

Book Review

Carbon, nitrogen and sulfur pollutants and their determination in air and water

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Marcel Dekker, Inc., New York and Basel, 1990. pp.376

Carbon, nitrogen and sulfur are major players in the life cycles in the biosphere, but have also roles in processes in the lithosphere, hydrosphere and atmosphere. Each of these elements cycles among these regions in biogeochemical cycles. Significant perturbations in their local levels can result in abnormal redistribution of regional and even global levels. Carbon, nitrogen and sulfur have, due to their ubiquity in technology and agriculture and their ability to move freely among lithosphere, hydrosphere, atmosphere and biosphere, nearly always played some role in pollution, but their roles now extend beyond local irritations of smogs or lake contaminations into local and even global problems like acid rain, ozone depletion and greenhouse warming. Hence, the control of these elements is inevitable. As a countless number of compounds of carbon, nitrogen and sulfur may be formed in almost all forms of human activity, control and research laboratories of many industries have become increasingly involved in their monitoring. Very often those charged with method selection are not analytical chemists but engineers or environmentalist who have not the ability to choose the appropriate method from the vast literature on the subject. This monograph is intended for those non-analytical chemists who are suddenly faced with the problem of monitoring some pollutants in waste stream or stack gases and need help and orientation in selecting the appropriate methodology.

The book consists of four parts.

Part I, Introduction provides an overview of the history of pollution and a brief description of the carbon, nitrogen and sulfur cycle, and serves to underline the importance of measurement and control of the level these elements.

In Part II, entitled The chemistry of carbon, nitrogen and sulfur as pollutants, after the description of the three elements and their bond types in general, the structures, properties and some chemical and biochemical reactions of the elements and some of their environmentally relevant compounds are dealt with.

Within Part II separate chapters deal with the roles played by the three elements in water and air pollution in which the definition of pollution and reactions and equilibria of some important polluting species are presented.

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Part III on the analysis of carbon, nitrogen and sulfur in the environment is the longest section in which separate chapters are concerned with the use of analytical methods with emphasis on the special aspects of method selection, sampling procedures, statistics and error analysis. Following them the methods used for the determination of the three elements in air water and other matrices of environmental importance are treated in groups of physical methods, electrochemical methods, chromatography, chemical methods and bioanalytical methods. Physical methods include spectrophotometry, non-dispersive IR, FTIR reflectance spectrometry, turbidimetry and nephelometry.

Of electrochemical methods potentiometry, conductometry and under the somewhat misleading and unusual title "kinetic methods" voltammetry and coulometry are dealt with.

In the chapter on chromatography gas, liquid and thin-layer chromatography are treated in some detail. The chapter entitled Chemical methods includes miscellaneous techniques from gravimetry through volumetry, gas detection tubes, combustion methods to flow analyzers.

Bioanalytical methods, e.g. enzyme analysis and immunochemical analysis are included to show the potential applications of these modern methods in environmental control.

Within Part III the chapters are organized similarly. First the principles of the techniques and basic elements of the instruments are described at an introductory analytical chemistry course level, followed by some environmental analytical applications, with emphasis on official methods used in the USA.

Reference is made mainly on ASTM and EPA methods, while other methods are treated very briefly, with reference, in the majority of cases to handbooks, often not even recent ones.

In Part IV covering 4 pages only, some comments are given concerning commercial equipment. This section provides information on the sources of more detailed information on equipment for environmental control purposes.

As the author stated, the monograph is presented at a level which requires no more background than is provided by typical introductory college level courses in chemistry.

The book can be recommended mainly to non-chemist engineers who start working in the field of environmental pollution control and are interested in the role and determination of carbon, sulfur and nitrogen. The book provides an insight into the problems of the field, the chemistry of the three elements, aspects of sampling and analysis, and information on the ASTM and EPA methods. For the practical implementation of any specific method the reader is referred to the original method description.

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