

The Comparison of Different Approaches to the Complex Water Quality Assessment in the Small Rivers of Cities

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Abstract: Comparison and analysis of water quality integral estimates for small rivers of strongly urbanized territories by different procedures were fixed. Elaboration of advanced procedure was proposed. Such procedure has to take into account the stochastic structure of water quality parameters and their factor conditionality.

Keywords: ecological appreciation, quality of water, ecological situation, small rivers, river basins, urbanized territories, geo-ecological state, ecological index.

1. State of the problem and analysis of the publications

Determination of the ecological state of environment is characterized by a few constituents, one of the major is research of the state of the water pool. That considerable part of its waterways made by small rivers which are located on the strongly urbanized territories and fall under the considerable anthropogenic loading is the features of the European region.

The analysis of the state of small rivers gives a sufficiently complete picture about the specifically of the ecological situation in the river pools on the whole, and allows to compare the degree of contamination of the territory within the limits of a certain river. The research of the quality of water of actually small rivers of cities is one of important components of estimation of the geoeological state of a city on the whole. Often rather large communal and industrial objects which are within the limits of cities use water of small rivers for the necessities. For this reason the control of the quality of water in rivers helps to avert ecocatastrophis (in case of technogenic accident and unrefined extras at these objects) through timely application of measures of suppressions. Coming higher resulted from we have such conclusions: the analysis and adduction of methods of estimation of the water quality of countries in European to the unique standards is a primary concern for the control, concerted actions on diminishing the negative influence of technogenic contaminations which constantly arise up on the strongly urbanized territories. The unique European standards of quality of water on the territory of Western and Eastern Europe will allow to create the checking and the vsystem of checking and bank and nature protection measures on the territory of all Europe.

The existing methods of both component and integral estimation of the water quality in Ukraine based on the principles which corresponded the standards of the former Soviet Union ([1-5]). Modern Ukraine moving to the European Union - trying over the legislation in legal, economic, ecological and other spheres to the European standards. So, there is the necessity of concordance of the existent methods of estimation of the waters quality of Ukraine with the European ([6]) one, taking into account the maintenance of Water Scope Directive ([7]) but with the regional landscapes features of territories (in this case strongly urbanized). The use of the proper concerted methods allows to give the analysis and ecological estimation to the quality of waters, and being based on monitoring information, to plan and realize the necessary measures because of the improvement of the state of small rivers.

Research of the water quality and geoeological state of small rivers on the example of Kyiv is given in our works [2, 3]. So in [2] on the basis of application of the method of ecological estimation of the surface-water quality due to the proper categories [4] the hydroecological state of the Kiev small rivers is analyzed in the context of geoeological problems of their pools. In [3] on the basis of the other method – of ecological estimation of the surface-water quality of dry land and estuary of Ukraine [1] (taking into account suggestions [5]) – the state of pools geosystems of small rivers in Kyiv is considered.

Comparison of results of integral estimation of the water quality of rivers according to European and to domestic methods was conducted only partly and in relation to large waterway (for example in [8] and etc) and was not practically carried out in relation to small rivers the more so for epy territories the city agglomeration. Exactly the presence of such an unsolved aspect of the general issue of the concerted control estimation and the setting of norms of the water quality of rivers stipulated the orientation and maintenance of this article.

2. Raising of task

On the basis of the afore-mentioned it is possible to outline the water quality main tasks for the decision of which there were . The tasks are as follows:

- carried out, comparison and analysis of the results of integral estimation of the water quality due to domestic and the European method on the example of the most characteristic small rivers of the city of Kyiv;
- selecting perspective directions of the development and perfection of the method of estimation of the water quality of small rivers on the strongly urbanized territories taking into consideration the methods existing in Europe and Ukraine.

3. Basic material

For the basis of the research there were taken methods based on domestic and European experience of classification and estimation of the surface-water quality from ecological aspect, and also the new requirements of EU to the water policy, in particular the improvement of the water quality([7]).

Comparison of the results of calculations due to different methods of complex ecological estimation of the water quality for the small rivers in cities was made on the example of Kyiv (table 4) and was based both on the basic data and results of the estimation that has been already executed after the domestic methods in our works [2, 3] and on additional, special for this article calculations due to the European method [6].

