Sorbate systems in solving monitoring problems and security of water objects

Introduction

Heterogeneous systems with developing surface of interphase contacts attracts more scientists' attention. It's determined by unique features of boarded structures of hard objects and liquid, where individual chemical features of hydrophobe can appear at long distances, but selection of interaction between lysed components and coupling stages increases according to the mobility of supramolecular foundation in both stages. Those systems effectively used at present time as sensor elements of metrical applies of ecological-analythic dedications, setup for preconsetration components during the analysis of natural water on contenting supertoxicoderma, accumulating indication chromatographic sensors. Special value getting sorbate methods of cleaning water wastes from industrial plants, recultivation of foul natural objects, researches of migration features of radionuclides and other poisons. For these aims sorbate photomaterials are effective as cheap and wide oporunities of renew.These sorbing agents are used in many cases as components of microelements in manuring.

In this work we made a research opportunities of ecological-analythic dedication of ponds (we took Svisloch as an example) with using sorbate sensor setup and accumulating systems, and the opportunities of expressing sertification of natural sorbing agents were studied for working out recommendations of using them in reduction of negative consequences anthropogenic water wastes.

Materials and Methods

Water test and clastic deposits were chosen, by method which was described by authors, at 5 points of the river in the city area. For comparing we took water from artesian pond at "Vesnianka" and reservation "Lebiazhiy". As main exponent for reseaching objects were taken:

1) Hydrogen index (pH) as water example and water extract of clastic deposits.

2) General salt water concentration and WCD.

3) Chloride water concentration and WCD.

4) Carbonate hardness and general.

5) Protolytic water reaction and CD.

6) Ability of CD indicates hard metals.

For demention protolytic features of examples we used a pair of electrodes - glass electrode and chlorosilver electrode. Demention of reduction features was conducted with the help of platinum electrode (in pair with chlorosilver electrode).

General salt concentration, ion compositions were determined with the help of H-cation at the end of analysis pH -metric method.

Determining of chlorides was taken by potentiometer-method (with Ag-electrode).

Ability of CD to inactivate hard metals was studied by head-on method of chromotography with using chromatographic method, determination of Cu^{2+}, column effluent (solution after yelding out of the station, filling with researching clastic deposits).

Photomaterials for research were taken in august- September 2005 from different parts of plants, which are growing on sandy humic pod loam, specific for Belarussian landscape. Sampled examples were paned out, dried and chaped with the help of agate stamp till the size less than 0,1 mm. Shot of examples were 0,5 gr. (sencsebility of balance ± 0,0001 gr) of allowance on humidity was caused into balance with electrolyte background (20 ml 0,1 M NaCl or 0,05 M $CuCl_2$), after that it was titrated 0,1M of solutions HC1 and NaOH. Doses of adding acid or alkali composed 0,20 -1,00 after adding each dose of reagent

Were determined by size of pH solution with sensibility ±0,01 for that we used laboratory ionometre И-130 with glass indicated electrode and chlorosilver electrode in comparison. According to the results of determination, lines of titration were built in pH-V readings, where V- volume of adding acid solution or alkali. Protolytic size of titrating examples was calculated according to the formula:

$$Z = \frac{c \times V}{m}, \qquad (2)$$

Where Z- metathetical size (grammamol), c - concentration of reagent (littermol), m - weight of shot of researching example (gr.).

For constructing brendsted's pK-specrums were calculated the amount of Z, which is responsible for changes of pH liquid fase, equal 1. In each underlined interval pH was calculated pK_a brendtsted"s acid of titrating material, using Henderson-Hasselbeck's formula:

$$pH = pK_a + \lg \frac{[A]}{[HA]}, \qquad (3)$$

Where [A] - molarity of metal-form sorbing agent, [HA] - molarity of protonated form.

According to the difference between Z-solutions NaCl and $CuCl_2$ were found the incremental value, causing by replacement of ions Na + for ions Cu^{2+} in electrolyte background.

