Removel Of Chromium (Vi) From Leather Industry Waste Water By Adsorbtion Methot

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1. INTRODUCTION

Environmental pollution is an event that causes deleterious changes in the physical, chemical or biological properties of air, water, soil or nutrients, which in turn negatively affects humans' or other living organisms' health, living or activities (1).

Development of industry and rapid population growth brought along pollution and consequently pollution of water sources. Today, the heavy metals present in drinking and utility waters are amount the most serious pollutions and pose a great threat for public health. Water used in industry is one of the sources of water pollution. As mentioned earlier, heavy metals have a respectively more important place in water pollution. Heavy metal pollution is caused by the liquid wastes of many industries such as metal coating, mining, tanning, chlorine-alkali, radiator production, melting, battery production and alloy industries. The facts that water is indispensable for life, and that it is used constantly in all areas of life set forth the importance of preserving water sources and the necessary level of water quality for drinking and using. All kinds of substances that may be in water is harmful to health over a certain concentration. Due to this reason, the pollutants in water have to be removed.

Examining the studies in the literature concerning the removal of Cr(VI) ions from waste waters shows that the Cr(VI) ion defoliates plants and trees and reduces yield particularly when the waters of the streams it is discharged to is used for agricultural irrigation, reduces meat and milk yield when used in breeding, and causes allergic reaction upon contacting humans. It is also seen from the literature that, in addition to the chemical methods, also factory wastes (sunflower meal, bagasse, glaze waste, gypsum waste, marble powder, fly ash, etc.) that are more economical and natural resources (marl, cinder, red loam, etc) are used for removing Cr(VI) ion, which is classified as a heavy metal, from water and successful results are obtained from these methods. Our purpose in this study is to plan the removal of the heavy metals, 90% of which are used in the leather industry and oxidized to Cr(VI) ion causing pollution in the Menderes river, Nif stream and particularly Gediz river in our region, by means of the absorbents that can be obtained economically and in a convenient way by utilizing the wastes generated in the factories of the same region and natural resources.

It is intended to determine the optimum conditions for absorbing chromium from leather waste water with the use of gypsum waste, which can be obtained in a highly economical way and the way of utilization is being sought as the abundant waste of the Serel ceramic factory.

Serel Ceramics gypsum waste	% Amounts

Total Alkali	0.00
Na_2O	0.00
Fe_2O_3	0.03
MgO	0.19
Al_2O_3	0.30
SiO_2	0.38
CaO	32.51
SO_3	45.85
Lime saturation factor	118.84

The works intended to determine the Cr(VI) absorption percentage and absorption parameters of gypsum waste will continue to be carried out in the next season

2. EXPERIMENTAL PART

In consequence of the measurements made on the sample taken in the waste water purification facility established in order to purify the waste water of Manisa Horozkoy Leather Enterprises, ph = 9 and Cr^{+6}=14,82 ppm values were obtained. Heavy metal determinations were measured with an AAS equipment and gypsum structure was determined by means of a x-ray spectrometer.

Table 1.Results of the structural analysis of Serel factory gypsum wastes, conducted with x-ray spectrometer.

Component	SiO_2	CaO	Fe_2O_3	Al_2O_3	MgO	SO_3	Loss on Ignition
%	0,38	32,51	0,03	0,30	0,19	45,85	21,11

The $K_2Cr_2O_7$ solution formed for determining the optimum conditions was prepared as 20 ppm. No centrifugation was applied after the treatment with gypsum and sample was taken after a waiting time of 5 to 10 minutes

Table 2. Absorbed Chromium amount concentration (ppm) according to the gypsum amount added to the solution prepared at 100 ml, 200ppm, pH = 9, T = 15C0, t =1 hour, Mixing speed = 500 rpm

Gypsum amount added (g)	3 g	5 g	10 g	15 g	20 g	25 g
Absorbed Chromium Amount (ppm)	14,864	15,272	15,66	16,252	16,232	16,253

