

HYDROCHEMICAL SPECIFICS OF THE KAMCHIA RIVER MOUTH AND THE ADJACENT BLACK SEA COASTAL AREA

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Abstract

The aim of the study is assessment of water quality (WQ) of the biggest Black Sea River (Kamchia River) and coastal waters on the base of chemical parameters. The results reveal that the nutrients content in river and mixing zone do not correspond to the Bulgarian WQ Standards. The transformed river waters are characterized with high nutrients concentrations and low salinity, pH and transparency.

Keywords: Black Sea, River Input, Nutrients, Metals, Oxygen

According to conceptual framework DPSIR (Driving forces –Pressure –State – Impact –Response) the main drivers (industry, agriculture and urbanization) in Kamchia River region (catchment and coastal zone) cause a significant pressure on the aquatic systems. The river collects urban effluents of many settlements in the catchment area, including untreated sewage discharges. The state of the river environment under long-term pressure/impact was already presented [1, 2]. The aim of the study is assessment of water quality of Kamchia River and coastal waters on the base of chemical parameters.

The study is based on monthly monitoring in Kamchia River during the 2006-2007 period of following parameters: pH, dissolved oxygen (DO), biochemical oxygen demand (BOD₅), nutrients as dissolved phosphorus (P), nitrogen (N), silica (Si) and metals. The investigation of water column in the coastal zone in front of the river mouth was carried out on the same parameters including salinity, transparency and metals in addition during the high flow period.

Long-term data of NIMH reveals monthly river discharge variability from 10.5 % to 17 % of annual discharge during the high flow period from January to May. In contrast to the historical data the recent period is characterized with similar mean monthly values of water quantity of discharge. An increase of the river discharge in autumn was established in relation to increased precipitation totals in Kamchia watershed. Average nutrients concentrations in the river for the investigated period are presented in Fig. 1.

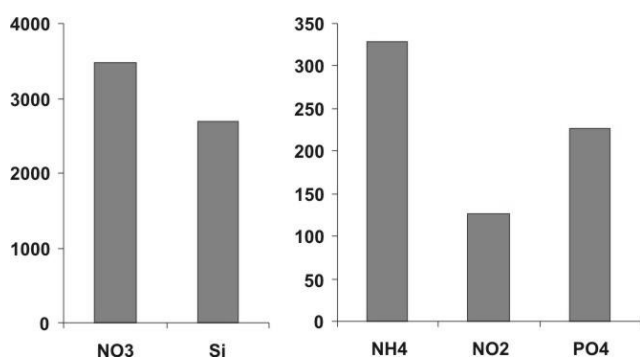


Fig. 1. Average nutrients concentrations in Kamchia River

The interannual distribution of hydrochemical parameters is characterized with maximums of nutrients content in Autumn-Winter period corresponding to high values of precipitations and high value of water quantity of the river discharge. Sometimes our results reveal “poor” and “bad” status relative to National classification system for WQ. It means that there is a distinct pollution by nitrogen compounds largely due to agricultural activities and runoff from soil pollution. Deviation from normal distribution of nutrients content during some periods was established in consequence of anthropogenic pressure domination along the river stream. The factors, which influenced the nutrients content in the river at the downstream locality, is more numerous and complex. The results for the river WQ show that the nutrient content exceeds the permissible concentration (PC) maximum determined by the Bulgarian WQ Standards.

The river discharge directly influences the coastal waters near the mouth [3, 4]. Dissolved oxygen (saturation) is very important quality parameter indicating “health” of water environment. The data for coastal zone influenced by the river discharge reveal decrease of DO and OS, especially in bottom layer. The mixing zone of coastal area is characterized by salinity < 7.9‰, pH < 8.22 and very low transparency (Table 1).

Tab. 1. Range of chemical parameters in coastal area in front of Kamchia River mouth

Parameters	Mixing zone	Sea
Transparency, m	0.5–1.0	2.0–3.0
Salinity, ‰	0.9–7.9	10.4–14.3
pH	7.89–8.22	8.35–8.41
Dissolved oxygen (DO), μM/l	246–283	306–323
Oxygen saturation (OS), %	84.2–102.7	109.6–117.8
BOD ₅	2.04–3.31	2.50–2.88
Nitrite N, μM/l	2.2–5.7	0.6–1.2
Nitrate N, μM/l	27–154	16–22.4
Ammonia N, μM/l	3.4–5.6	1.6–2.7
PO ₄ -P, μM/l	1.6–3.2	0.1–0.2
Total P, μM/l	2.1–3.7	0.5–1.4
Si, μM/l	58–127	5–41
Ca ²⁺ , mg/l	84.7–144.6	204–219
Mg ²⁺ , mg/l	33.4–208.7	340–510
Fe, μg/l	190–413	43–92

Nutrients distribution in mixing zone reveals high nitrates and nitrites content exceeding PC [5]. The average concentration of DIN for all sampled area is 64.2 μM/l with maximum reached in coastal waters - 165 μM/l. Relatively higher content of metals Fe and Mn are found in samples collected in and near river mouth. Heavy metals concentrations in waters of coastal zone correspond to WQ standards according Regulation 8 [5].

The sediments with dominated coarse-grained fraction are characterized with low organic carbon content and low concentrations of metals. They are located near the river mouth, where the sedimentation is more active due to the sudden changes in hydrological conditions. The concentrations of metals in surface sediments are characterized by the following order of spreading: Fe > Mn > Zn > Pb, Cu > Ni > Cd.

The Kamchia River discharge impacts the coastal zone in an area located less 1 mile eastward and southward from the river mouth. Most significant influence is found in the upper surface layer which is characterized by higher nutrients and particulate material content and lower transparency, pH and salinity.

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