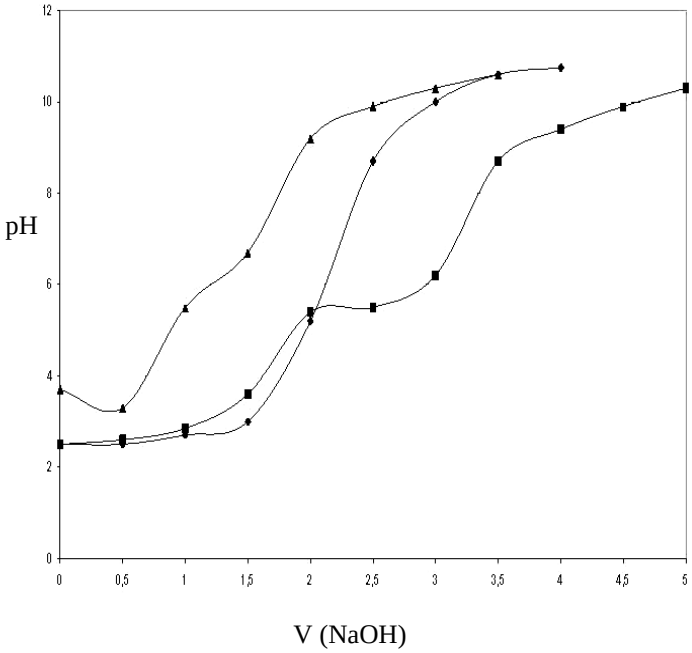
Results

Table 1

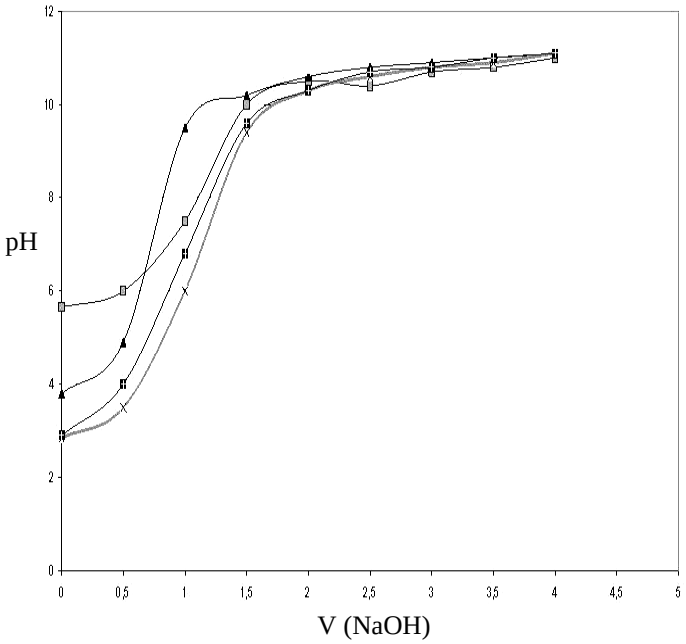
Characteristics of water from artesian pond and river Svisloch with in Minsk

№	Outflow	pH	General Salt Concent Ration, littermol	Chlorid Concent Ration, littermol	Percentage of Chlorides Concent Ration, %	Concent Ration SiO_3^{2-}
1	"Vesnianka" pond	7,4	6,4	0,46	7,0	3,4
2	Reservation "Lebiazhiy"	7,9	4,6	1,94	42,0	-
3	Gorky Park	7,2	3,4	0,43	13,0	1,6
4	Lake Komsomolskoe	7,6	2,4	0,32	13,0	-
5	Chizhovskoe Pond	7,7	2,2	0,47	21,0	-
6	Bus station "Vostochniy"	7,7	2,0	0,23	12,0	-
7	Poultry Factory	7,5	1,6	0,25	16,0	-

Tests data ionometric dementions are shown in this table. Lines of potentiometere-type of researching examples of river Svisloch and reservation "Lebiazhiy" are presented in pictures 1, 2

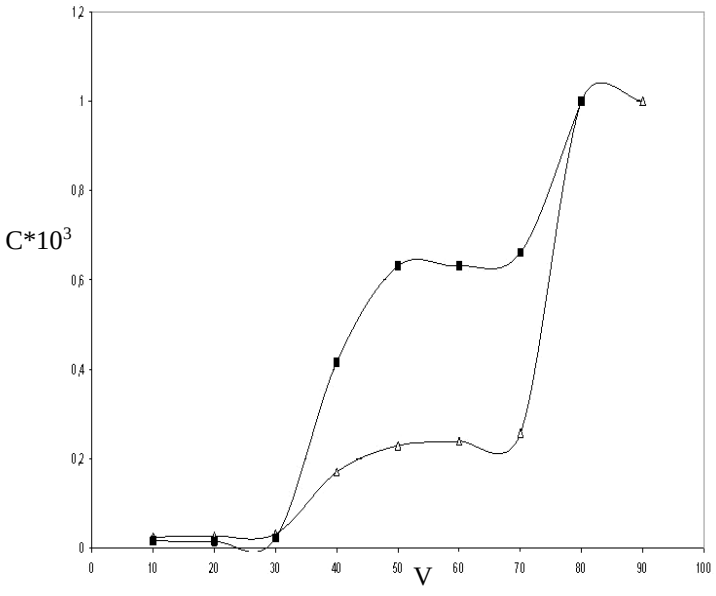


Picture 1. Lines of protonometric titration of water examples from river Svisloch: reservation "Lebiazhiy", "Vesnianka" pond, Gorky Park



Picture 2**.** Lines of potentiometric titration of water example from river Svisloch: Komsomolskoe lake, poultry factory, bus station *' Vostochniy", Chozhovskoe pond

Head-on results of lines of ions of cuprum (II) on the clastic deposits in river Svisloch, chosen at 2 points (Gorky Park and bus station " Vostochniy") they are presented in picture 3.