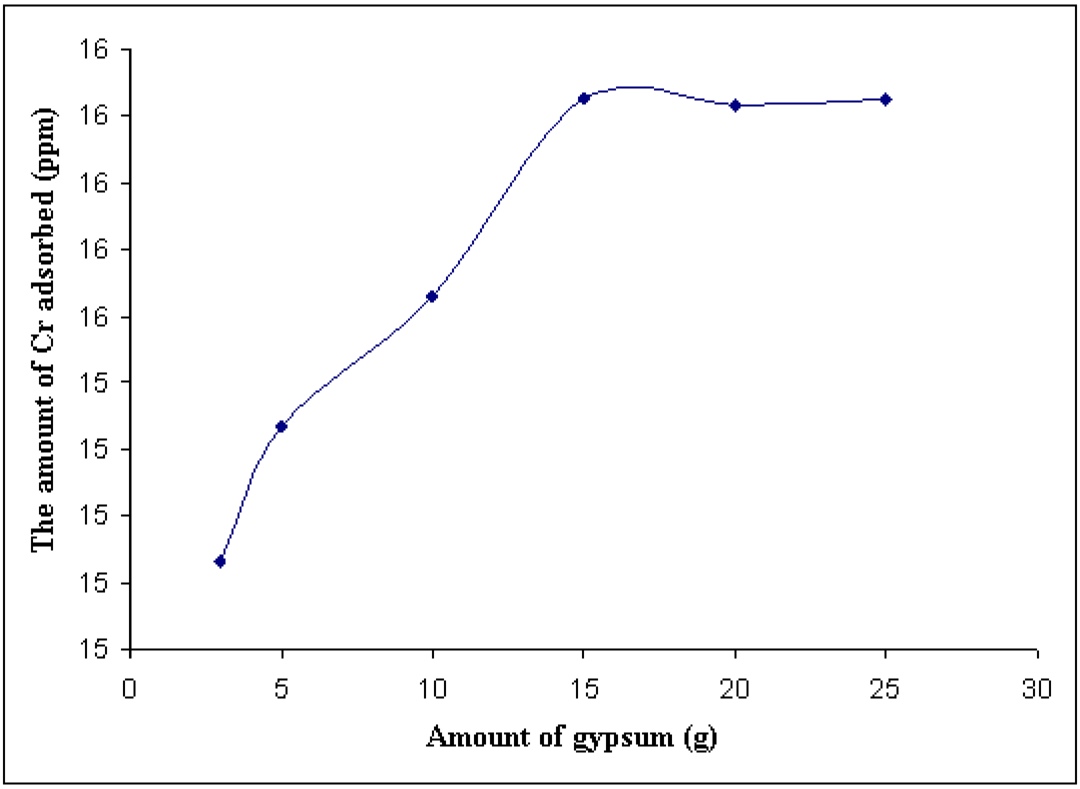

Figure 1. Absorbed chromium amount concentration (ppm) according to the gypsum amount added

Table 3. Absorbed Chromium amount concentration (ppm) according to the granule size of gypsum added to the K2Cr2O7 solution prepared at 100 ml, 200ppm, pH = 9, T = 15C0 t =1 hour Mixing speed = 500 rpm Gypsum amount = 15 g

Granule Size of Gypsum (mesh)	1	2	3	4	5
Absorbed Chromium Amount	16,120	16,422	16,534	16,765	16,925

(ppm)					

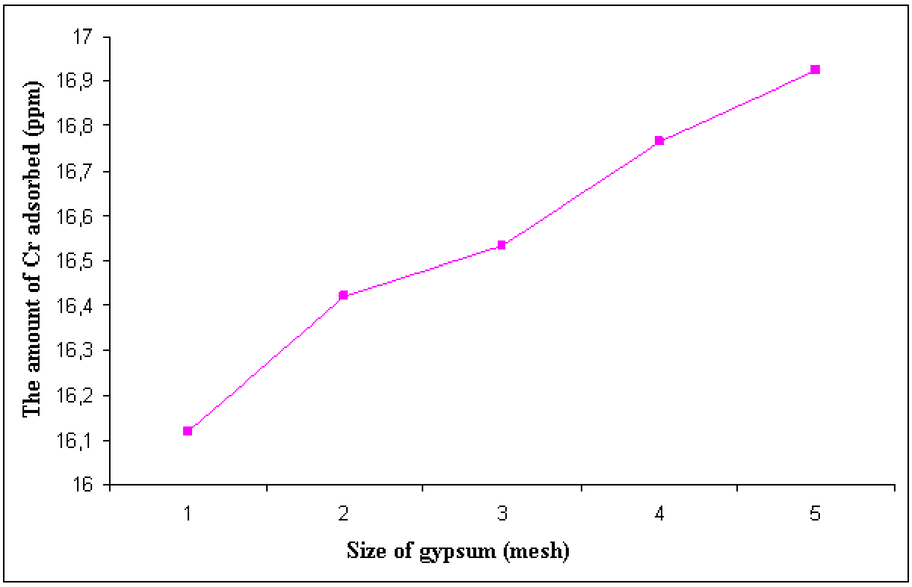

Figure 2. Absorbed chromium amount concentration (ppm) according to the gypsum amount added

Since 500 mesh size gypsum was dissolved in 1 hour with 500 rpm mixing speed and left layer of sludge at the bottom, greater granule size gypsums were given priority in the tests.

