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REAGENT PROCESSING METHOD AS THE MOST EFFECTIVE PROCEDURE OF FUR INDUSTRY WASTEWATER PURIFICATION AND SEWAGE TREATMENT

Nosova E.G.[1],

[1] NOSOVA Elizaveta Grigorievna – postgraduate student of the Water Supply and Drainage Department,
Samara State University of Architecture and Civil Engineering, Samara, Russia
e-mail: eliza_v@mail.ru, kafvv@mail.ru

Teplykh S.Yu.[2]

[2] TEPLYKH Svetlana Yurievna - candidate of Technical Sciences, Associate Professor of the Water Supply and Drainage Department,
Samara State University of Architecture and Civil Engineering, Samara, Russia
tel. (846) 242-44-26, e-mail: lana2802@mail.ru, kafvv@mail.ru

The article presents the ecological status of water sources from sewage of dressing fur skins. Experiments on wastewater treatment reagent method. According to the results were plotted and counted the effects of cleaning.

Keywords— wastewater composition, cleaning, fur industry, chemical treatment, chrome.

According to the World Health Organization, 80 percent of health problems all over the world occur as a result of the poor quality of the water and its unsanitary conditions.

Annually thousands of chemicals pollute water and adversely affect environment. Some of these chemicals are new chemical entities and the others present elevated concentrations of toxic heavy-metal ions (e.g. ions of cadmium, quick silver, led or chrome), pesticides, nitrates, phosphates, petroleum-based products and surface active agents.

Industrial enterprises are nowadays among the main sources of water pollution.

In fur industries when rawhide and fur are being manufactured drainages are formed. Their quality is assessed for admixture of primary products, chemical wastes, dyestuff and trimmings, such as formaldehyde, sulfates, synthetic surface active agents (surfactants), amines, fats, suspended substances, chlorides, chrome and others.

Soaking, fleshing, pickling, tanning and dyeing are the industrial processes used in fur industries which generate wastewater.

The most harmful wastewater comes from the processes of soaking in stagnant water, liming, pickling, chrome plating, and from size-making and wool-washing manufactories. Concentrated solutions are also extremely poisonous.

We have collected wastewater samples from two local fur industries (Otrada Ltd. and Melita Ltd) and done comprehensive chemical analysis of these samples (Table 1).

TABLE 1. Average analysis of the fur industry samples

Criterion	Otrada Ltd.	Melita Ltd
BOD_{20}, mgO_2/l	1480,0	53,2-266
BOD_5, mgO_2/l	1112,8	40-200
COD, mg/l	2160,0	900-2000
Cr^-, mg/l	2000,0	400-2000
SO_4^{2-}, mg/l	763,5	100-400
Surfactants, mg/l	n/a	10-40
Fats, mg/l	n/a	50-400
Suspended substances, mg/l	n/a	300-1000
Chlorides, mg/l	n/a	1800-2500

Wastewater drainage containing toxic heavy-metal ions is the one most harmful both for the environment and people. In fur industries this harmful drainage contain chrome. Chromium is a chemical element characterized by great toxicity and carcinogenic properties which effect on human being is extremely harmful [1]. Contact with products containing chromium salts (chromates) can lead to allergic contact dermatitis and irritant dermatitis, resulting in ulceration of skin or a mucous membrane (sometimes referred to as “chrome ulcers”). Upper respiratory airway, lungs and eyes are mostly affected by chromates. This is one of the reasons why removing chromium form water is a very important part in wastewater and sewage treatment as well as deferrising, removing manganese, chlorine, hydrogen nitrides and nitrates and so on.

So, firstly, it is important to remove chromium form water because of its harmful influence on people’s health. Secondly, removing chromium gives a chance to wastewater further biological treatment. And besides, it helps to process secondary products.

Nowadays environmental protection is the problem of great importance which is being solved on individual, organizational and governmental levels.

For that reason fur industries are required to provide and use wastewater purification and sewage treatment facilities.