Picture 3. Head-on lines of chromatography of clastic deposits in river Svisloch: Gorky Park, bus station "Vostochniy"

Brendstend's pK - spectrums of researching phytomaterials are presented in pictures 1-16 of appendix. According to these facts the constants of the acidity and exchange size are presented in the tables 2-4.

Table 2

Constants of the acidity and exchange size of proton on metal of plants' roots

Plants	Fone	Separation pK			Balance, %	General size
		2-4	4-9	9-11		
Pea	NaCl	1,87	0,67	0,89	55:19:26	3,43
Potato	NaCl	1,25	0,44	0,20	66:23:11	1,89
Cow Clover	NaCl	4,32	1,05	1,41	64:15:21	6,78
White clover	NaCl	1,50	0,53	3,86	31:11:58	4,89
Wheat	NaCl	1,53	0,46	0,78	55:17:28	2,75
Rye (ll months)	NaCl	0,91	0,37	0,49	51:19:30	1,77
Rye (10 days)	NaCl	1,82	0,21	0,88	62:7:31	2,91
Bean	NaCl	7,07	1,10	4,25	57:9:34	12,4

Table 3

Constants of acidity and size of exchange in leaves

Plants	Fone	Separation pK			Balance, %	General size
		2-4	4-9	9-11		
Potato	NaCl	3,06	1,14	0,37	67:25:8	4,57
Potato	$CuCl_2$	5,41	2,68	0,86	61:30:9	8,95
Mustard	NaCl	2,12	1,13	3,11	33:18:49	6,36
Mustard	$CuCl_2$	3,77	2,32	1,75	48:30:22	7,84
Chestnut	$CuCl_2$	2,54	1,84	1,42	44:32:24	5,80

Table 4

Constants of acidity and size of exchange in seeds

Plants	Fone	Separation pK			Balance, %	General size
		2-4	4-9	9-11		
Pea (cotyledon)	NaCl	1,62	0,63	0,75	54:21:25	3,00
Bean (cotyledon)	NaCl	1,58	0,56	0,40	62:22:16	2,54
Bean (blanket)	NaCl	1,38	0,44	0,57	58:18:24	2,39

Discussion

As shown the receiving results (table 1), the size of pH in all studied water examples vary insignificant - within 7,2-7,9 (average size pH is 7,6). According to this fact, there are no outflows in Minsk which could pollute water with alkali objects or acidity nature (free alkalis and acids, or strong hydrolyzing salt)

Salt concentration in researching water examples changes so strong. The saltiest water is the artesian pond (6,4 littermol). That is naturally for artesian water. As well high salt concentration is in reservation "Lebiazhiy"(much more than in river water). The outflow of salt could be building works, swans' life activity. The lowest salt concentration is in river Svisloch when it flows into the city, what shows that some salt comes into the river in the city; maybe it is comes from surface water, it must be pointed out that water in the river belongs to the soft type of water.

According to the concentration of chlorides pointed out the water example from reservation "Lebiazhiy". Here the concentration of chlorides is 4 times more than average concentration in the river Svisloch. In this pond percentage concentration of chlorides is the highest (42 %).

In 2 researching water examples (pond Vesnianka, Gorky Park) according to the results of potentiometric titration, supposed that there are silicate-ions. For artesian water it is normally, for Gorky Park presence of SiO_3^{2-} is a bit unexpected. Perhaps it is connected with relief factor - within big inclinations of the surface is possible with ablation according to the big amount of clay high dispersive minerals. According to the forms of the titrating lines we can talk about the presence of silicates (pic. 1,2). In great majority these lines have gradual forms. It means that H-cation-exchange salts, which are contained in water, turns into strong acids. Lines for examples, where supposed the presence of SiO_3^{2-}, have twists in the space pH 5,6 - 6,0. It corresponds to the to the space of the sizes pK acidity groups, and it is typical to the silicic acid.

We can speak about the interesting results which are connected with data, that are presented in pic.3. Here we can see the head-on coming out lines getting out 2 examples of clastic deposits of the river Svisloch. According to the data line sorbating size of CD was determined concerning to the metal ion (in this case Cu^{2+}). The results were calculating according to the formula (C x V)/m, where C-concentration of metal in coming out solution, V- volume of solution till "centre of gravity" on the coming out line, m-weight of sorbing agent (in this case CD)calculating shows that CD in Gorky Park is characterizing by sorbing size at 0,0028 grammamol, for CD at bus station " Vostochniy" this datum is 0,0049 grammamol. As you see sorbing size is not so big. However, we can say that CD of researching ponds possess so strong inactivating action -indexes for the 2 examples are higher then 1 :2,8 (Gorky Park), 4,9 (bus station " Vostochniy").

