Treatment of waste water contaminated with iron ions on the basis of activated defecate

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Abstract. The results of the analysis of the waste water of the industrial enterprise containing iron ions and the analysis of these iron ions on the basis of defecate is being as a local sugar production waste are presented. In the analysis, laboratory tests were conducted for wastewater treatment using samples of the sugar production waste activated at different temperatures. The information on the results of the analysis of the dependences on the activation temperature of the defecate, the stirring time, and the amount of weight added defecate to in order to remove of iron ions from the waste water is presented.

1. Introduction

Currently, waste water from all types of chemical and electrochemical and metallurgical plants is mainly discharged into natural water bodies. All these wastewaters mainly contain various metal compounds. The presence of metals eliminates the possibility of using these waste waters in industrial enterprises, and they are harmful substances that have a harmful effect on human health in various degrees.Therefore, treatment of waste water contaminated with metals is one of the urgent issues [1-3]. Analyzing the literature, it can be concluded that the physico-chemical and biological methods used in the treatment of waste water from pollution sources have high results, but they cause large material costs. The adsorbents used for the purification of metallurgical industry wastewater from heavy metals are unique in nature and are not widely used, because the cost is high or the level of purification is low and ineffective [4-5]. At present, inefficient methods of treatment of polluted water are used in electroplating workshops and metalworking enterprises. Due to the large number of such enterprises, they cause great ecological damage to the environment, therefore, the problem of wastewater treatment is of particular importance. The main drawback of all the technologies used for the treatment of wastewater from heavy metals is that none of them provides a cheap and effective way to eliminate the formed sediment [6-7].At the same time, various methods of cleaning wastewater from metals, including reagents and adsorbents, are being used. In this process, the use of expensive reagents and adsorbents is relatively ineffective due to their economic cost.

In addition, large tons of waste are generated during the production process in industrial enterprises. The possibility of using these wastes as various catalysts, mineral and organomineral fertilizers and other purposes is increasing [8-13]. When the composition of the produced waste is analyzed physico-chemically, it can be seen that it is possible to use it in wastewater treatment. For this reason, the treatment of industrial waste water containing various metals with the waste of production enterprises is one of the urgent problems of the present time.

Today, the problem of waste disposal is one of the urgent problems due to the accumulation of various industrial wastes, including the defecate, which is considered the waste of the sugar industry. It enables recycling of waste by creating opportunities to divert it to production.A large amount of organic waste is generated every day in the activities of industrial enterprises and the national economy. Sugar industry waste can be used to obtain carbon adsorbents suitable for water treatment. In the process of sugar production, large tons of waste are generated. A small part of them is used for soil mineralization, most of them are thrown away. By obtaining adsorbents from the defecate, several problems can be solved at the same time, waste reduction and wastewater treatment are achieved [14-16].

Due to the presence of organic compounds in the defecate, it was determined that carbon formation on the surface due to the combustion of organic substances during thermal treatment. The method of purification of thermally heated defecation at 600º C has been determined and its use for cleaning wastewater of metallurgical plants from heavy metals, sulfuric acid residues from iron, lead and antimony ions, during the treatment of calcium gluconate obtained

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from defecation with sulfuric acid, mixtures of acid, water PbSO4, FeSO4, HSbO3 interaction with the formation of insoluble precipitates is known from the literature.
The experiments conducted on the treatment of waste water of the metallurgical combine showed the prospect of using the thermally carbonized defecate. In particular, the possibility of cleaning from heavy metal ions such as Mn, Ni, Sr, Mo, and Co, Fe, Su in wastewater [17-19] has been shown.
Summing up from the above, it is a very urgent task to obtain high-performance adsorbents based on the defect of sugar industry waste and to conduct research on methods of treatment of waste water of industrial enterprises with the obtained adsorbents.