To purify wastewater from tri- and hexavalent chromium the following chemical and physicochemical procedures were previously used:

- coagulation;
- mutual neutralization;
- reagent processing;
- ion-exchange method.

Having studied possible methods of sewage treatment in fur industry, we have come to the conclusion that complex sewage treatments as well as the reagent-processing method are the most effective procedures from the point of view of environmental safety and protection [2].

To analyze the rate of chromium contamination of fur industry sewage sediment we have carried out experiments using a certain standardized test solution. The standardized test solution contained chromic anhydride with chromium concentration 1800 mg/l. It did not contain any non-dissolved remains. In the course of our experiment the standardized test solution became orange due to dichromic acid formation ($H_2Cr_2O_7$).

We used magnesium chloride hexahydrate ($MgCl_2 \cdot 6H_2O$) and barium chloride bihydrate ($BaCl_2 \cdot 2H_2O$) as coagulants.

Magnesium chloride is the name for the chemical compounds and its various hydrates. These salts are typical ionic halides, being highly soluble in water. Magnesium chloride, as the natural mineral bischofite, can be extracted via solution mining.

Barium chloride is the inorganic compound, one of the most common water-soluble salts of barium.

For alkalizing we used sodium bicarbonate ($NaHCO_3$) and calcium oxide (CaO).

The research was based on single-factor analysis. The data shown in the tables below is derived from dry substance (g/l).

The effect of purifying wastewater from hexavalent chromium can be quantified using the formula given:

$$E = \frac{(C_{in} - C_{fin})}{C_{in}} \cdot 100\%,$$

C_{in} – initial concentration of hexavalent chromium ions in wastewater, g/l;

C_{fin} – chromium concentration in purified wastewater, g/l.

Experiment 1. Magnesium chloride as a reagent is added to the solution, followed by some alkali.

The research was based on single-factor analysis, coagulant dosage varied 4-12 g/l (in water free raw product).

TABLE 2. The results of Experiment 1.

№	$MgCl_2 \cdot 6H_2O$ g/l	Cr mg/l	pH	purifying effect %
1	4	590	4	67,2
2	6	470		73,8
3	8	450		75
4	10	440		75,5
5	12	420		76,6

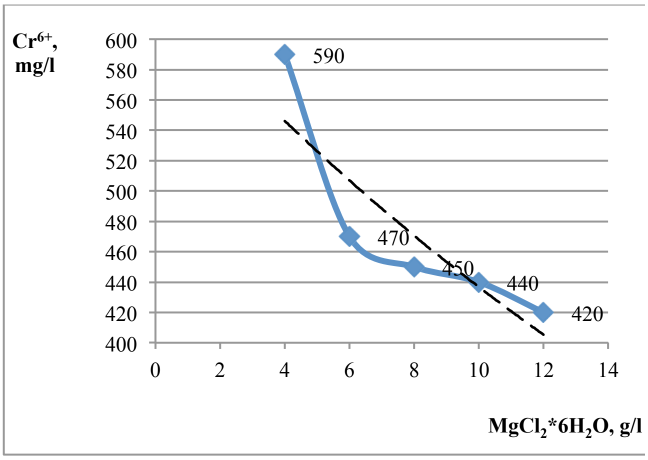

Figure 1. The results of Experiment 1.

Experiment 2. Magnesium chloride as a reagent is added to the solution, followed by some alkali.

The research was based on single-factor analysis, coagulant dosage varied 0,5-20 g/l (in water free raw product).

TABLE 3. The results of Experiment 2.

