Chapter 22
Hydrochemistry of Polluted Surface Water: Case Study of Moldova

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ABSTRACT

Surface water is one of the most significant sources of natural ecosystems existence, climate regulation, broadly used for economic activity, drinking water supply, recreation, irrigation, etc. Therefore, chemical composition and grade of water pollution are of great importance to evaluate the ecological state of water resources and their usage in different scopes. The chapter represents the complex study of water chemical composition and pollution of the Dniester River basin within the borders of the Republic of Moldova during 2015-2020. The following water bodies were selected for this purpose: Dniester River and its tributaries Răut and Ichel. Based on the traditional hydrochemical parameters, the grade of water pollution with biogenic substances and biodegradable and persistent organic matter was estimated. The tributaries contribution to the Dniester River's water chemical composition formation was analyzed.

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INTRODUCTION

The Republic of Moldova is an independent state in southeastern Europe located in a geographical area with a temperate-continental climate and insufficient humidity. The physical-geographical factors determine the rather limited reserve of surface waters, which constitute about 1.5% of the total surface of the country, that considerably decrease their balance in arid years (Duca, 2014; Mustea et al., 2011). The surface waters in the country are represented by large and small rivers, lakes and artificial reservoirs, all belonging to the Black Sea basin. The longest are the cross-border rivers Nistru and Prut, and their tributaries Răut, Bâc, Botna, Ichel, Cogâlnic and Ialpug. The transboundary water resources of the Dniester and Prut rivers constitute on average 90% of the total water resources in the country (UNDP Moldova National Human Development Report, 2013). All rivers can be grouped in three main water basins affiliated to the Dniester river, Danube river and the Black Sea estuaries which accumulate the small rivers in the south part of the country. The main sources of rivers supply are snow and rains, the role of groundwater being much lower. This mode of rivers supply ensures the maximum rivers' water level in spring. In the summertime, during periods of torrential rains, the river's water level, including small ones, can rise considerably, sometimes causing catastrophic floods (Gladchi, Bunduchi, et al., 2020).

The Dnieste River is a cross-border watercourse, which streams from the Ukrainian Carpathians, starting near the border with Poland and the Republic of Moldova flowing through the eastern to the south part of the country. It forms a portion of Moldova's border with Ukraine to the northeast, then crosses the territory of the country, reaches again the border of Ukraine in the southeast, and then flows into the Black Sea. The total length of the Dniester river is 1362 km, of which 657 km are within the Republic of Moldova's territory. The perimeter of the Dniester river basin area is about 19 thousand km^3 within the country, and the average of annual flow is 10.7 km^3 (Cazac, et al., 2007). The Dniester River is the main water artery of the Republic of Moldova, its river basin occupies about 60% of the country's territory and represents the main source of drinking water for more than 1 million of the country's population. The waters of the Dniester are intensely polluted by sewage, municipal and domestic wastewater, negatively influencing the river water quality (Moldova: Water Security and Future Outlook, 2021). This considerably affects the socio-economic development of the region, which mostly depends on the river's waters quality (Goreaceva and Duca, 2004; Duca, 2014; Duca and Vaseashta, 2020).

From the Dubasari dam accumulation reservoir to Chisinau, the Raut and Ichel tributaries flow into the Dniester at the right side of the river. Raut River is the largest tributary of the Dniester, with a length of 286 km and the water accumulation basin surface - 7,760 km^2. Within the basin of both above-listed tributaries the large administrative points, industrial and agricultural objects are located. On the Raut river, the city Balti is located with a population of about 150 thousand people, where the city's treatment plant is discharging the sewage water into the river. Apart from Balti, there are located some large localities such as Marculesti, Floresti, Orhei and others. The biggest part of the Raut basin on its course towards the Dniester captures the waters of the polluted streams from small rivers Copacianca, Cubolta, Cainari, Ciuluc, Cula, Cogalnic. Another Dniester right bank tributary is the river Ichel, which has a total length of 101 km and flows into the Dniester near Chisinau. Most part of the river basin is used for agriculture. Through its basin flow over 80 small rivers with a total length of 294 km, of which 75 are less than 10 km long and 7 - between 11-20 km (Goreaceva and Duca, 2004).

Therefore, the tributaries of the Dniester river flowing through many urban and rural localities, represent the additional sources of pollution due to the untreated wastewater discharge, sanitary protection areas uncontrolled grazing, significant anthropogenic impact on the main river, which poses a danger