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THE QUALITY OF RIVERS: FROM PRISTINE STAGE TO GLOBAL POLLUTION

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Abstract

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River water quality is highly variable by nature due to environmental conditions such as basin lithology, vegetation and climate. In small watersheds spatial variations extend over orders of magnitude for most major elements and nutrients, while this variability is an order of magnitude lower for major basins. A standard river water for use as reference is therefore not applicable. As a consequence natural waters can possibly be unfit for various human uses, even including drinking. The Water Quality (WQ) concept has greatly evolved since the beginning of the century in accordance with expanding water uses and analytical developments. Even in well developed countries the dissolved heavy metal measurements in rivers are not very reliable while dissolved organic micro-pollutants are even rarely analysed routinely. Major WQ problems have been identified according to river basin size, including organic pollution, salinity, total suspended solids, heavy metals, eutrophication, nitrate, organic micro-pollutants, acidification. They generally occurred in this order over a period of about 100 years in the industrialized countries. Historical records of WQ are rare but can be established indirectly through studies of lake sediments. When proper control action is taken at an early stage, numerous examples of WQ recovery have been found in rivers for most of the common pollution problems. Future WQ problems will mostly derive from mine tailings and toxic waste disposal in both developed and developing countries, industrial accidents and organic micropollutants which emerge faster than our analytical capacities. The newly industrializing countries will face all the above-mentioned problems within a very short time period without having the means to cope with them one at a time. River studies point out the global alteration of the biogeochemical cycles of many major elements and nutrients (S, Na, K, N, P). For heavy metals such as lead, present estimates of global river loads emphasize the role of interim storage on land, thus delaying downstream pollution problems.

Introduction

Major scientific concern about global river quality dates from the 1950's when the International Association for Scientific Hydrology launched a worldwide programme for the first time (Durum et al., 1960). This work was one of the data bases of Livingstone (1963), a masterwork on river chemistry which still constitutes the only available thesaurus at global scale. Since then, our knowledge has considerably progressed in two directions. Firstly, scientific studies of major river basins were completed for the Amazon (Gibbs, 1967; Stallard, 1980) the Mekong (Carbonnel and Meybeck, 1975), the Zaire (Eisma, 1978), the major Chinese rivers (Hu Ming Hui et al., 1980), the Orinoco (Lewis and Saunders, 1989) etc. Some major programmes developed ten years ago are still going on as on the Amazon organic matter (Richey et al., 1980), and the International programme (SCOPE-CARBON) on river chemistry (Degens and Kempe, 1982, 1983, 1985, 1987). Secondly,

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