UDC 57

TAGANROG BAY IN WINTER: HYDROCHEMICAL COMPONENTS DISTRIBUTION

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Information about Taganrog bay hydrochemical regime in winter period has irregular character and generally concerns water chemistry research. In the period of ice formation, when the wind has no dominant influence, when the activity of planktonic community decreases, chemical substances transformation processes slow down, river runoff decreases, ice cover restricts oxygen income into water, not only alteration of biogenic matters hydrochemical fields represents a special interest, but also their distribution in snowpack, in ice and in subglacial water. In winter 2006, 2007, 2014, 2015 and 2016 the South scientific centre RAS and Institute of arid zone SSC RAS conducted hydrochemical researches in Don river estuary and in the littoral part of Taganrog bay, in the process of which the probes of snow, ice and subglacial water were analyzed and selected to determine nitrites, nitrates, ammonia nitrogen, attenuated nitrogen, gross nitrogen, phosphates, attenuated phosphorus, gross phosphorus, silicon, dissolved substances, suspended substances, heavy metals (Fe, Cu, Pb, Mn, Cr). Selection of snow ice and subglacial water probes and their analysis were conducted according to standard methods, recommended for using under ocean hydrochemical researches.

In December 2006 nitrites content in the water probes was changed within the interval 5–4, nitrates 55–810, phosphates 23–163 mgk/l, the general admixtures content varied within the range 852–3983 mg/l. In the beginning of February 2007 nitrites and nitrates in the subglacial water were three times more, phosphates – 10 times, dissolved substances – 9 times more, than in the ice. In comparison with snow in subglacial water phosphates were 23 times more, dissolved substances –in 47 times more. Suspended substances in the water probes were the same as in the snow probes, but in the ice probes – 1,4 times more than in the subglacial water probes. In the end of 2007 nitrites in the subglacial water were 1,3 times more, nitrates – 7,5 times more, phosphates – 4 times more, dissolved substances – 22 times more than in the ice. In the same time suspended substances content in water was the same, as in the ice probes. Content determination of heavy metals (Fe, Cu, Pb, Mn, Cr) in the probes of snow and ice showed that ferrum, cuprum and manganese were 2 times more in snow than in ice. Content of lead and chrome in snow was significantly more in 1,2 and 1,4 times than in ice.

Thus, during researches conduction concentration of nitrites, nitrates, phosphates and the admixtures general content were maximum in the subglacial water. Minimum quantity of nitrites and nitrates were detected in the probes of ice, the minimum concentration of phosphates, attenuated and suspended substances – in the probes of snow. In February 2014 concentration of nitrites in subglacial water varied within the limits 10,0–20,0, nitrates –143,0–483,0, phosphates – 12,0–47,0 mgk/l. In February 2015 content of nitrites in subglacial water was changed within the range 4,0–24,0, nitrates – 1110,0–3090,0, phosphates – 3,0–77,0 mgk/l. In February 2016 ammonium ions content in subglacial water was changed within the interval 60–140,0, nitrites –15,0–24,0, nitrates –290,0–1120,0, gross nitrogen 910,0–2310,0, phosphates – 5,0–54,0, gross phosphorus 98,0–221,0, silicon 2100,0–7000,0 mgk/l. Decrease of amplitude concentrations contraction for all biogenic matters according to the distance from esturial seashore and river runoff influence decrease is characterized for all biogenic matters. Realization of systematic hydrochemical observations during the whole year and study of hydrochemical components distribution in snow, ice and subglacial water have a great theoretical and practical significance during the forecasting of hydrochemical regime and water quality of water objects.

Key words: Taganrog bay, winter period, hydrochemic regime, biogenic elements, salty water, ice.

