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Preface

This special issue contains material presented at the international Summer School on 'The biological sulfur cycle: environmental science and technology', held in Wageningen, The Netherlands, April 19–24, 1998. The Summer School was sponsored by the Training and Mobility of Researchers programme of the European Union (ERBFMMACT970267). The Summer School participants included engineers, (micro)biologists, chemists and earth scientists from universities and research organisations as well as environmental consultants and contractors.

Sulphur is an essential element for life on earth and its redox conversions are of significance in the biogeochemical sulphur cycle. The study of the microbiota present in the sulphur cycle was already initiated at the end of the 19^{th} century with the pioneering work of Winogradsky and Beijerinck. Sulphur conversions involve the metabolism of several different specific groups of bacteria (sulphate reducing bacteria, phototrophic sulphur bacteria, thiobacilli,...), specialised to use these sulphur compounds in their different redox states. These bacteria possess unique metabolic and eco-physiological features. Consequently, these bacteria have often been used in front line research and the development of new analytical techniques. Some of these techniques include microelectrodes, molecular biological detection methods (16S ribosomal RNA probes, PCR) and nuclear magnetic resonance (NMR) procedures. Their use to monitor population dynamics and sulphur dependent metabolic conversions are addressed in the opening chapter of this issue.

Besides its importance from a basic scientific point of view, the sulphur cycle is also important for environmental pollution and bioremediation. Big environmental problems can arise when the natural sulphur cycle is disturbed. Increased anthropogenic activities disturb the natural sulphur cycle, thus leading to local imbalances of the sulphur, but also of the organic matter, nitrogen or heavy metal fluxes. Many adverse effects from sulphur pollution are well known: acid rain, odour nuisance at polluted rivers, landfills or treatment systems, corrosion of steel and concrete, heavy metal and acidity release from oxygen exposed sediments and mineral ores,... These examples show that sulphur pollution is encountered at all levels in the environment: natural waters and wastewaters, the atmosphere, solid waste, soils and sediments. The remaining chapters of this issue deal with pollution of each of these compartments and the available remediation technologies.

This issue particularly focusses on a whole set of biological technologies, recently developed to minimise the impact of sulphur pollution. To date, environmental engineering disposes of biological techniques to treat wastewaters (biological removal of sulphur, organic matter and heavy metals), off gases (bioscrubbers, biological flue gas desulphurisation), solid wastes and soils (constructed wetlands, microbial desulphurisation of coal, oil, rubber and gypsum). The papers in this issue discuss the microbiology, process technology and socio-economic aspects of some of these technologies. Special attention is given to novel biotechnological processes that utilise sulphur cycle conversions. These recently developed technologies allow a complete removal of sulphur from wastestreams by its conversion into insoluble elemental sulphur. Thus, elemental sulphur can be reused, which fits well in the concept that sound environmental remediation techniques should focus on resource recovery.

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