WASTEWATER TREATMENT BY FLOTATION WITH POLYELECTROLYTE

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Pressurized reagent flotation is being used more and more in the treatment of wastewater to remove finely dispersed impurities, emulsified oil, and colloidal particles. The usual coagulant is aluminum sulfate, at a dose of 80-150 mg/liter (calculated as $Al_2SO_4)_3$. However, the use of this reagent results in the formation of considerable amounts of foam and also an increase in the sulfate content of the treated wastewater, with a corresponding increase in the salt content of the water in the recirculating supply system when the industrial wastewater is returned to this system.

The search must be continued for reagents that do not change the chemical composition of the wastewater in the course of treatment. Research carried out in the USSR and other countries [1-5] has shown that the most promise is offered by the use of polyelectrolytes as treating reagents. Cationic polyelectrolytes give a higher degree of wastewater purification in comparison with the traditional reagent, aluminum sulfate.

The polyelectrolyte dose is usually no greater than 5-7 mg/liter, so that the quantity of foam that is formed is reduced by a factor of 3-4; also, there is no change in the pH of the treated wastewater. Commercial tests have been performed on three batches of the cationic polyelectrolyte VPK-402 (polydimethyldiallylammonium chloride) in the flotation treatment of wastewater from the No. II sewer system. The three batches of polyelectrolyte differed in intrinsic viscosity.

Before performing the commercial tests, the optimal polyelectrolyte dose was determined. As shown in Table 1, in treating the wastewater from the No. II sewer system of the Ufa refinery using VPK-402, the residual contents of oily and suspended matter were different for the different batches of reagent. The optimal dose of VPK-402 was also found to depend on the intrinsic viscosity of the product, with the required dose decreasing by a factor of 2 as the intrinsic viscosity increased from 0.2 to 1.03 dl/g.

In addition, comparative tests were run at the Ufa and Novokuibyshevsk refineries on experimental batches of VPK-402 with intrinsic viscosities of 0.64, 0.8, and 1.01 dl/g, and also on aluminum sulfate. The data from these tests (Table 2) indicate that for the same efficiency in treating wastewater from the No. II sewer system of the Ufa refinery in terms of removal of oily matter, the required dose of VPK-402 was 4-4.5 mg/liter, which is smaller than the dose of aluminum sulfate by a factor of 15.

In the flotation treatment of wastewater from the Novokuibyshevsk refinery with the VPK-402 polyelectrolyte (13 mg/liter), the treating efficiency was 83% for oily matter and 87% for suspended matter. When using aluminum sulfate (180 mg/liter), the treating efficiency was 37%

TABLE 1

Index	VPK polyelectrolyte								
	0.2 dl/g; dose 10 mg/liter			0.27 dl/g; dose 9.5 mg/liter			1.03 dl/g; dose 5.5 mg/liter		
	before flotation	after flotation	treating efficiency, %	before flotation	after flotation	treating efficiency, %	before flotation	after flotation	treating efficiency, %
PH	8,59	8,32	—	8,34	8,07	—	8,3	8,2	—
COD, mg O_2/liter	669	227	66,1	263	189	28,1	357	217	39,2
Oily matter extract. by CCl_4, mg/liter	131	35,5	72,9	33,6	15,2	54,7	38,9	18,1	53,5
Suspended matter, mg/liter	81	38	53,1	55,1	32,7	40,6	49	20,2	58,8
BOD_5, mg O_2/liter	—	—	—	40,5	24	40,7	71	31	56,4

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TABLE 2

Index	Treating efficiency at Ufa refinery, %				Treating efficiency at Novokuibyshevsk refinery, %	
	with $Al_2(SO_4)_3$; dose 65 mg/liter	w. VPK-402 with indicated viscos. 0.64 dl/g; dose 4.5 mg/liter	0.8 dl/g; dose 4.5 mg/liter	1.01 dl/g; dose 4 mg/liter	with $Al_2(SO_4)_3$; dose 180 mg/liter	with VPK-402 with 0.64-1.08 dl/g; dose 13 mg/liter
COD, mg O_2/liter	37	30,5	30	29,5	24,8	43,4
Oily matter, mg/liter	47	53	63	42	37	83,4
Suspended matter, mg/liter	25	43	39	55	44	87
BOD, mg O_2/liter	52	57	43	29	—	—
pH	—	—	—	—	—	—

for oily matter and 44% for suspended matter, i.e., 46-43% lower. A change in the intrinsic viscosity of the polyelectrolyte from 0.64 to 1.01 dl/g did not affect the treating efficiency.

Commercial production of the VPK-402 has been achieved at the Sterlitamak Industrial Association "Kaustik." Widespread use of this material will tend to increase the effectiveness of flotation treatment of wastewater.

LITERATURE CITED

1. L. V. Gandurina, I. N. Myasnikov, et al., Tr. Vses. Nauchno-Issled. Inst. Vodosnabzheniya, Kanalizatsii, Gidrotekh. Sooruzh. Inzh. Gidrogeol., No. 71, 16-18 (1978).
2. B. B. Shmidt, É. G. Ioakimis, A. S. Éigenson, et al., Khim. Tekhnol. Topl. Masel, No. 4, 59-60 (1979).
3. L. N. Butseva, L. V. Gandurina, B. M. Ustinov, et al., Khim. Tekhnol. Topl. Masel, No. 6, 36-37 (1986).
4. J. Richard, E. Robert, and R. Terry, J. Water Pollut. Control Fed., 44, No. 2, 331-346 (1972).
5. I. L. Steiner, J. E. Bennett, and L. F. Clere, Chem. Eng. Prog., No. 12, 39-45 (1978).

TREATMENT OF WASTEWATER FROM CATALYST MANUFACTURE

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In the process of catalyst manufacture, the wastes that are formed contain hydroxides of chromium, copper, iron, and aluminum. The production of copper–chromium catalyst alone creates up to 100 m^3/day of wastewater with a pH of 5.8-6.8, containing (before treatment) 300 mg/liter of copper(II) and 1200 mg/liter of chromium(III).

Wastewater from the copper–chromium catalyst manufacturing unit is currently treated by the use of two reagents — spent caustic from propane–propylene caustic washing, and iron sulfate. The spent caustic contains Na_2S, NaHS, and H_2S; it serves as a carrier of sulfide ions, containing up to 315 g/liter of sulfur-containing compounds, or up t0 180 g/liter of pure sulfur. The iron sulfate is used in the form of a 100 g/liter solution.

The wastewater, the spent caustic, and the iron sulfate solution are fed to a reactor tank, where they are mixed for 1 h. In the course of the mixing, relatively insoluble compounds are formed and are precipitated as sludge: iron sulfide, copper sulfide, and hydroxides of iron, chromium, and copper. After the mixing operation, the wastewater is allowed to settle for 4-8 h. The settled water is taken from the reactor to a slime separator; the precipitate is burned. The wastewater leaving the slime separator is discharged to the refinery sewer system; the slime is withdrawn for burning.

In the process of manufacturing 1 tonne of the copper–chromium catalyst, 1.2-1.4 tonnes of slime is formed, with a water content of 96-98%. The main solid components of the slime

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