2. Materials and Methods

During the experimental research, the physico-chemical analyzes of waste water from the sugar industry and waste water of the industrial enterprise were studied. In this case, the composition of the defecate differs depending on the raw material and type of production, mainly dry raw material (moisture content 25-30%), lime - 60-70%; organic matter - 10-15%; nitrogen - 0.2-0.7%; phosphorus -0.2 - 0.9%; potassium 0.5-1%; the presence of a small amount of sulfur, magnesium and other trace elements, the presence of a large amount of iron ions in the waste water of the industrial enterprise was proven from the results of the analysis.
According to the obtained results that are shown in Table 1, it was found that Fe^{2+} 40 mg/l and Fe^{3+} 440 mg/l are in the wastewater. The determined results are given in the table below. Adsorbent samples were obtained based on the activation of the analyzed waste defecate at temperatures of 400, 450, 500, 550 and 600 °C. At the next stage, the possibility of wastewater treatment was analyzed by adding the activated waste water samples in 100 : 1, 100 : 2, 100 : 3 and 100 : 4 weight ratios. Cations, anions, pH, dry fraction and physical parameters of purified water samples based on activated defects were studied.

Table 1. General physico-chemical analysis of wastewater of an industrial enterprise

Cations	Content in liter		Other indicators	
	mg/l	mg- eq/l		
Na^+	340	14.78	Hardness mg-eq/l: total	850.00
K^+	138	3.54	Carbonate	824.00
NH_4^+	720	39.91	Non-carbonate	
Ca^{2+}	3000	150.00	pH	<1(0.80)
Mg^{2+}	8512	700.00	$CO_{2\ free}$ mg/l	
Fe^{3+}	440	23.64	CO_2 mg/l	
Fe^{2+}	40	1.43	SiO_2mg/l	
Total		1373.30	Dry residue: mg/l	
Anions			Experimental	61650
			Calculated	51432
Cl^-,	886	13.75	Physical Properties	
SO_4^{2-}	37076	65.50	Transparency	transparent
NO_2^-			Taste	brine
NO_3^-	20	11.93	Color	brown
CO_3^-	Her	-	Smell	rankness
HCO_2^-	No acided test	2.25	Sediment	5202 mg/l
Total		797.74	Na^+ found on a flame photometer	340 /l

3. Results and Discussion

The obtained results showed that the removal of total iron ions from the waste water content increased with the increase in the defecate activation temperature and the weight ratio of waste water and activated defecate. For example, 68.66% of iron ions were removed when the defecate was activated at 450 °C by mixing with waste water at a ratio of 100:1 by weight, and 71.54% of iron ions were removed at the same temperature at a ratio of 100:3 by weight. It was found that in the weight ratio of waste water and activated sludge of 100 : 4, the sludge had the possibility of 77.65% when activated at 400 °C, 92.39% when activated at 500 °C, and 99.05% when activated at 600 °C (Figure 1).
When wastewater was mixed with different ratios of activated waste water, it was concluded that 100 : 3 ratio and activation of waste water at 600 °C was the optimal amount. Wastewater was mixed with thermally modified sewage at different time intervals. It was found that the pH of purified water increases as the duration of mixing increases. The

obtained results are shown in Figure 2. It was found that the thermally modified defecate is known to have an alkaline environment in pure solution. It was found that the water being treated has an acidic environment. As a result of increasing the duration of exposure to wastewater with an activated defecate, it is possible to see an increase in the pH level in the system until the saturation period. For instance, after 5 minutes of stirring, the pH of the medium was 3.5, after 15 minutes it increased to 6.5, and after 25 minutes, the pH of the medium was 7.9. The pH of the medium was slowly increased up to 15 min and after 20 min the pH increased to 8, after which the pH remained almost unchanged. This indicates that the process is complete.

