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NATURAL SCIENCES

WASTE PRODUCED IN PHOSPHATING OF METALS AND THEIR COMPOSITION

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Annotation. In this article, waste water from metal processing enterprises and its composition, physical-chemical properties, atmospheric air and soil mineral composition are studied. In addition, the amount of micro and macro elements in the waste water was checked in relation to the permissible concentration. Currently, the main problems of industrial enterprises are to improve phosphating solution processes, reduce the amount of waste, save raw materials and fuel, develop measures to avoid waste in production, new high-performance technologies, waste-free and low-waste technologies. consists of implementation.

Key words: industrial waste, phosphating solution, permissible concentration.

Annotasiya. Ushbu maqolada metallarni qayta ishlash korxonalaridan hosil bo’ladigan chiqindi suvlar va ularning tarkibi, fizik-kimyoviy xossalari, atmosfera xavosini va tuproq mineral tarkibiga ta’sini o’rganilgan. Bundan tashqari chiqindi suvlarning tarkibidagi mikro va makro elementlarning ruxsat etilgan konsentratsiyasiga nisbatan miqdori tekshirilgan. Hozirgi paytda sanoat korxonalarining eng asosiy muammolari Fosfatlovchi eritma jarayonlarni takomillashtirish, chiqindilar miqdorini kamaytirish, xom-ashyolarni va yoqilg`ilarni tejash, ishlab chiqarishda isrofgarchilikka yo`l qo`ymaslik chora-tadbirlarini ishlab chiqish, yuqori unumli yangi texnologiyalar, chiqindisiz va kam chiqindili texnologiyalarni amalga joriy etishdan iboratdir.

Kalit so‘zlar: sanoat chiqindisi, fosfatlovchi eritma, ruxsat etilgan konsentratsiya.

Аннотация. В данной статье изучены сточные воды металлообрабатывающих предприятий и их состав, физико-химические свойства, минеральный состав атмосферного воздуха и почвы. Кроме того, проверялось количество микро- и макроэлементов в сточных водах относительно допустимой концентрации. В настоящее время основными проблемами промышленных предприятий являются совершенствование процессов фосфатирования, снижение количества отходов, экономия сырья и топлива, разработка мероприятий по предотвращению образования отходов в производстве, новые высокопроизводительные технологии, безотходные и малоотходные технологии. реализации.

Ключевые слова: промышленные отходы, фосфатирующий раствор, допустимая концентрация.

Introduction. In the 21st century, the problem of environmental pollution caused by waste is considered one of the most acute and controversial issues. Solid waste generated at chemical industry enterprises is extremely diverse in terms of its physical and chemical properties and its impact on the environment. The treatment of wastewater generated in production is one of the most pressing problems of our time and requires special attention. Water is one of the most important natural resources; however, today large quantities of harmful substances and toxic compounds are discharged daily into water bodies throughout the world. As a result, the chemical composition of water undergoes negative changes, thereby causing damage to human health and the state of the environment. The production of non-ferrous metals is one of the most water-intensive industries. As a result of neutralizing and discharging wastewater generated in metallurgical production into open water bodies, a number of valuable useful components—chromium, zinc, nickel, iron, copper, and other metals—are also lost together with the wastewater. The conducted studies have shown that the complex extraction of metals from wastewater represents one of the most difficult problems to solve, since the presence of many components with similar properties complicates their selective separation. At the same time, research is being carried out to improve phosphating solution processes aimed at utilizing these wastes in order to additionally recover valuable metals by purifying wastewater from the main phosphating solutions and returning it to production.

In wastewater treatment studies, adsorption is widely used. In this case, local wastes are used as adsorbents in research: these include oak bark and leaf residues, as well as aquatic plants. Clays can also be used as sorbents in the adsorption process. Low-grade adsorbents include agricultural wastes (rice husk, wheat husk, eggshells, coconut shells, palm fruits, mushroom residues, peanut shells, fruit peels, biochar) and industrial wastes. Agricultural wastes consist of lignin, cellulose, hydrocarbons, sugars, water, and starch. These wastes can be used directly; they are first washed and then applied to soil. Afterwards, they are sieved to obtain the required particle size for adsorption tests.

