Chapter 10
Assessment of Surface Water Pollution With Heavy Metals

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ABSTRACT

Water pollution represents the direct or indirect change of its normal composition as a result of human activity in such extent that is affecting all other possibilities to use the water in its natural state. This study was carried out to investigate the seasonal variability and distribution of heavy metals in the waters of Somesul Mic (Romania), Bic (Republic of Moldova), and Prut (Romanian-Moldovan natural border) rivers. Water samples were collected from nine sampling sites in Autumn 2016, Spring and Summer 2017. Dissolved metals concentrations were measured using inductively coupled plasma mass spectrometry (ICP-MS) and flame atomic absorption spectrometry (AAS). The metal index (MI) was calculated to assess the contaminations of the Somesul Mic, Bic, and Prut rivers. MI values revealed that Somesul Mic and Prut rivers are pure to moderately affected by metal pollution, while Bic river is slightly to strongly affected by metal pollution.

DOI: 10.4018/978-1-7998-1241-8.ch010
INTRODUCTION

The small rivers are the focus of scientists around the world, as they have become the main receptors of the most diverse pollutants. According to the numerous bibliographic data, the pollution induces considerable changes in both the hydrochemical composition of the rivers and the future water use options (Xie et al., 2013; Cao, 2016; Khatri, 2015; Begu, 2006). Permanent sources of pollution, which primarily modify the composition of biocenoses, include the household and agricultural waste waters, industrial effluents, meteoric water, as well as the unauthorized landfills near the river meadows (Mustea, 2002; Duca, 2014).

In the Republic of Moldova domestic waste waters represent the main and most serious pollution source of small rivers, as most of these waters are discharged untreated or treated inappropriately. The discharge of untreated waters with high loads of pollutants and nutrients directly into the natural basins cause their eutrophication, a phenomenon detected in the Bic and other small rivers, as described in “The state of the environment in the Republic of Moldova” for 2004 and 2006 years.

River water pollution in Romania is mainly due to the agricultural activities, urban agglomerations and industrial activities. In the Somes river basin extraction and processing of non-ferrous ores causes the metal pollution in the Rodna and Baia Mare mining areas, along with the agro-zoo-technical activities (fertilizers, animal manure and untreated wastewater) in the rural areas, and insufficiently treated wastewater discharges in the urban areas. Levei (2008a, 2011b), Ani (2011) and Smical (2015) showed that in the Somesul Mic river the main source of pollution is the discharge of insufficiently or partially treated wastewaters.

Worldwide, the problem of water pollution is of a big concern. A large number of researches demonstrate the worsening of the river water quality and ecological status around the world (Nienhuis, 2002; Barinova, 2004; Scierbak, 2006; Ivanova, 2007; Goher, 2014; Zhang, 2014; Hasan, 2016; Bilgin, 2016).

Some of the most toxic inorganic pollutants are heavy metals. Generally, trace amounts of metals are always present in freshwaters from the weathering of rocks and soils. In addition, particularly in developed countries, industrial wastewater discharges and mining are major sources of metals in freshwaters. Significant amounts of metal pollutants penetrate the surface waters in sewage, as well as with atmospheric deposition (e.g. lead). Lead is still widely used as an additive in petroleum for automobiles and is emitted to the atmosphere in their exhaust gases, thereby entering the hydrological cycle (Chapman, 1996).

Thus, this chapter presents a study of heavy metals concentrations in the water samples collected from the Somesul Mic, Bic and Prut rivers. For the first time the water quality of these rivers was evaluated and compared using metal index (MI). The MI values of water samples were calculated according to Tamasi and Cini (2004), and for assessment of water quality was used classification applied by Yusuf et al. (2018). For calculations were used the maximum allowable concentration for surface water regulated by the Moldavian standards (“The Regulation on Environmental Requirements for Surface Waters. GD Nr.890/2013”, 2013). The concentrations of heavy metals were monitored by applying inductively coupled plasma mass spectrometry method (ICP-MS), a modern and powerful characterization tool used in elemental analysis, along with the atomic absorption spectrometry (AAS).