

# Preface

For as long as history has been recorded man has polluted and overexploited the environment in the pursuit of his own well-being. However, as everyone knows, nature itself is a source of pollution (volcanic eruption, natural burning, etc.)

Engineers occupy a strategic place in society because of their dualistic role. If on the one hand their work has sometimes a negative impact on the environment, on the other hand they help reducing or even eliminating pollution by developing treatment processes for water, solid waste and air.

According to the Royal Academy of Engineers, Engineering is “the application of scientific principles to the optimal conversion of natural resources into structures, machines, products, systems and processes for the benefit of humankind”.

Nowadays, it is well understood that we must make every possible effort to protect the environment. And now more than ever engineers must provide insights leading towards a sustainable standard of living to protect human and environmental health. However, although the concept of sustainable development has been defined more than 20 years ago, to date its application to actual technological context has not been so straightforward.

The main challenge that green engineering has had to face so far is the operational quest for sustainability. This means looking for strategies where water management and energy use are evaluated jointly. In order to meet this challenge, a number of considerations have to be integrated in the design of wastewater treatment plants, e.g., higher levels of removal efficiency of contaminants, and energy and nutrient recovery. To facilitate direct water reuse, research programs for wastewater treatment must be directed towards technologies that require less non-renewable energy sources, reduce the use of hazardous chemicals, and remove contaminants.

Several Life Cycle Assessment studies of wastewater treatment systems have been evaluating competing technologies and consistently identifying the strong influence that energy consumption has on the overall environmental impact. Not to mention the strong influence that also sludge handling and disposal process have on the overall environmental impact.

In light of these aspects of wastewater treatment, [Chap. 1](#) presents the advantages linked to the application of chemically assisted primary sedimentation (CAPS); this enables energy optimization of wastewater treatment plants and points to the possibility of wastewater as a possible resource. The increase in production of primary sludge obtained in CAPS generates a major production of biogas in anaerobic digestion which can off-set the power used for the treatment process, thus reducing the use of non-renewable energy. In addition, this chapter discusses the use of organic coagulants such as chitosan (which has a much lower cost) in the CAPS process.

In recent years, there has been increasing concern about the release of contaminants such as endocrine disruptors compounds (EDCs), pharmaceuticals and personal care products (PPCPs) into the environment. These contaminants are ubiquitous, persistent and biologically active, and they may cause disruption of endocrine systems as well as affect the hormonal control of development in aquatic and terrestrial biota. Because the majority of emerging compounds are detectable in the environment at concentrations ranging in ng/L to µg/L levels, [Chap. 2](#) discusses the analytical problems related to the analytical detection of pollutants and of their transformation products.

The effluent from urban wastewater treatment plants (UWWTPs) are among the major sources involved in surface water contamination by EDCs/PPCPs. Hundreds of tons of pharmacological substances enter UWWTPs each year, and very likely they would not be degraded by the physical and biological processes, thus contributing to widespread environmental pollution. The likelihood of water contamination with emerging pollutants as a result of discharge of UWWTP effluents depends on several factors. Among them the most important are: (i) the physico-chemical properties of pollutants; (ii) the wastewater treatment technology in use; (iii) the type of activated sludge process, and (iv) the climatic conditions (such as rainfall, temperature and sunlight). Activated sludge has been the most frequently used biological process in wastewater treatment plants. However, its effectiveness in the removal of emerging contaminants has been recently questioned leading to the employment of advanced processes. A number of investigators have addressed this issue over the past decade highlighting the promising role of a special class of oxidation techniques defined as advanced oxidation processes (AOPs). Other studies have focused on membrane bioreactors (MBR) to treat emerging contaminants from water and wastewater. A brief description of MBR principles and technology is presented in [Chap. 3](#), with updated figures showing the distribution of these plants worldwide. Based on literature data, the efficiency of MBR plants for removing trace pollutants is compared with conventional systems. Finally, there is a discussion on the “green” character of MBR technology.

[Chapter 4](#) evaluates the application of Wet Oxidation (WO) for the treatment of aqueous effluents to remove trace pollutants, based on flow rate and organic content in the wastewater effluent.

[Chapter 5](#) is a review of the application of Photo-Fenton process and complementary treatment systems ( $\text{H}_2\text{O}_2/\text{UV-C}$  and Fenton’s reagent) for the

degradation of two industrial pollutant categories with significant endocrine disrupting properties: alkyl phenols (nonyl and octyl phenols) and bisphenol A.

All chapters include fundamentals of the processes investigated as well “green aspects” of technologies that will offer students, technicians, and academics the opportunity to evaluate and select the technologies that lead to better and more sustainable treatment.

Salerno, October 2011

Giusy Lofrano

<http://www.springer.com/978-94-007-1429-8>

Green Technologies for Wastewater Treatment  
Energy Recovery and Emerging Compounds Removal

Lofrano, G. (Ed.)

2012, XX, 92 p. 24 illus., Softcover

ISBN: 978-94-007-1429-8