The pools geosystems of the basic small rivers in Kyiv were examined in the given article, namely: the inflow of the Kaniv storage pool – the Lybid' and the Vita with their own influxes; the inflow of Irpen' is the Nyvka and the Horenka, and also the Syrets', that now falls in the chainlet of the reservoirs in place of the crease in the Obolon'. The basic hydrographical and hydrological descriptions of the rivers selected for the research and determinant of the state of their cumbines are given in table.1.

Table 1. Hydrographical and hydrological descriptions of the explored rivers and indexes of the state of their cumbines (due to [11])

<i>Name of the river</i>	<i>The Nyvka</i>	<i>The Horenka</i>	<i>The Syrets'</i>	<i>The Lybid'</i>	<i>The Vita</i>
<i>Characteristics</i>					
Length, km	19,7	12,0	12,3	16,1	13,9
Area of cumbine, km ²	94,0	56,0	24,4	66,2	244,0
Middle slope m/km	17,0	20,0	7,6	5,8	0,2
Middle long-term expense m ³ /s	0,17	0,10	0,04	0,12	0,58
Middle long-term flow 10 ³ m ³	5,40	3,27	1,39	3,76	18,3
Volume of hard flow 10 ³ m ³ /y	1,15	1,00	1,00	1,15	1,64
Index of urbanization of cumbine %	31,0	10,3	57,0	80,4	11,5
Index of thrown open of cumbine %	–	5,71	4,10	1,81	51,6
Index of wooded of cumbine %	27,0	82,1	21,7	13,1	36,1
Index of lake's cumbine %	2,20	0,54	1,30	0,16	0,42

Being based on the already noted approaches of the method [1] with its certain simplifications and account [5], there was the executed complex ecological estimation of the water quality of the selected small rivers in Kyiv both due to the three sectional indices – salt composition (I_1) ecological-sanitary indexes (I_2) and specific indexes of toxic action (I_3) and due to the integral (average readings after three previous) or ecological index (I_e). In all cases, oriented taking into account values of weekend in the blocks of determinant and their indices, as a result was used the scale of eight categories of the water quality, through which the value of the got individual on the indices (components), sectional and integral indexes, identically take the water quality to the certain category (pursuant to [5]) due to the criteria of the natural state of the surface-water (from excellent to very bad) or due to the criteria of the degree of anthropogenic contamination of these waters (from very clean to very dirty). The results of the estimation on the just expounded principles are resulted in table 2.

Briefly analysing the results of table 2, it is possible to mark such.

On decount of the indices of the salt composition the most muddy water is given that of the rivers Syrets' and Lybid' (moderate muddy), and, besides the conditionality by the corresponding properties of the soil and bottom of the sedimentary beds columbine and soil waters, can, to a great extent, represent both substantial "anthropogenic conditionality" in this case ions of sulfate at their receipt as a result of the foremost fluvio-hydromigratory processes on very anthropogenic columbines, taking into account that latter at the rivers of Syrets' and Lybid' have the most indices among the explored rivers urbanizations and the least indices of wooded (see табл.2). At the same time the water of rivers Horenka, Vita and Nyvka are identified due to the given indices as clean and rather clean.

The indices of ecological-sanitary indexes certify a considerably higher level of muddiness of waters of all objects of the research in comparison with the previous block. Thus, although for the characterization of the water quality of the rivers Syrets', Lybid' and Horenka (that are, very dirty, dirty and moderato muddy water) as the criterion over the extremum of pH-value of the water, which are on the whole related both to natural, in thereby inwardly years and with anthropogenic processes, governed legalistically, not this index is, from our view, most representative and adequate to maintenance of the setting of norms due to the a ecological-sanitary block. Yes, rivers Lybid' and Syrets' are very muddy, on the hand, after the maintenance of organic untoxic matters, because of the value of mediocre index of saprobiont waters, as a rule due to anthropogenic sources. On the other hand, what partly concerne the waters of Horenka, in the noted rivers there is a fixed considerable maintenance of nitrogen of ammoniacal, that in particular represents the contamination of "fresh" in the moment of fixing by connections of nitrogen. Already enhanceable maintenance in waters of biogenic matters of the combined origin, on the whole the sizes to the ion of ammonium testify with predominance in this case for the substantially anthropogenic rivers of Lybid' and Syrets' of factor of technogenesis. The high level of eutrophication of waters is characteristic for the rivers Vita and Nyvka, as well but however, in this process is more probably considerable, in comparison with Lybid' and Syrets', the role of natural factors.

