

Environmental analytical chemistry has evolved from the traditional analytical chemistry to a well-established discipline and a profession attractive to a diverse group of environmental scientists / engineers, chemists, and educators. Environmental analysis and monitoring is a very challenging and dynamic field in a sense that it involves the most uncertain and error-prone stage of acquiring representative samples, laborious sample preparation from complex matrices, costly instrumental qualification and quantification of contaminants at the parts per million to parts per quadrillion levels, and the ever changing requirements for regulatory compliance in monitoring drinking water, UNESCO – EOLSS SAMPLE CHAPTERS ENVIRONMENTAL MONITORING – Environmental Analytical Chemistry – Chunlong Zhang ©Encyclopedia of Life Support Systems (EOLSS) wastewater, ambient / emission air, and solid / hazardous wastes. The discussions of this chapter start with the historical perspectives, unique features, and scopes of this discipline. The importance of representative sampling, the approaches to select costeffective sampling design schemes, as well as classical grab / active sampling vs. passive diffusion-based sampling techniques are delineated, followed by the discussions of environmental sample preparation goals, various digestion procedures for inorganic metals, and various extraction and partition based methods for volatile and semi-volatile compounds. Traditional chemical instrumental methods and their corresponding environmental applications are briefly described with respect to spectroscopic, chromatographic, mass spectrometric, electrochemical, thermal, and radiological methods. Complementary bioanalytical methods currently used in environmental analysis such as immunoassays and those with promise in future development such as biosensors are introduced. This chapter concludes with the remarks on the future perspectives and challenges of environmental analytical chemistry. There is an urgent need for advancing sampling methodology for practical applications, instrumental innovations for faster, more sensitive and affordable bench instruments, and miniature sensing devices for real time monitoring and remote application.