the 4th World Congress of Chemical Engineering, Karlsruhe, Germany 16 - 21 June, 1991.