On the high enough level of dominant technogenic predefined toxication waters specify the indexes of select specific indices of toxic action, according of the values of which the water of the rivers Lybid', Syrets' and Nyvka are identified as dirty, and Vita – as very muddy. Thus, if for a criterion for a sectional index in relation to waters of Lybid' and Syrets' maintenance is considered at them such an organic toxic, as phenols for Vita, the criterion for the characterization waters of the Nyvka, and the Horenka, is the concentration in them of common iron, which is usually taken for the analysis of the group of heavy metals concluding the unregulations content that have already been mentioned.

Table 2. Results of ecological estimation of the water quality of the explored rivers for 2001-2003 years (due to a method [1] and [5])

<i>Name of the river</i>	<i>The Nyvka</i>	<i>The Horenka</i>	<i>The Syrets'</i>	<i>The Lybid'</i>	<i>The Vita</i>
Index / Category					
<i>Index of salt composition:</i>					
due to the sum of ions	2,4	1,6	3,4	2,3	2,8
due to chlorides	2,7	1,8	3,9	3,1	2,5
due to sulfates	2,7	1,4	4,3	4,4	1,7
block (I_1)	2,7	1,8	4,3	4,4	2,8
<i>Category of the water quality, proper I_1, due to the degree of their contamination:</i>					
value	3	2	5	5	3
name	rather clean	clean	moderato muddy	moderato muddy	rather clean
<i>Index of ecological-sanitary indexes:</i>					
due to the hanging matters up	–	–	5,3	4,8	3,1
due to pH	6,6	4,1	6,3	8,0	5,0
due to bihrom oxidation	2,7	2,7	5,7	6,8	4,6
due to biochemical consumption of oxygen (BCO_5)	0,8	2,0	1,3	0,8	1,3
due to nitrogen ammoniacal	6,7	3,9	6,2	6,4	5,7
block (I_2)	6,7	4,1	6,3	8,0	5,7
<i>Category of the water quality, proper I_2, due to the degree of their contamination:</i>					
value	7	5	7	8	6
name	dirty	moderate muddy	Dirty	very dirty	very muddy
<i>Index of the specific indices of toxic action:</i>					
due to a copper	4,3	3,3	4,8	5,1	3,3
due to zinc	–	1,5	4,1	4,4	2,8
due to iron (general)	6,1	3,4	5,2	5,0	4,6
due to phenols	–	–	–	5,3	5,3
due to SGAS	–	–	6,7	6,2	–
block (I_3)	6,1	3,4	6,7	6,2	5,3
<i>Category of the water quality, proper I_3, due to the degree of their contamination:</i>					
value	7	4	7	7	6
name	dirty	poorly muddy	dirty	dirty	very muddy
<i>Value of ecological index (I_e)</i>	5,2	3,1	5,8	6,2	4,6
<i>Value of category of quality waters, proper I_e</i>	6	4	6	7	5
<i>Name of the category of the water quality, proper I_e, due to the degree of their contamination</i>	strongly muddy	poorly muddy	strongly muddy	dirty	moderate muddy

<i>Name of the category of the water quality, proper I₀, by their natural state</i>	bad	satisfactory	bad	very bad	middling
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The complex evaluation of the waters quality due to the accepted criteria, namely due to the ecological indexes, resulted in the actually logically expected (factor conditioned) results accordingly which the water of the Lybid' on the whole skilled due to the degree of their contamination as dirty, and due to their natural state – as very bad, the water of Syrets' and the Nyvka – as very muddy and bad, water Branches – as moderate muddy and middling, and only the water of the Horenka – as poorly muddy and satisfactory. Such integral results, in spite of the presence in then defects in the applied methodical approaches which were marked by us in [2] and in the other our works, certify above all the actuality of this article orientation on the successive decision of problems of objective basis and realization of modern complex measures on the ecological rehabilitation of the pool geosystems of the small rivers on the strongly urbanized territories, in this case in Kyiv.