Taganrog bay occupies a special place in the ecosystem of Azov sea, as estuarial reservoir of moderate geographical type, the important peculiarities of which are shallow depth, stratification absence, influence of limnetic drains in the eastern part, mixture of river and sea waters. Information of hydrochemical regime in the winter period has irregular character and generally concerns the water chemistry study [4]. In the same time not only regime of biogenic matters and other hydrochemical components of Taganrog bay water in the winter period, but also their distribution in snowpack, in ice and subglacial water in the period of ice formation represent the special interest. In the quality of study object one chose Taganrog bay – the most ice-infested region of Azov sea that is explained by exceedingly favourable for ice formation conditions: bay location between January isotherms –5 and –6 ˚C (the coldest part of the sea), strong water softening, bay shallowness and rather big angularity of its watersides.

The researches of chemistry of snow and ice covers and subglacial water in Taganrog bay were begun in 2006 – 2007 [5]. These works were continued by South scientific centre RAS and Institute of arid zones SSC RAS in 2014, 2015 and 2016 for the purpose of littoral part waters study of Taganrog bay and river Don deltoid part in the winter period.

Probes of subglacial water, ice and snow were selected, where the following parameters were distinguished: nitrites, nitrate, ammonia nitrogen, attenuated nitrogen, gross nitrogen, phosphates, attenuated phosphorus, gross phosphorus, dissolved substance content, suspended substance content, heavy metals (Fe, Cu, Pb, Mn, Cr). Probes selection is realized at stations of Taganrog bay south waterside (Port-Katon, Chumbur-Kosa, Pavlo-Ochakovskaya spit, Stefanidinodar, Kagalnik) and of north waterside (Beglitskaya spit, Petrushino, Mikhailovka, Morskoy Chulek).

Plastic bucket and Molchanov bathometer were used for water sample taking. The atmospheric temperature, water temperature, dissolved oxygen concentrations were measured at once at the station. The probes were selected into polyethylene bottles and transported cool in the thermobag. The annular borer with external diameter 120 mm was used for the ice probe selection. After the brief description of ice structure bore specimens were packed into chemically clean tightly closing poly bags (or chemically clean polyethylene dry buckets). The analysis was taken in the same day in stationary hydrochemical laboratory of SSC RAS after ice firing by natural way.

After probes displacement the concentration of attenuated biogenic matters according to standard methods, recommended for using under the ocean hydrochemical researches were determined: phosphates – according to the method of Murphy and Riley [3]; nitrites – according to the method of Benshneider and Robinson [1]; nitrates – according to the method of Morris and Riley (in modification of Grasskhoffa; Strickland and Parsons; Sapozhnikov, Gusarova, Lukashev) [1]; ammonium ions – according to the method of Sadgi-Solorzano [2]. The concentration of oxygen attenuated in water was determined according to the method of Winckler [1]. Photometer “Expert–003” was used during the analysis of water probes. Significance of pH and water temperature were determined with the help of pH-meter HANNA. Information about biogenic matters content in the ice and subglacial water was processed by the methods of mathematical statistics

by means of EXCEL data analysis program.

Anomalous hydrometeorological conditions predominated in winter of 2006–2007, only in the end of the first – beginning of the second decade of January, within the time-limits, close to extremally late, the stable atmospheric temperature transition occurred through 0 ºC to negative quantities. In December of 2006 the nitrites content was changed on the interval 5 – 41 mgk/l, nitrates 55 – 810 mgk/l, phosphates 23 – 163 mgk/l, the general admixture content varied within the limits of 852 – 3983 mg/l in the probes.

In the beginning of February 2007 the content of nitrites, nitrates, phosphates, and the general inert content accordingly comprised 9, 265, 7 mgk/l and 25 mg/l in the snow, and in the ice – 5, 130, 14 mgk/l and 121 mg/l. At that the content of nitrites and nitrates in 3 times greater, phosphates – in 10 times greater, dissolved substances – in 9 times greater in subglacial water than in the ice. The suspended substance in the ice probes were in 1.4 times greater, than in the probes of subglacial water. In the subglacial water phosphates were in 23 times greater, dissolved substances – in 47 times greater in comparison with snow. Suspended substances in the water probes were as many as in the probes of snow, and in the ice probes –insignificantly, in 1.4 times more than in the probes of subglacial water.