Chemical precipitation is an effective and simple technology for the treatment of wastewater containing heavy metals. Traditionally, strong alkaline reagents such as ammonia, lime, sodium hydroxide, sodium carbonate, and sodium sulfide are used to increase the pH level of wastewater. In this process, soluble heavy metal ions are converted into insoluble hydroxide, carbonate, or sulfide compounds and precipitate in an alkaline medium. Nevertheless, traditional reagents have several disadvantages: most heavy metal ions are present in acidic solutions, and sulfide reagents in acidic media may generate toxic hydrogen sulfide gas, which has harmful effects on human health and the environment.

The authors studied the separation of metal ions by electrochemical methods from a solution obtained after selective leaching of Fe–Mn mixed ore. The study investigated the electrochemical behavior of chromium and iron ions in sulfate chromium–iron solutions in an acidic medium, depending on temperature, time, and solution concentration.

Research section. In the recycling of metals, to separate metal ions, hydrophosphate, phosphate, dihydrophosphate, chloride, and nitrate from the phosphating solution by the neutralization method, wastewater containing NaOH from caustic soda waste of phosphating solutions at enterprises producing automobile reflectors was used as a neutralizing reagent. Initially, the compositions of both wastewaters were determined by mass spectrometric analysis.

1-table

Chemical composition of wastewater generated after metal phosphating.

elements	A	B
Cu	22000	18000
Zn	23000	12000
Fe	20000	320
Ni	6100	100
Mn	14000	100
Co	1400	10

The phosphating solution undergoes the following chemical reactions.

$2\ H_3PO_4 + Fe = Fe(H_2PO_4\ )_2 + H_2$

$Fe(H_2PO_4)_2 + Fe = 2FeHPO_4 + H_2$

$2FeHPO_4 + Fe = Fe_3(PO_4)_2 + H_2$

2-table

Metal residues present in the phosphating solution.

№	Phosphating solution	Mixed volumes (ml)	Solution after filtration (mkg/l)		
			Zn	Ni	Cu
1	1:9	20 : 180	<100	1200	8000
2	1:4	40 : 160	<100	2600	9000
3	1:2.33	60 : 140	<100	4800	10000
4	1 :1.5	80 : 120	<100	5600	11000
5	1 :1	100:100	200	6000	13000
6	1.5 :1	120 : 80	200	6300	15000
7	2.33: 1	140 : 60	200	6600	17000
8	4 :1	160 : 40	200	6700	17000
9	9 :1	180 : 20	200	7000	18000

In the study, wastewater generated after metal phosphating was taken, and samples with different ratios (1:9, 1:4, 3:7, 2:3, 1:1, 3:7, 7:3, 4:1, 9:1) were prepared and mixed. The mixing was carried out using a glass rod every 10 minutes. The process was conducted at room temperature. After one hour, the mixing was stopped and the solution was filtered. The composition of the filtrate was determined. The amounts of ions remaining in the solution and the precipitated solids after filtration were determined.