For the second part of the research for basis of calculations the method of ecological estimation of the surface-water quality was taken due to the proper categories [4]. This method is the basis for drafting the programs of supervisions, data analysis, description of the quality of surface-water of dry land Ukraine from the ecological position and the receipt of the state information of water objects. The description of the surface-water quality is given on the basis of the ecological classification of the surface-water of dry land. The classification includes a wide set of hydro physical, hydro chemical, hydrobiological and other indexes which represent the features of abiotic and biotic component of water ecosystems. This method is the basis for finding out the tendencies of changes of the surface-water quality of dry land in time and space, thev determination of influencing the anthropogenic loading on ecosystem of water objects, the estimation of changing the state of water resources, the decision of the economic and social questions related to providing the guard of the environment. Also, the given method is the basis for the estimation of influencing of human activity on a natural environment, determination of certain bank-protection regulations and warnings, for planning and realization of bank-protection measures and estimation of their activity. In this research was executed the meaningful ecological estimation, that is founded on the basis of measurings of separate of water quality indexes, which more precisely characterize the state of water objects and according to this state the quality of the most water.

Procedure of implementation meaningful ecological estimation of quality of surface-water consists of four stages:

1. stage of grouping and basic data processing;
2. stage of the determination of classes and categories of the water quality on separate indexes;
3. stage of the generalization of estimations of the water quality with separate indexes on separate blocks with the determination of integral values of classes and categories of the water quality;
4. stage of the determination of the incorporated estimation of the water quality for a certain water object.

The system of ecological classification of the surface-water quality includes three groups of the specialized classifications, namely:

- group of classifications through the criteria of the salt composition;
- classification through the ecologo-sanitary criteria;
- group of classifications through the criteria of maintenance of specific matters of toxic action, and also through the level of toxicness.

The results of estimation on afore-mentioned principles are resulted at tablas. 3

Thus, being based on the already noted approaches of the method of ecological estimation of the surface-water quality through the proper categories [4], there was executed the complex ecological estimation of the water quality of select small rivers in Kyiv as well through three criteria - the criteria of the salt composition ($I_{1\text{ avr.}}$), the ecologo-sanitary criteria ($I_{2\text{ avr.}}$) and through the criteria of the maintenance of specific matters of toxic action, as through the level of toxicness, ($I_{3\text{ avr.}}$) and also through an integral (averaging-out due to the three previous) or ecological index with selecting and maximum integral to the index. In all cases, oriented on the worst value of the weekend in the blocks of determinant and their indexes, as a result was used from the scale seven categories of quality and the five classes of the water quality, after which value of got individual on indexes, sectional and integral indexes take the quality of water to the proper classes. Through state waters the names of classes and categories of their quality change from excellent to very bad, and through the degree of cleanness (muddiness) – from very clean to very dirty. Also, by this method it is possible to define trophobiosis (the prevailing type) and saprobity of waters.

Analysing the results of table 3, it is possible to conclude the following.

Due to the criteria of the salt composition are most muddy waters of the rivers Lybid' and Syrets' (moderate muddy), that is explained, above all things, by the high degree of urbanization and insignificant wooded of the territory of columbine (table 1). The index of the salt composition testifies that water of. The Nyvka and the Vita refer to clean enough, and the Horenka – to clean.

The ecological-sanitary criteria testify to the considerably higher level of muddiness of waters of all objects of research in comparison with a previous block. Indeed, water of Lybid' after this sectional index refer to very dirty of the Nyvka and the Syrets' – to dirty, the Vita and the Horenka - to moderate muddy.

The classification through the criteria of maintenance of specific matters of toxic action, and also over the level of toxicness represents the following picture: the water of the Lybid' and the Syrets' is moderate muddy, of the Nyvka – poorly muddy, the Horenka – clean enough, and of the Vita – clean.