In the end of February nitrites were in 1.3 times more, nitrates – in 7.5 more, phosphates – in 4times, dissolved substances – in 22 times more in subglacial water than in the ice. In the same time suspended substances content in the water was the same, as in the ice probes. Determination of heavy metals content (Fe, Cu, Pb, Mn, Cr) in the probes of snow and ice showed that ferrum, cuprum and manganese was 2 times more in the snow than in the ice. Thus, during the period of researches conduction in winter 2007 the concentration of nitrites, nitrates, phosphates, dissolved substance content and the general admixtures content were maximum in the subglacial water, that is explained by the concentration effect of freeze-out. The minimum quantities of nitrites and nitrates were detected in the probes of ice, the minimum concentrations of phosphates, attenuated and suspended substances – in the probes of snow.

In February 2014 the content of nitrites in subglacial water ranged from 10,0 to 20,0 mgk/l, nitrates – from 143,0 to 483,0 mgk/l, phosphates – from 12,0 to 47,0 mgk/l. Ice thickness in the February 2015 was significant (4,8 – 5,5 cm) in comparison with February 2007 (0,5 – 1 cm). According to the mean daily temperature indications of water and air and duration of ice formation the winter of 2015 (the beginning of the year) is referred to cold winters. In February 2015 the content of nitrites in the subglacial water changed within the range from 4,0 (st.Petrushino) to 24,0 mgk/l, nitrates – from 1110,0 (st. Mikhaylovka) to 3090,0 mgk/l, phosphates – from 3,0 (st. Petrushino) to 77,0 mgk/l. The concentration of biogenic matters was minimum at the stations near the north seaside of Taganrog bay and maximum at the south stations Pavlo-Ochakovskaya spit and Chumbur Kosa.

In February 2016 the biogenic matters concentration in the subglacial water changed in the next intervals: ammonium ions from 60 to 140,0 mgk/l, nitrites from 15,0 to 24,0 mgk/l, nitrates – from 290,0 to 1120,0 mgk/l, gross nitrogen from 910,0 to 2310,0

mgk/l, phosphates – from 5,0 to 54,0 mgk/l, gross phosphorus from 98,0 to 221,0 mgk/l, silicon from 2100,0 to 7000,0 mgk/l.

During the results comparison, obtained in 2006 (December), 2007 (February, March), 2014 (February), in 2015 (February) and in 2016 (February), one considered hydrochemical indice (nitrites, nitrates, phosphates), registered in waters of Taganrog bay in winter period at the same stations Port-Katon, Pavlo-Ochakovskaya spit Chumbur Kosa). One attempted to generalize the results, obtained during the research of Taganrog bay waters in winter period, at that stations broadly provided with data were compared.

Concentration of biogenic elements mineral forms naturally decreases in motion from Swinoy girl to the sea side, amplitude contraction of concentration vibrations is character for all biogenic matters according to distance from estuarial seashore and decrease of river runoff flow. As content of hydrochemical components in water, so their concentrations in snow and ice have spotty distribution character.

Reservoir thermic regime broadly influences on accumulation of hydrochemical components, concentrations of biogenic elements in spring are also determined by their reserve in autumn period of previous year and the character of winter. Warm winters especially without ice formation, contribute to accumulation of organic substances and decrease of mineral forms content in consequence of photosynthesis processes predominance over destruction processes. Photosynthetic activity of planktonic community decreases in the cold period of time, chemical substances transformation processes slow down, river runoff diminishes, ice cover restricts oxygen admission to water. The observing increase of salt concentrations in subglacial water is explained by the effect of freeze-out concentration.

Information about hydrochemical regime of Tagantog bay in winter period has irregular character, nevertheless alteration of biogenic matters hydrochemical fields in winter period, in freezing period is interesting, when the wind has not prevailing influence, that is why it is considered to be practical to published certain values of hydrochemical parameters for the purpose of using them during the following observations in winter in the examined water area. The systematic hydrochemical observations conduction during the whole year and study of hydrochemical components distribution in snow, ice and subglacial water at the water area of Taganrog bay has theoretical and practical significance under the forecasting of its hydrochemical regime and water quality.

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