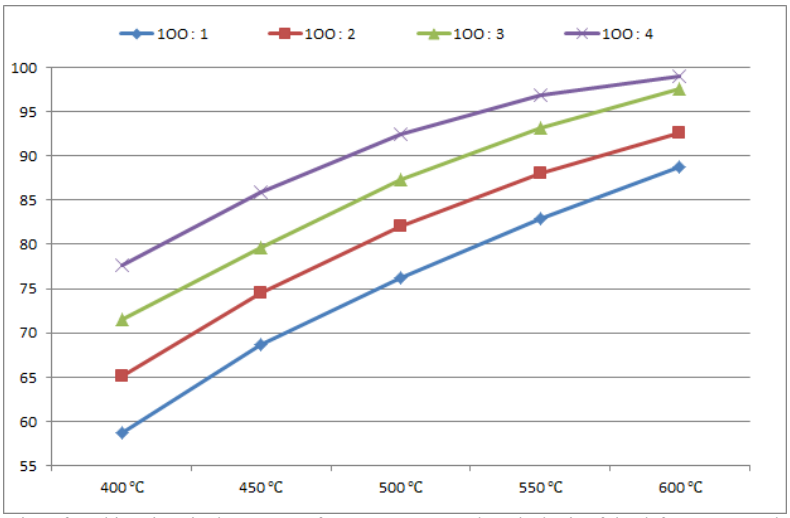

Fig. 1. The reduction of total iron ions in the content of waste water treated on the basis of the defecate versus the temperature of activation of the defecate and the weight ratio

Chemical analysis of purified water with a modified defecate at 600 °C in a ratio of 100 : 3 by weight shows $Fe3^{+}$ from 440mg/l to 10.74 mg/l, Fe^{2+} from 40mg/l to 0.98 mg/l, Ca^{2+} from 3000mg/l 450 mg/l, Mg^{2+} decreased from 8512mg/l to 754mg/l, total hardness from 850,000 mg-eq/l to 89.50 mg-eq/l, dry residue from 61650mg/l to 8420mg/l, Sl-889mg /l to 377mg/l, SO_4^{2-} decreased from 37076mg/l to 4938mg/l and pH increased from 0.8 to 7.3.

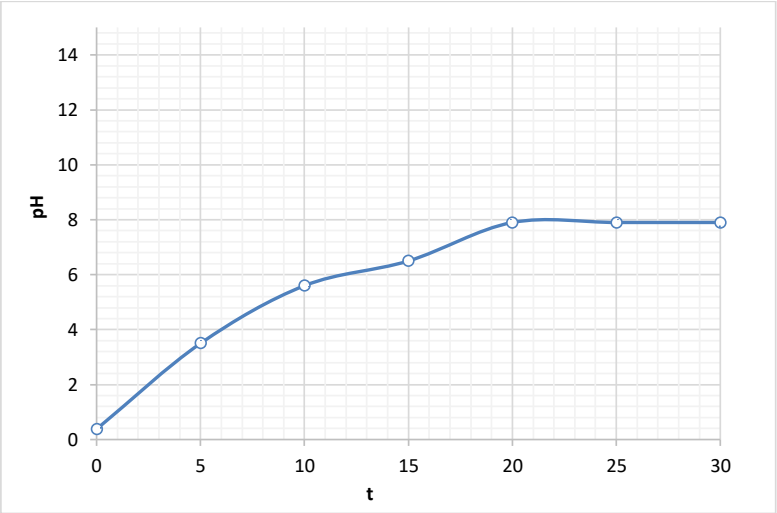

Fig. 2. Variation of environmental pH with time of a 100 : 3 weight ratio mixture of wastewater and defecate waste activated at 600 °C

Table 2. Analysis results of waste water and treated water in 100 : 3 weight ratio of defecate activated at 600°C

Cations	**Content in liter**		**Other indicators**	
	mg/l	mg- eq/l		
Na^+	355	15.46	Hardness mg-eq/l: total	89.50
K^+	120	3.08	Carbonate	3.00
NH_4^+	180	9.97	Non-carbonate	86.50
Ca^{2+}	450	27.50	pH	7.30
Mg^{2+}	754	62.00	$CO_{2\ free}$ mg/l	
Fe^{3+}	10.74	-	CO_2 mg/l	
Fe^{2+}	0.98	-	SiO_2mg/l	6
Total		118.01	**Dry residue: mg/l**	
Anions			Experimental	8420
			Calculated	8350
Cl^-	377	10,62	**Physical Properties**	
SO_4^{2-}	4938	102.87	Transparency	transparent
NO_2^-			Taste	very saltyй
NO_3^-	94	1.52	Color	colorless
CO_3^-	Нет	-	Smell	Odorless
HCO_2^-	183	3.00	Sediment	985 mg/l
Total		118.01	Na^+ found on a flame photometer	341 mg/l

4. Conclusions

Thus, in the treatment of industrial wastewater containing iron ions, the treatment with adsorbents obtained based on the activation of the sugar industry waste defecate is highly effective, and by treating industrial wastewater with the obtained adsorbents, it is possible to use it as technical water in industrial enterprises, which has a positive effect on the environment. was determined to show.