Table 3. Results of the ecological estimation of water quality of the explored rivers for the period of 2001-2003years. (due to method [4])

Indexes	Name of rivers									
	The Nyvka		The Horenka		The Syrets'		The Lybid'		The Vita	
	class	category	class	category	class	category	class	category	class	category
<i>Classification on the criteria of the salt composition</i>										
Through chlorides	II	3	II	3	III	4	III	4	II	3
Through sulfates	II	2	I	1	II	3	II	3	II	2
Middle sectional index ($I_{1\text{ avr.}}$)	II	3	II	2	III	4	III	4	II	3
The worst sectional index ($I_{1\text{ max.}}$)	II	3	II	3	III	4	III	4	II	3
<i>Classification on the ecological-sanitary criteria</i>										
Through the hanging matters up	-		-		III	5	III	5	III	4
Through bihrom oxidation	II	3	II	3	IV	6	V	7	III	5
Through biological consumption of oxygen	IV	6	III	4	IV	6	V	7	III	5
Through nitrogen nitrite	V	7	III	4	IV	6	V	7	IV	6

Through nitrogen nitrate	V	7	V	7	IV	6	IV	6	IV	6
Through nitrogen ammoniacal	V	7	III	5	V	7	V	7	IV	6
Middle sectional index ($I_{2\text{avr.}}$)	IV	6	III	5	IV	6	V	7	III	5
The worst sectional index ($I_{1\text{max.}}$)	V	7	V	7	V	7	V	7	IV	6
<i>Classification on the criteria of maintenance of specific matters of toxic action, and also on the level of toxicness</i>										
Through a copper	II	2	I	1	II	3	II	3	I	1
Through iron (general)	III	4	I	1	III	4	III	4	II	3
Through a chlorine	Absent		I	1	III	5	IV	6	-	
Through mineral oil	-		-		III	5	III	5	III	5
Through phenols	-		-		-		IV	6	II	2
Middle sectional index ($I_{3\text{avr.}}$)	II	II	I	III	4	I	5	II	I	3
The worst sectional index ($I_{3\text{max.}}$)	III	III	1	III	5	I	6	III	I	5
Ecological index due to the mean values ($I_{e\text{avr.}}$):	III	III	3	III	5	I	6	III	II	4
– name of categories of the water quality through their state	Satisfactory		Good		Middling		Bad		Satisfactory	
– name of categories of quality of water after the degree of their cleanness (muddiness)	Poor muddy		Clean enough		Moderate muddy		Dirty		Poor muddy	
Ecological index though the worst values ($I_{e\text{max.}}$):	III	5	III	4	IV	6	IV	6	III	5
– name of categories of the waters quality after their state	Middling		Satisfactory		Bad		Bad		Middling	
– name of categories of quality of waters after the degree of their cleanness (muddiness)	Moderate muddy		Poor muddy		Dirty		Dirty		Moderate muddy	

Third method that is used in European Union [6], on the whole basis on comparison of the indexes of quality of water got as a result of analysis of concentration with the intervals of concentration of similar indexes which belong that is why or other class of quality from the classification chart of the noted method (the proper results are also resulted in table 1)

Table 4. The comparative characteristics of the methods of water quality assessment as to the level of pollution (according to the methods [12] [4] [6]) based on the example of small rivers in Kyiv

Name of the river	Method [1]	Method [4]		Method [6]
	I_e	$I_{e\text{avr}}$	$I_{e\text{max}}$	
The Nyvka	very polluted	lightly polluted	moderately polluted	unsatisfactory
The Horenka	lightly polluted	quite clean	moderately polluted	quite clean
The Lybid'	polluted	polluted	polluted	polluted
The Syrets'	very polluted	moderately polluted	polluted	unsatisfactory
The Vita	moderately	lightly polluted	moderately polluted	lightly polluted

	polluted			
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Comparing and analysing for the table 4 the results of the test estimation of the quality on the example of the Kyiv small rivers, it should be noted the following.

