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Treatment of cyanide-contained waste water

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ABSTRACT

This work contains results of theoretical and experimental investigations of possibility to apply industrial ionites of different kinds for recovering complex cyanide of some d-elements (Cu, Zn and so on) and free CN-ions with purpose to develop technology and unit for plating plant waste water treatment. Finally, on basis of experimental data about equilibrium kinetic and dynamic characteristic of the sorption in model solutions, strong base anionite. in CN- and OH- forms was chosen. This anionite has the best values of operational sorption uptake. Recommendations of using the anionite have been developed for real cyanide-contained wastewater treatment.

Key Words:Cyanide Contained Wastes/Electroplating Waste Treatment/Industrial Ionites

One of the main sources of high-toxic cyanide and heavy metal intakes in the Environment is waste water of electroplating industry.

Current technologies of cyanide-contained waste water sterilization and recovery of valuable components from the wastes are based on use of electrochemical, membrane, ion-exchange, biochemical, reagent and others methods.

It is need to say that, in connection with necessity of creation of low-waste and non-waste technologies, including the discharge solution regeneration and the component recovery, the range of ion-exchange application will be expanded in the near future and one of the ways is establishment of modular ion-exchange units involving in the operational technological mechanism.

and importance. But, although the ion-exchange resins are common in others industries, their application for waste water treatment is problematic due of ion-exchange thermodynamic constant deficiency, difficulties in calculating of the chemical potentials in the such complex multicomponent solutions as the waste waters, and their chemistry and volume variety

On purpose to improve the technology and to develop the local unit for plating industry waste water treatment, the theoretical and experimental investigation of possibility to apply industry ionites of different kinds for recovery of complex cyanides of some d-elements (Cu, Zn and so on) and free CN-ions was carried out.

It was revealed from the analysis of cyanide compound stability constants that metal ions, being subject to recovery, are presented in the real solutions as polyatomic anions. Therefore, anionites with various basic capacity and in different forms- SO42-, Cl-, CN-, OH- were studied.

As a result of the study experimental data of equilibrium, kinetic and dynamical characteristics of the sorption process were received and, finally, strong base anionite of CN- and OH- forms was chosen.

The technological parameters of the sorption treating for the chosen sorbents were determined from the process of the real cyanide-contained waste water treatment on a bench-top sorption column with diameter 25 mm and height 500 mm in dynamic conditions.

Desorption of the cyanide compounds was conducted with using 3-5 % solution of sulfaric acid and with inputting oxidizer for destruction of the cyanide compound of Cu (I), taken by the sorbent. The solution delivery rate was 1 volume of the waste water on 1 volume of the sorbent per hour, t=50-60°C.

The method of desorption allows recovering and concentrating copper, zinc and cyanide-ion in the small volume (5-8 column volumes). During the desorption, cyanide hydrogen is escaping due the interaction between saturated ionite and sulfaric acid. A lot of the cyanide hydrogen is trapped and returned into the main technological process.

As the example, there are results of the cyanide-contained water waste treatment, shown in the table 1 30 14, C 40, ∑ Fe,Co,Ni-8.

Table 1

Values of the sorption treatment of the cyanide-contained water waste with the chosen ionite.

I. Sorption

Elementary component	Number of delivered volumes												
	50	100	160	180	220	240	260	280	300	340	360	380	400
Cu,mg/l	н/о	н/о	н/о	0,1	0,2	0,4	0,9	1,6	3,0	8,1	16,0	24,0	30,0
Zn, mg/l	н/о	н/о	н/о	н/о	н/о	н/о	н/о	н/о	0,1	0,2	0,4	0,8	1,5
CN-, mg/l	0,5	5,1	11,4	15,6	29,1	34,5	39,7	40,0	40,0	-	-	-	-

II. Desorption

Elementary component	Number of delivered volumes											
	1	2	3	4	5	6	7	8	9	10	11	12
Cu,mg/l	25	14	120	250	2800	2700	1400	420	180	50	10	5
Zn,mg/l	9	6	290	115	1800	1420	900	120	120	1,5	0,8	0,3

Thereby, as result of the investigations, process conditions and parameters (table 2) of the cyanide-contained water waste treatment with usage of the certain ionite were determined.

Table 2

Technological parameters of the sorption treatment of the cyanide-contained waste water

Action	Process conditions
1.Sorption	T=5-300C; CCu=20-50mg/l, CZn=5-30 mg/l, CCN=30-40 mg.l; solution delivery rate - 0,5-10 vol./vol. of the sorbent per hour
2.Desorption	T=40-60oC; CH2SO4=30-50 g/l; desorbent delivery rate - 0,5-1,0 vol./vol. of the sorbent per hour; solution yield - 5-8 column volumes
3.Water cleaning	T=20-40oC; water delivery rate - 5-10 vol./vol. of the sorbent per hour; water volume - 2-4 column volumes
4.Alkali treatment	T=20-40oC; CnaOH=20-40г/л; solution delivery rate - 3-5 vol./vol. of the sorbent per hour, solution volume - 3-4 column volumes

Literature

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