BOOK REVIEW

WATER AND WASTEWATER TREATMENT, CALCULATIONS FOR CHEMICAL AND PHYSICAL PROCESSES

by

Michael J. Humenick, Jr.

Marcel Dekker, Inc., New York and Basel 1977, pp. viii + 236

This book deals mainly with process calculations in the field of water and wastewater treatment. It has been published in "Series of Reference Books and Textbooks on Pollution Engineering and Technology". The author, Professor M. J. Humenick, Jr., of the Department of Civil Engineering, the University of Texas at Austin, has brought together a wealth of material showing calculations of various processes in physical and chemical treatment.

The book is organized into nine chapters. Equalization problems in wastewater treatment are presented in **Chapter 1**. Various methods for design of flow and concentration equalization basins are included. A computer program for the calculation of equalized flows and concentrations from these basins is given in the appendix.

In **Chapter 2**, coagulation and flocculation problems are considered. The problems include determination of chemical doses and estimation of the amount of produced sludge. The precipitation of phosphate and removal of organic phosphorous from wastewaters by coagulation and flocculation by the use of aluminium or iron salts or lime is included. Design calculations are performed for flocculators and kinetic modelling of the flocculation rate is presented.

Chapter 3 covers chemical precipitation, water conditioning, and softening. The equilibrium expressions for the carbonate and hardness systems are presented. Various methods of estimation of chemical doses and of final water composition in softening processes are illustrated. The bar diagram method and stoichiometric equations for water softening, as well as the application of equilibrium diagrams to determine the condition of these doses are given.

Chapter 4 is devoted to gravity sedimentation, thickening, and flotation. Design methods are outlined for sedimentation basins, grit chambers, thickeners, and oilywater separators. In Chapter 5, the main emphasis is placed on filtration. Calculations for headloss through sand filters, sand preparation, expansion of the media during backwash, and underdrain systems are performed. The problems also include determinations of optimum operating conditions for diatomite filtration and the optimum polyelectrolyte dose for sludge conditioning before vacuum filtration. A procedure for the determination of vacuum filter loadings by filter-leaf studies is given.

Chapter 6 deals with the application of activated carbon adsorption in water and wastewater treatment. Design calculations of batch and continuous systems are performed. The use of the adsorption isotherm relationships for removal of organics from aqueous solutions is given and various methods of continuous-flow column design are included.

Ion exchange problems are presented in **Chapter 7**. Calculations of ion-exchange beds capacity are performed. The material balance and equilibrium equations are used and the method of calculation of

pressure drop during operation of an ion-exchange column is shown. Design problems deal with: a small demineralization system with mixed bed, throw-away ion-exchange cartridges, and a large two-stage ion-exchange system containing (in sequence) a cation unit, decarbonator, and an anion unit.

Chapter 8 introduces chlorination and disinfection. Examples of oxidation-reduction equations for disinfection by chlorination, calculations of chemical dosage, and economic aspects of the use of various disinfectans are included. Applications of Chick's Law and the kinetic analysis of disinfection in some systems are presented. The effect of various environmental factors on contact tank performance is considered.

The last chapter introduces the aeration process. Calculations of the solubility of the atmospheric gases are performed and the dependence of the dissolved oxygen concentration in water on the temperature, pressure, and salinity is shown. Problems include also calculations of the volume of the compressor discharge gas, as well as calculations of mass transfer coefficients and the transfer efficiency of aeration devices for steady-state and nonsteady-state reaeration.

The book concludes with appendices containing various physical data, balancing redox equations, conversion factors, and a subject index. A computer program written in Fortran for calculation of the autocorrelation coefficient is also included.

In the view of the reviewer this book is well-written and it is expected to prove quite useful to design engineers. The book is also strongly recommended for a graduate engineering course in physical-chemical water and wastewater treatment.

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