Inequality of changes of protolytic size in measuring pH background electrolyte is general for all studying phytomaterials. Though, for roots (table 2) in sour area (intervals pH 2-4) size of ion Exchanges in the intervals of 0,91-4,32 grammamol, what corresponds 0,455 - 2,16 on 1 pH. In the weakly acid and alkaline areas (pH 4-9) demention pH on 1 connected with changes in exchange size in the intervals of 0,05 -0,2. Corresponding data getting out of leaves and seeds of researching plants (tables 3 апв 4) average summery size at all studying materials according to the results of tables 2-4 for intervals pH 2-4,4-9,9-11 corresponds as:

roots 4,2 : 1 : 2,5

leaves 1,9 : 1 : 0,8

seeds 2,7 : 1 : 1,1

Getting results according to their value we can study at 3 aspects:

1) ability of plants to show their protecting functions in relation to external chemical influence;

2) of choice of optimal conditions of using phitomaterials in chemical technology and analythic chemistry for getting macro containing manurings and feed additives;

3) assessing physical-chemical conditions of functioning plants members during the process of natural development.

Protecting properties of plants and their ability to minimize influence of outside chemical components capable to break natural development of plants. In this case it is useful to use methods which is using for assessing buffer conditions of hydrophobe, so their abilities to keep chemical structure and properties within changes of chemical area. For cases of influence of acids, alkalis and hard metals quantitative assess of buffer is possible with the help of Henderson-Hasselbah's formula (formula 3). Measure of protecting function may be the buffer size, chemical quantity of hydrophobe, that is possible to change the measure of pH of hydrophobe system for 1. According to this criterion -as more fluent ions as higher its buffer size.

As getting results show, maximum protecting functions of plants are shown in strong acid and strong alkali areas. Even this ability of buffer of plants limits the action of external hydrophobs on the same parts of human flesh, where we can find the area close to neutral (pH 4-9), giving maximum freedom for forming new structures and synthesis of new connectings. We can name this area of "mobile structures" or "nanostructures". These systems present a great interest to science of the nearest future, as action of quantitative transformations in "soft" natural conditions will be discovered, about these actions of traditional chemistry (chemistry of strong influence and hard structures) is not presented.

From viewpoint of methods optimization of concentration microelements with the help of phytomaterials data, that we got by changing pH area, we can control the process of interphase conduction of these elements, as we have an opportunity compare the size of ions changes H^+ on metal ion (Cu^{2+}, table 2) and the size of pH of those solutions, from which a given metal is necessary to point out.

Data of changes of protolitic size during the exchange of ions of Na^+ on Cu^{2+} show that leaves of plants (ex. Potato and mustard) is perspective for their use as microelements containing manurings and feed additives.

Presented data of pH-metric dementions as pK-spectrums - the most important sorbating characteristics of studying materials (see appendix). Full data about ability of exchange of H^+ on metal ion during the whole diapason pH area is containing in pK -spectrums, where quantitative dementions are possible as account of pH and capacity exchange.

Conclusion

1) There are no outflows of pollution that are capable for essential exchange in main-acidity water characteristics of the river Svisloch.

2) Essential difference of salt concentration in different parts of taking examples is established. It is supposed that the main outflow of salt in river Svisloch is surface water.

3) It is disclosed the higher concentration of chloride-ions in the water of reservation " Lebiazhiy"

4) The presence of silicate -ions at some points of taking examples (Vesnianka, Gorky Park) may be explained by geological conditions of water forming and of entrance $SiCb^2$- during the washing-off the surface of streets and houses.

5) Clastic Deposits from the river Svisloch show the highest ability to inactivate hard metals.

6) There is a bank of experimental data of protolitic abilities of phytomaterials, chosen out of typical plants for Belarus (pea, potato, chestnut, clover, wheat, rye, bean).

7) As it was fixed that maximum size(according to the exchange process) is a characteristic for acid area of main solution (pH 2-4). Lower size we can see in alkali area (pH 9-11) and the lowest size is in areas that are close to neutral (pH 4-9). These data are useful for giving assess of protecting functions of plants in relation to external chemical influence, ability of seed fat organisms give maximum

"freedom" for chemical transformations into soft conditions, and ability of engineering use accessible renewable materials naturally for technological aims and chemical-analythic concentration of microelements and getting microelements containings of manuring and feed additives.

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