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DESCRIPTION OF THE HYDROCHEMICAL REGIME OF THE DNISTER RIVER (BY BASIC IONS)

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Dniester is the second longest river in Ukraine and the ninth in Europe. It flows within the territory of Ukraine and Moldova. The source of the Dniester is in the Ukrainian Carpathians, the river flows into the Dniester estuary, connected to the Black Sea. The length of the river is 1362 km (within Ukraine - 925 km), the basin area – 72 100 km^2 (in Ukraine – 52 690 km^2). The flow of the Dniester in the average water year is 10.0 km^3 (flow rate - 310 m^3/s). The Dniester basin is divided into three parts according to the complex of natural channels: the Carpathian (upper), Volyn-Podilsky (middle) and lower southern. The river network in the Dniester basin is developed unevenly. It is the densest in the Carpathian part of the pool, on which about 70% of the flow is formed. The river network is less developed on the left-bank of the Volyn-Podilsky part and is not developed at all in the lower steppe part of the basin. The Dniester hydroelectric station was built on the Dniester in Ukraine and three reservoirs were created: the Dniester, the Dniester buffer and the Dniester hydro-storage. The main purpose of the reservoirs is anti-flood and hydropower. In Moldova, on the Dniester River, the Dubossary reservoir was created for the operation of the Dubossary hydroelectric station.

The anthropogenic impact in the Dniester basin is manifested through the extraction of oil and gas, the functioning of the chemical and woodworking industries, hydropower, and agriculture. At the same time, the Dniester has significant recreational and environmental potential. In Ukraine, in the Dniester basin, there are 5 national natural parks. When flowing into the Dniester estuary, the Dniester forms a system of floodplains with a total area of 700 km^2. This is an independent element of the landscape of the Dniester basin, included in the international list of the Ramsar Convention on the Protection of Wetlands.

And most importantly, large cities are provided with drinking water from the Dniester: Lviv, Chernivtsi, Odessa, Mogylyiv-Podilskyi, Kam'yanets-Podilskyi, Kishineu, Rybnitsa, Dubossary, Tiraspol, Bendery et al. Therefore, hydrochemical studies in the Dniester basin are always relevant [2, 3].

The aim of this work was to study the change in average concentrations of basic ions and the mineralization of the Dniester water for different sections of the river (1994-2018), as well as the total ion runoff of the Dniester River. The information base was the materials of hydrometeorological institutions of the

State Emergency Situations of Ukraine and the State Water Resources Agency of Ukraine. The information was used at 17 observation points on the Dniester, which was then processed for three sections of the river: Dniester - upper (mountain part); Dniester - medium; Dniester - lower (table 1).

Table 1

Average concentrations of basic ions and mineralization water of the Dniester River in different parts of the pool (1994-2018), mg/L

Section of the Dniester River	HCO_3^-	SO_4^{2-}	Cl^-	Ca^{2+}	Mg^{2+}	$Na^+ + K^+$	Mineralization
Spring flood							
Dniester, upper (mountain)	180	17.6	28.3	54.6	9.3	15.2	305
Dniester, medium	185	53.5	40.3	57.4	11.2	31.1	379
Dniester, lower	166	95.1	51.2	48.8	26.7	38.1	425
Summer-autumn low water							
Dniester, upper (mountain)	196	30.3	44.6	64.7	11.5	23.8	371
Dniester, medium	182	54.6	41.5	58.6	12.7	34.3	384
Dniester, lower	188	85.6	43.7	59.2	24.6	43.1	444
Summer-autumn floods							
Dniester, upper (mountain)	180	17.2	28.3	54.7	9.6	15.2	305
Dniester, medium	184	53.5	40.5	57.6	11.4	31.3	378
Dniester, lower	166	95.3	51.2	48.6	26.8	38.2	426
Winter low water							
Dniester, upper (mountain)	199	52.8	43.7	67.3	12.5	23.5	399
Dniester, medium	216	42.4	51.6	71.5	11.6	34.6	428
Dniester, lower	235	101	59.1	62.1	28.7	40.3	526

The origin of the main ions in river water (HCO_3^-, SO_4^{2-}, Cl^-, Ca^{2+}, Mg^{2+}, $Na^+ + K^+$) is associated with the dissolution of salts of geological rocks and soil, as well as with ion exchange processes. In total, the main ions make up the mineralization of water. The ionic composition of the river waters in the upper part of the Dniester basin is formed under conditions of mountainous terrain and high humidity and is characterized by a hydrocarbon-calcium composition and lower mineralization water (305-399 mg/L) - table 1. On the flat part of the Dniester basin, the ionic composition of river waters is formed under the influence of carbonate and gypsum rocks of the Podilsky plateau [1]. In this part of the Dniester, water mineralization increases: Dniester - medium (379-428 mg/L); Dniester - lower (425-526 mg/L). Mineralization of the Dniester River water decreases during the spring flood (305-425 mg/L) and increases during the winter low-water period (399-526 mg/L).

This is due to an increase in groundwater inflow into the river during the low water period.

An important indicator characterizing the processes of chemical erosion in the territory of the Dniester River basin is the ion runoff (table 2).

Table 2

The average annual and seasonal ion runoff of the Dniester River at the mouth (1994-2018), $n \cdot 10^3$ t

Hydrological phase	HCO_3^-	SO_4^{2-}	Cl^-	Ca^{2+}	Mg^{2+}	$Na^+ + K^+$	Σ_i (minerali-zation)
Spring flood	713.8	408.9	220.2	209.8	114.8	163.8	1832/25.4*
Summer-autumn low water	244.3	111.3	56.8	77.0	32.0	56.1	577.5/8,0
Summer-autumn floods	581	333.5	179.2	170.0	93.8	133.7	1491/20.7
Winter low water	211.5	90.9	53.2	55.9	25.8	36.3	473.6/6.7
Per year	2115	944.6	509.4	512.7	266.4	390	4374/60.8

Note: 25.4 * - indicator of the ion runoff, t/km^2

The Dniester water runoff is on average 10 km^3 per year. According to the seasons, it is distributed as follows: spring flood - 43%; summer-autumn low water -13%; summer-autumn floods - 35%; winter low water - 9%. Ion runoff depends on the water runoff and the concentration of basic ions.

The average annual ion runoff (Σ_i) of the Dniester River is 4374.10^3 tons (table 2). For ionic runoff, the same proportion remains for seasons as for water runoff. The ion runoff in the Dniester basin is 60.8 t/km^2 per year, which is 2.3 times higher than the ion runoff in the Dnipro basin (26.8 t/km^2), but 1.6 times less than in the Danube basin (95.2 t/km^2). In general, this is a high indicator of chemical erosion in the river basin.

References

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