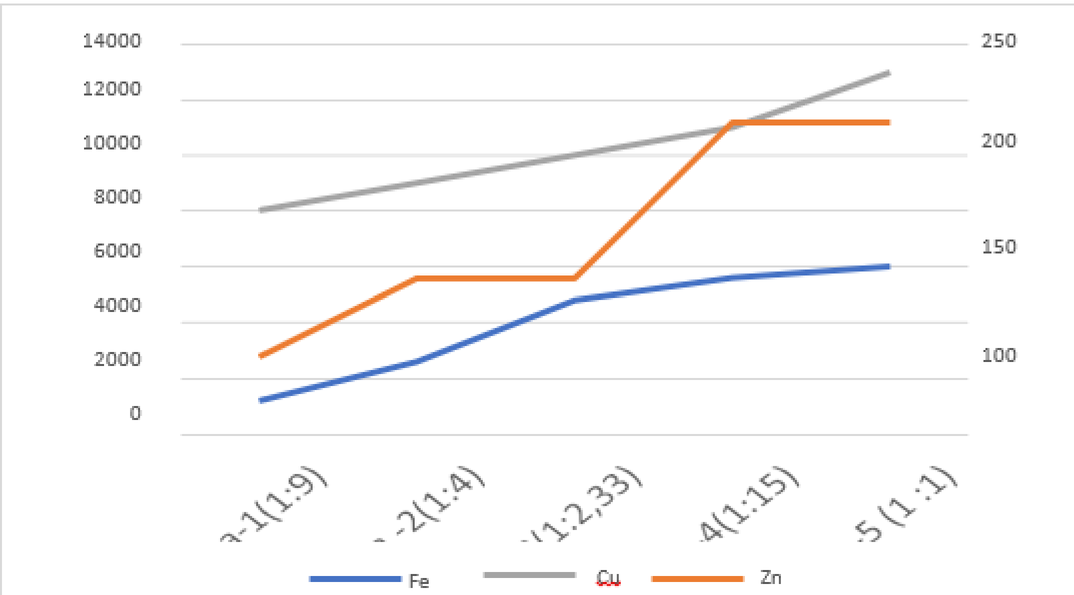

Figure 1. Content of metals (Fe, Zn, Cu) in the filtered solution of samples 1, 2, 3, 4, and 5.

In the study, the pH values of the initial solutions and the solutions after mixing were determined (Table 3).

3-table

pH values of the solutions.

Primary wastewater			**Solutions after mixing**		
№	**Name**	**pH value**	**№**	**Mixing ratio**	**pH value**
1	Phosphating solution	1.48	1	1:9	8.41
2	Alkaline solution	9.23	2	1:4	6.68
			3	1:2.33	2.08
			4	2.33:1	1.75
			5	4:1	1.65

The chemical analysis results of the precipitation indices at various pH values used to precipitate metals from the phosphating solution are presented in Table 3, and based on the obtained results, a graph of the pH dependence of the precipitation process was constructed (Figure 3).

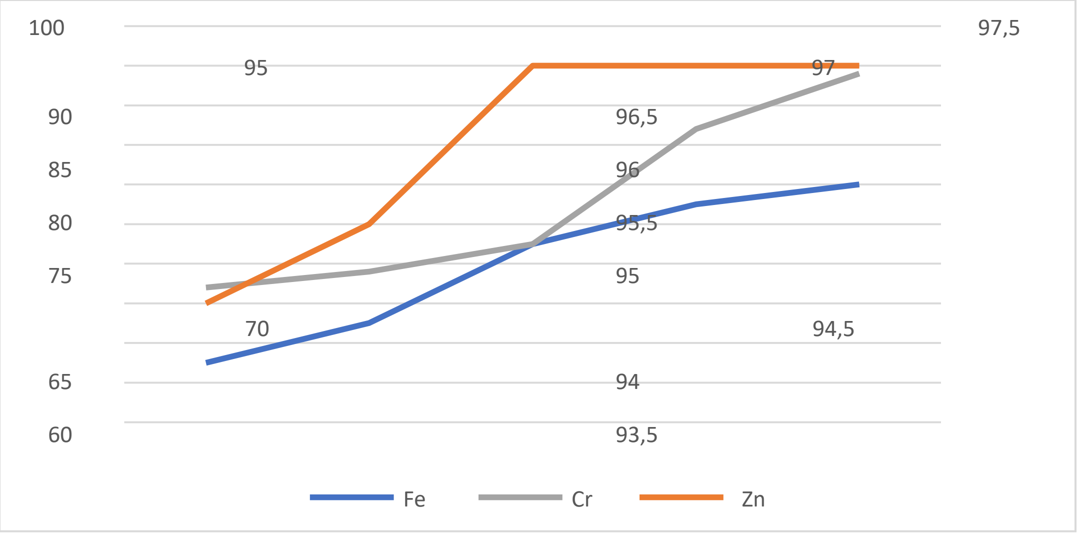

Figure 2. Dependence of metal precipitation on pH in the study.

Conclusion. The wastewater containing rhodanide ions from Navoiazot Unit 201 (thiourea production unit) was used to separate metals with high concentrations (chromium, iron, zinc) from phosphating solutions generated during metal phosphating. According to the research results, the simultaneous precipitation of metals from the solution under various conditions was observed. The maximum precipitation of chromium from the solution reached 80%, iron reached 94%, and zinc reached 97%. These results indicate that with an increase in pH, the precipitation of metals also increases.

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