Above all things it follows to consider that domestic method [1] and method [4] distinguish, accordingly, eight and seven categories of the quality of water, being based on the analysis of hydro chemical indexes and the properties of water. Thus, due to a method [1] the category of the quality of water concerns on the basis of mean values of sectional indexes, and due to a method [4] it is possible to take into account and extreme heterogeneous values, i.e. values which have a large variation of around the middle. In that time, the European method [6] selects five classes quality of water, which are specially set with the orientation on defence of water flora and fauna, that with the desired strengthening of criterion estimation of favourableness of the terms of water environment for the vital functions of organisms. Taking it into account and comparing middle indexes after table 4, got through different methods, it is possible to mark, at the first, of the principle coincidence of the general tendency of such estimations of the water quality due to all the methods for investigational rivers with certain rich deviations in content from such coincidence in relation to the river of the Nyvka, when the use of the method [4] results in estimation of quality as satisfactory, in that time as two other methods, including European, characterize the quality of the Nyvka water as bad and unsatisfactory.

Secondly, estimations of the water quality due to all methods on the whole logically confirm direct proportional dependence between the quality of water in the certain river and the index of wooded of its columbia and the reverse proportional dependence between the noted quality and the index of the urbanization of certain pool [2, 3]). In particular, the noted rating of the water quality is the greatest for the river of the Horenka, which is marked by the greatest index of wooded and the lowest index of the urbanization, and the worst quality of water (with lowest its rating), clearly, in Lybid', that is the waterway of city, most disfigured by the antropogenic loading and transformation ([2, 3, 11]).

4. The prospects of the subsequent researches

Thus, it is all above enumerated predetermines the prospects of the subsequent researches due to the problems of this article, that must be directed, from one side, on basis and development of the improved method and the classification chart of integral estimation of the water quality of the small rivers of the strongly urbanized territories, which will consider by all positive moments and lacks of the methods [1, 4, 6] by an account above all things such aspects, as:

- the choice of optimum to composition of the representational indices of the water quality due to the certain blocks of the classification chart;
- the research of the stochastic structure of such representational indices [9];
- application of the components of the noted stochastic structure, at the first, for the basis choice of gradations and intervals between the categories of the water quality, in thereby with application of function to the standard and introductions of "transitional" subcategories, etc. and, the secondly, for the objective comparison of the real values of the indices of the water quality with criteria, using the models of confiding estimation of the actual values of such indices and other proper models of the method of stochastic estimation of authenticity geocological information [9, 10].

From other side, the just noted improved method and classification chart of integral estimation of the water quality must be component part of the complex recommendations from the geocological basis charts of improvement of the ecological state of pools geosystems of the small rivers of the strongly urbanized territories (see [3]).

5. Conclusions and prospects

For the example of information about the quality of water of small rivers of city in Kyiv comparison and analysis of the results of integral estimation of the water quality is conducted

after domestic and the European method. The features of the noted methods and their failings among which are appraised, in particular, imperfection of determination of the intervals of the categories or the classes of the water quality and averaged of initial indices which are tested, no account of stochastic structure of criteria parameters ignoring of errors of discreteness and narrow-mindedness of supervisions and factor specific of their results, is selected. How perspective task, offered approaches to development of the improved method and classification chart of the integral estimation of the water quality of the small rivers of the strongly urbanized territories which will take into account the defects of present methods and principles of stochastic design and will be the component of recommendations from the geoecological basis charts of improvement of the ecological state of pools geosystems of the small rivers of cities agglomeration .