№	$MgCl_2 \cdot 6H_2O$ g/l	$NaHCO_3$ g/l	Cr mg/l	pH	purifying effect %
1	0,5	10	560	≈7	68,89
2	2	10	460		74,44
3	5	10	350		80,55
4	10	10	320		82,22
5	15	10	345		80,83
6	20	10	296		83,55

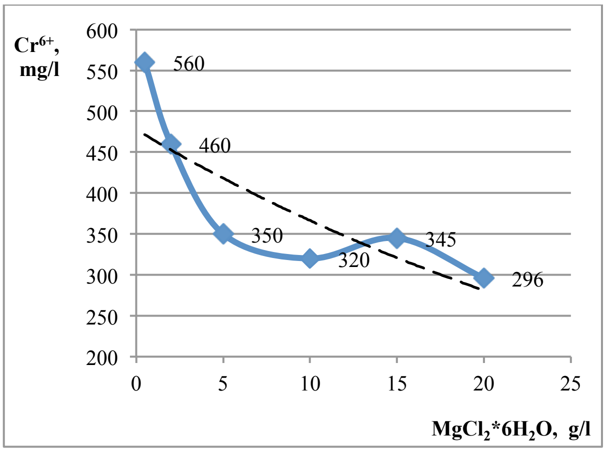

Figure 2. The results of Experiment 2.

Experiment 3. Magnesium chloride as a reagent is added to the solution, followed by some alkali.

The research was based on single-factor analysis, alkali dosage unvaried (5 g/l in water free raw product), coagulant dosage varied.

TABLE 4. The results of Experiment 3.

№	**$MgCl_2 \cdot 6H_2O$ g/l**	**$NaHCO_3$ g/l**	**Cr mg/l**	**pH**	**purifying effect %**
1	4	5	300	10	83,3
2	6	5	270	10	85,0
3	8	5	270	10	85,0
4	10	5	255	10	85,8
5	12	5	240	10	86,6

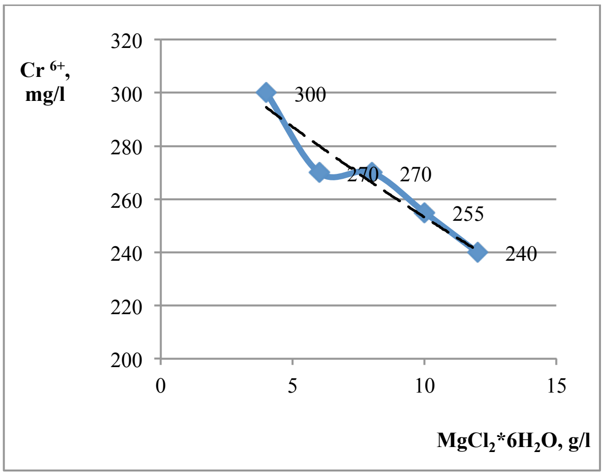

Figure 3. The results of Experiment 3.

Experiment 4. Barium chloride as a reagent is added to the solution, no alkalizing of the standardized test wastewater solution.

The research was based on single-factor analysis, coagulant dosage varied 0,5-20 g/l.

TABLE 5. The results of Experiment 4.

№	**$BaCl_2 \cdot 2H_2O$**	**Cr^{6+}**	**purifying effect %**
1	0,5	220	89
2	1	220	89
3	5	120	94
4	10	32	98,4
5	15	92	95,4

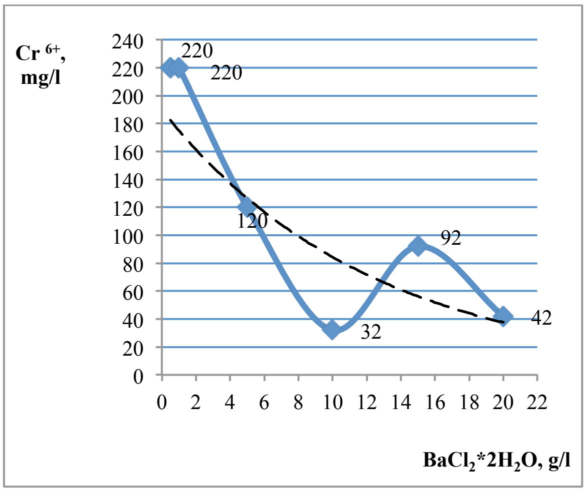

Figure 4. The dependence of chromium concentration on the quantity of coagulant added.

Experiment 5. Barium chloride as a reagent is added to the solution, accompanied with alkalizing of the standardized test wastewater solution with sodium bicarbonate (baking soda).

