METHODS OF MULTICOMPONENT WATER-SALT SYSTEMS SLUDGE PITS UTILIZATION BY METHODS OF RECEIVING OF VALUABLE COMPONENTS FROM THEM (ON THE EXAMPLE OF STEBNIK'S SLUDGE PIT)

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The multicomponent water-salt systems (WSS) have the very important value, in particular in the aspect of rational use of the nature, because they belongs to the most widespread on earth. They are a working environment for most of the chemical processes, for example productions of mineral fertilizers As far as the processes are rational or inefficiently organized depends the economic efficiency of production, in particular unit cost, and also scales of the human influence on a natural environment. These problems are very important for Ukraine, especially for Pricarpattya, because of the unique composition of the polimineral ores which are located in this region. Therefore it is impossible in principle to use some simple decisions of the technological and structural processing of neither polimineral ores, nor, even, wastes (sludge's, etc.) which would not be accompanied by the chain of new problems, in particular by formation of the secondary wastes with the not always predicted ecological consequences.

Taking into account that circumstance, that the problem of polimineral salt materials processing, and also processing of salt brines which appear from them (including the processes on technological stages of dissolution-crystallization) is studied sufficiently for a long time in the research establishments with participation of hundreds high quality specialists, to expect the development of some new technological processes or equipments for their realization in the nearest future in the compressed terms groundlessly. With a serious approach we can only consider which from the known technologies and the equipments to use and how to put them together with the best result for the complex processing of ore, dumps and brines.

The modern state of problem can be described as starting.

First of all, because scarcely the repair, reconstruction and input of new technologies on the base of tailings of old equipment can be practically possible and economically expedient.

Secondly, because we need basically new principle than that approach of the use of wasteless technologies that has been used before (in particular in Stebnyk). At the same time it is necessary to realize that these (wasteless) technologies were not used before not because they were unknown, but:

a) they require scientific technologies and highly expensive technological equipment, including the tools of automatic process control;

b) they need high qualification and professional culture of managerial and engineering staff.

Thus, long-term strategy of successive introduction of technologies of the complex processing of ore raw material and accumulated wastes of its partial processing in the past and also brines of a different origin, should become the problem's decision.

For making a decision about a strategy of problems of polimineral ores processing and utilization of wastes and brines, in particular, those, that appear in environment, it is necessary:

1. To determine in general what products and half-products can be received from them, depending on composition of ore, accumulated wastes and brines:
   a) as a result of physical division on the simple substances regardless of what kind of technologies are needed for this purpose;
   b) as a result of chemical conversions.
2. To set, which necessities and markets of sale of these products exist now and will be in the future.

The perspective direction of scientific-searching approach, as bases of development of optimum technologies for the complex processing of multicomponent salt hard phase and brines, there is creation of the imitation computer programs on the base of new approaches to the mathematical design of equilibrium and trajectories of dissolution and crystallization processes (in particular factious), providing their sufficient complete base of experimental reference data at solubility for the interval of temperatures, in which conducting of industrial processes is real.

Computer experiments allow us to sufficiently decrease the time of search of the best possible variants of conducting the polimineral ores and their brines processing, but control laboratory experiments for final clarification of parameters of the technological regimes are needed on a final stage, as up to now there is no full data at a politermic equilibrium in the multicomponent water-salt systems.

The task is to develop the optimum algorithm of construction of between-phase equilibrium model in multicomponent WSS. It means that in it there has to be organically combined the models of all its subsystems, which means the WSS with the smaller number of components up to two-component systems. Therefore information about equilibrium in all subsystems has to be used, and more precisely plugged in the all-embracing model of WSS equilibrium.

We use the translation principle for construction of mathematical models of equilibrium between simple minerals and multicomponent WSS solution, which is based on application of matrix calculation apparatus. Computer programs for the automated calculation of parameters of equilibrium surfaces in the simple water-salt systems with the arbitrary number of components are developed and approved.

We calculated mathematical models of trajectories of the elementary processes, such as evaporation, crystallizations and dissolution in the simple water-salt systems which appear as a great number of figurative points of solution. They are formed as a result of crossing the equilibrium surface of WSS mineral, concerning which solution becomes satiate with the proper beams (evaporation, dissolutions-crystallizations).
An algorithms and programs for conducting of numeric experiments for processes in simple multicomponent WSS are developed on the basis of mathematical models. That enables us to choose the optimum technologies without laboratory researches.

The example of construction of trajectory is considered for the chotiricomponentoi system $NaNO_3$-

$NaCl-KNO_3-KCl-H_2O$. With amplification of theoretical data-base principle of mathematical design and the mathematical model itself it will be possible to apply it for the multicomponent water-salt systems, such as a system of brines of Stebnyk **sludge pits** and «marine» system.

The freezing method, which is possible to apply on the first stage of processing, is also considered as one of the perspective methods for multicomponent polimineral ores processing. Demineralization of the water by freezing method is used in many fields of industry, where it is necessary to purify the water to drinkable quality. This method has a prospect for the receiving of high quality water with salt amount up to 8 g/dm^3 from sea water.

The process of desalination of the salted waters by freezing based on cooling of water to the below 0 ^0C temperature, by its freezing and separation of ice crystals, which do not maintains salts.

The freezing method is applied to get separate components out of natural brines - salt lakes brines and arm of the sea.

Experience shows that when freezing at different temperatures the crystals of separate salts fall out compatible with ice. So, at a minus 2 ^0C temperature a $CaCO_3$ falls out, at minus 5 ^0C – Na_2SO_4. Consequent lowering of temperature to minus 20 ^0C causes the fall of other sulfates and NaCl crystallizes at minus 23 ^0C. At very low temperatures, minus 40-55 ^0C the chlorides of magnesium, potassium and calcium fall out. Therefore in the processes of freezing it is not necessary to use very low temperatures, because it resultes to the receipt of dry mixture of salts with ice (water).

We did the row of freezing experiments. As the result we received an information about the changes, that take place in the water-salt systems (on the example of Stebnyk brines) at temperatures below 0 ^0C. We have also conducted the parallel analysis on determination of ionic composition of the given brine at the normal temperatures.

On the basis of the research work analysis we've recommended an optimum temperature for the technological process (-4 -5 ^0C).