6. References

- Method. KND 211.1.4.010-94. (1994): Ecological estimation of the surface-water quality of dry land and estuary in Ukraine, 37 p., Kyiv, Ukraine.*
- Ivashkevich K.O. (2005): *Geoecological problems of the small rivers in Kyiv, Physical geography and geomorphology . T.49, P.254-258 Kyiv, Ukraine*
- Samoylenko V.M., Ivashkevich K.O. (2005): *Improvement of the ecological state of pools geosystems of small rivers of Kyiv, Hydrology, hydrochemistry and hydroecology., T.7., P.243-251. Kyiv, Ukraine*
- Romanenko V.D., Schulinkyi V.M. , Oksiuk O.P. and other (1998): *Method of the ecological estimation of the surface-water quality due to the proper categories. , 28 p., Symvol - T, Kyiv, Ukraine*
- Snishko C.I. (2001): *Estimation and prognostication of the fresh waters quality, 257 p., Nike – center, Kyiv, Ukraine*
- The Draft (1990): ECE Classification of Ecological Freshwater Quality CES/668, 25 p., Geneva*
- Directive (2003): of European Parliament and Council European Union № 2000/60/EC here 23 October 2000z., determine foundations of activity in region water policy (Water Framework Directive), Electronic resource of RTCIM, Kyiv, Ukraine*
- Source 3th worker meeting on the project (2003): "Development ecological base information basin's of Dnipro", 78 p., PTCIM, Kyiv, Ukraine*
- Samoylenko V.M. (2003) *Mathematical design in a geoecology, 199 p., VPC "Kyiv university", Kyiv, Ukraine*
- Samoylenko V.M. (2003) *Model optimization of the geoecological monitoring is, Hydrology, hydrochemistry and hydroecology, Tom 5, P.29-34, Kyiv, Ukraine*
- Boyko O.B., Obodovskiy O.G., Hilchevskiy V.K. (2002): *Hydrology of rivers of the urbanized territories (on the example of city of Kiev), Hydrology, hydrochemistry and hydroecology, T.3., P.97-106, Kyiv, Ukraine*

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The research of the quality of water of actually small rivers of cities is one of important components of estimation of the geocological state of a city on the whole.

On the basis of the afore-mentioned it is possible to outline the water quality main tasks for the decision of which there were. The tasks are as follows:

– carried out, comparison and analysis of the results of integral estimation of the water quality due to domestic and the European method on the example of the most characteristic small rivers of the city of Kyiv;

– selecting perspective directions of the development and perfection of the method of estimation of the water quality of small rivers on the strongly urbanized territories taking into consideration the methods existing in Europe and Ukraine.

The pools geosystems of the basic small rivers in Kyiv were examined in the given article, namely: the inflow of the Kaniv storage pool – the Lybid' and the Vita with their own influxes; the inflow of Irpen' is the Nyvka and the Horenka, and also the Syrets', that now falls in the chainlet of the reservoirs in place of the crease in the Obolon'.

Being based on the approaches of the method "Ecological estimation of the surface-water quality of dry land and estuary of Ukraine", there was the executed complex ecological estimation of the water quality of the selected small rivers in Kyiv both due to the three sectional indices – salt composition (I_1) ecological-sanitary indexes (I_2) and specific indexes of toxic action (I_3) and due to the integral (average readings after three previous) or ecological index (I_e).

For the second, part of the research for basis of calculations the method of ecological estimation of the surface-water quality was taken due to the proper categories. This method is the basis for drafting the programs of supervisions, data analysis, description of the quality of surface-water of dry land Ukraine from the ecological position and the receipt of the state information of water objects. The description of the surface-water quality is given on the basis of the ecological classification of the surface-water of dry land. Thus, being based on the already noted approaches of the method of ecological estimation of the surface-water quality through the proper categories, there was executed the complex ecological estimation of the water quality of select small rivers in Kyiv as well though three criteria - the criteria of the salt composition (I_1 $_{avr.}$), the ecologo-sanitary criteria (I_2 $_{avr.}$) and through the criteria of the maintenance of specific matters of toxic action, as through the level of toxicness, (I_3 $_{avr.}$) and also through an integral (averaging-out due to the three previous) or ecological index with selecting and maximum integral to the index.

Third method that is used in European Union [6], on the whole basis on comparison of the indexes of quality of water got as a result of analysis of concentration with the intervals of concentration of similar indexes which belong that is why or other class of quality from the classification chart of the noted method.

For the example of information about the quality of water of small rivers of city in Kyiv comparison and analysis of the results of integral estimation of the water quality is conducted after domestic and the European method. The features of the noted methods and their failings among which are appraised, in particular, imperfection of determination of the intervals of the

categories or the classes of the water quality and averaged of initial indices which are tested, no account of stochastic structure of criteria parameters ignoring of errors of discreteness and narrow-mindedness of supervisions and factor specific of their results, is selected. How perspective task, offered approaches to development of the improved method and classification chart of the integral estimation of the water quality of the small rivers of the strongly urbanized territories which will take into account the defects of present methods and principles of stochastic design and will be the component of recommendations from the geoecological basis charts of improvement of the ecological state of pools geosystems of the small rivers of cities agglomeration .