The research was based on single-factor analysis, sodium bicarbonate dosage 10g, coagulant dosage varied 6-10 g.

TABLE 6. The results of Experiment 5.

№	**$BaCl_2 \cdot 2H_2O$**	**$NaHCO_3$**	**Cr^{6+}**	**purifying effect %**
1	6	10	0,03	99,99
2	7	10	0,02	99,99
3	8	10	0	100
4	9	10	0	100
5	10	10	0	100

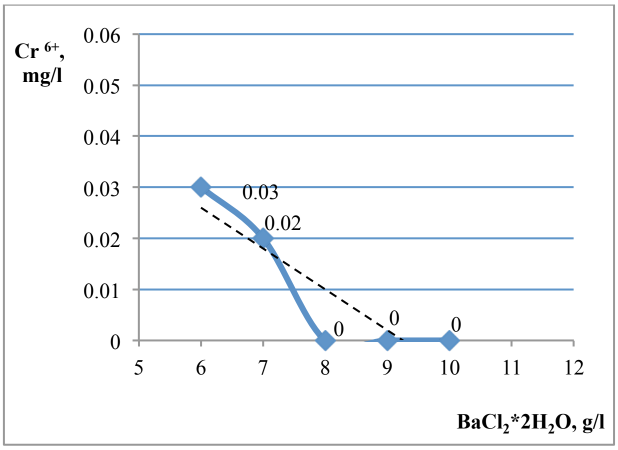

Figure 5. The dependence of chromium concentration on the quantity of coagulant added.

Experiment 6. Barium chloride as a reagent is added to the solution, accompanied with alkalizing of the standardized test wastewater solution with calcium oxide (quicklime).

The research was based on single-factor analysis, alkali dosage unvaried (5 g/l in water free raw product), coagulant dosage varied 1-8 g.

TABLE 7. The results of Experiment 6.

№	$BaCl_2 \cdot 2H_2O$	CaO	Cr^{6+}	purifying effect %
1	1	5	97,0	94,61
2	2	5	67,0	96,27
3	3	5	68,0	96,14
4	4	5	29,0	98,38
5	5	5	11,6	99,35
6	6	5	0,53	99,97
7	7	5	0,04	99,99
8	8	5	0	100

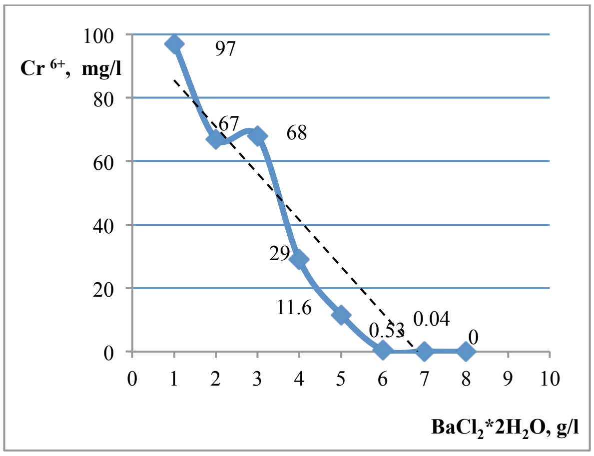

Figure 6. The dependence of chromium concentration on the quantity of coagulant added.

The above figures of the dependence of chromium concentration on the quantity of coagulant added and the purifying effect are based on the results of the experiments described.

The desired purifying effect was achieved in Experiments 1-3 while adding magnesium chloride hexahydrate ($MgCl_2 \cdot 6H_2O$) to the solution, its concentration up to 20 g. The maximum purifying effect reaches up to 86,6%, achieved while alkalizing of the standardized test wastewater solution with calcium oxide (quicklime).

The desired purifying effect was achieved in Experiments 4-6 while adding barium chloride bihydrate ($BaCl_2 \cdot 2H_2O$) to the solution, its concentration up to 20 g. The maximum purifying effect reaches up to 100%, achieved with varied alkali added to the standardized test wastewater solution.

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