References

1. I.E. Avtukhovich, D.A. Postnikov, Biological method of cleaning the substrate, composed on the basis of OSV, *Actual problems of modern science* **1**, 132-135 (2012)
2. D.V. Anisimov, Removal of phosphorus from wastewater, *Ecology of production* **5**, 201284-87 (2012)
3. D.V Anisimov. Removal of phosphorus from wastewater, Ecology of *production* **6**, 50-54 (2012)
4. U.Sh. Temirov, P.Kh. Ganiev, Sh.S. Namazov, N.Kh. Usanbaev, Features of composting cattle manure and phosphorite sludge with the addition of phosphogypsum, *Universum: Chemistry and Biology* **50**(8), 25-32 (2018)
5. Yu.V. Bataeva, R.G. Gabitov, Halophilic microorganisms for the treatment of highly mineralized wastewater, *Ecology and Industry of Russia* **10**, 29-31 (2010)
6. V.V. Burenin, New methods and devices for cleaning and neutralization of waste waters of industrial enterprises, *Ecology and Industry of Russia* **9**, 12-15 (2009)
7. V.V. Burenin, New methods and devices for cleaning and neutralizing wastewater of chemical, petrochemical and oil processing enterprises, *Chemical and oil and gas engineering* **6**, 46-48 (2010)
8. V.V. Goncharuk, Complex wastewater treatment of solid waste dumps, *Chemistry and technology of water* **29**(1), 55-66 (2007)
9. V.V. Datsenko, E.B. Khobotova, Wastewater treatment in oil refining, *Ecology of production* **12**, 65-69 (2012)
10. U. Temirov, N. Doniyarov, B. Jurakulov, N. Usanbaev, I. Tagayev, A. Mamataliyev, Obtaining complex fertilizers based on low-grade phosphorites, *E3S Web of Conferences* **264**, 04009 (2021)
11. T.J. Pirimov, S.S. Namazov, N.K. Usanbaev, A.R.Seytnazarov, U.S. Temirov, Obtaining of magnesium oxide from serpentenites of the arvaten deposit of Uzbekistan, *International Journal of Advanced Science and Technology* **29**, 1619-1627 (2020)
12. I. Bozorov, M. Iskandarova, A. Mamataliyev, N. Usanbayev, U. Temirov, Nitrogen-sulfur-containing fertilizers based on melt ammonium nitrate and natural gypsum, *AIP Conference Proceedings* **2432**, 050062 (2022)
13. S. Shamuratov, U. Baltaev, U. Alimov, N. Shafoat, S. Kurambaev, B. Ibadullaev, Utilization process research of the soap industry acid waste water with high carbonate phosphorite of central Kyzylkum, *E3S Web of Conferences* **264**, 04079 (2021)
14. J.A. Sverguzova, Purification of model solutions and emulsions from milk fat, whey and asparagine with a modified defecation, *International Scientific Conference on Geosystems: Development Factors, Rational Use, Management Methods,* Sterkh, Tuapse (2008)

15. A.V., Sazonova, V.S. Maltseva, Prospects for the use of sugar beet waste as sorbents, *Water Supply* **49**, 16-18 (2012)
16. I.D. Eshmetov, R.M. Usmonov, D.S. Salikhanova, F.N. Agzamova, S.R. Shamuratov, Decontamination of acidic wastewater of My-my enterprises with modified defecation, *Composite Materiallar* **2**, 109-111 (2019)
17. D.A. Azimova, D.S. Salikhanova, I.D. Eshmetov, F.E .Umirov, The use of defecation in the processes of wastewater treatment of a metallurgical plant, *Uzbek Chemical Journal* **1**, 41-46 (2021)
18. A.G. Ashirov, Ion-exchange treatment of waste water, solutions and gases, Chemistry, Leningrad (1983)
19. R.M. Usmonov, S.R. Shamuratova, I.D. Eshmetov, D.S. Salikhanova, F.N. Agzamova, Treatment of acid waste of PFAs with compositions obtained from defecation, *LXIII "International Scientific Review of Problems and Prospects of Modern Science And Education,* Boston, USA (2019)