Table 4. Absorbed amount of chromium according to the mixing speed applied to the 100 ml 200 ppm K2Cr2O7 solution prepared at ph = 9   T = 15 C0, t = 1 hour , gypsum amount = 15 g, gypsum size = 5 mesh

Mixing Speed (rpm)	100	200	300	400	500	700
Absorbed Chromium Amount (ppm)	12,120	12,850	14,450	16,700	16,910	14,550

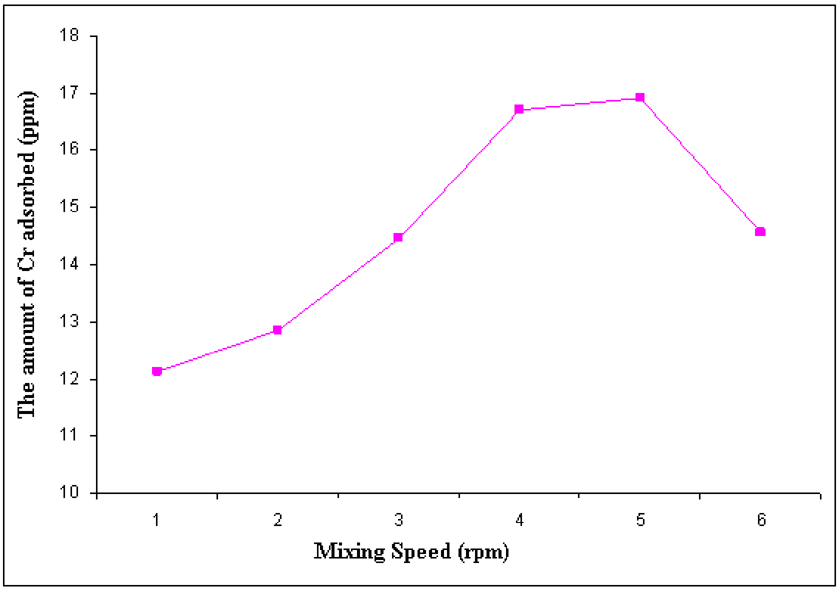

Figure 3. Absorbed chromium amount according to mixing speed.

Table 5. Absorbed amount of chromium according to the mixing duration applied to the 100 ml 200 ppm K2Cr2O7 solution prepared at ph = 9 T = 15 C0, t = 1 hour , gypsum amount = 15 g, gypsum size = 5 mesh Mixing speed = 500 rpm

Duration Hours	1	2	3	4	5	6
Absorbed Chromium Amount (ppm)	16,825	17,155	17,875	18,110	19,220	19,180

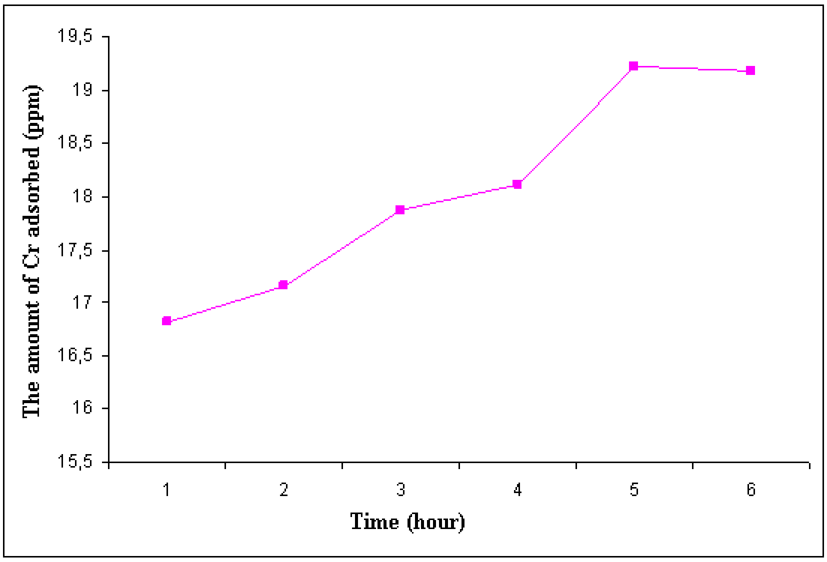

Figure 4. Absorbed chromium amount according to mixing duration.

Table 6. Absorbed chromium amount according to different temperatures of 100 ml, 200 ppm K2Cr2O7 solution prepared at ph = 9 , gypsum amount = 15 g, gypsum granule size = 5 mesh, mixing speed = 500 rpm, t = 6 hours

Solution Temperature (Co)	15	20	25	30	35	40
Absorbed Chromium Amount (ppm)	19,080	19,180	19,300	19,280	19,220	19,240

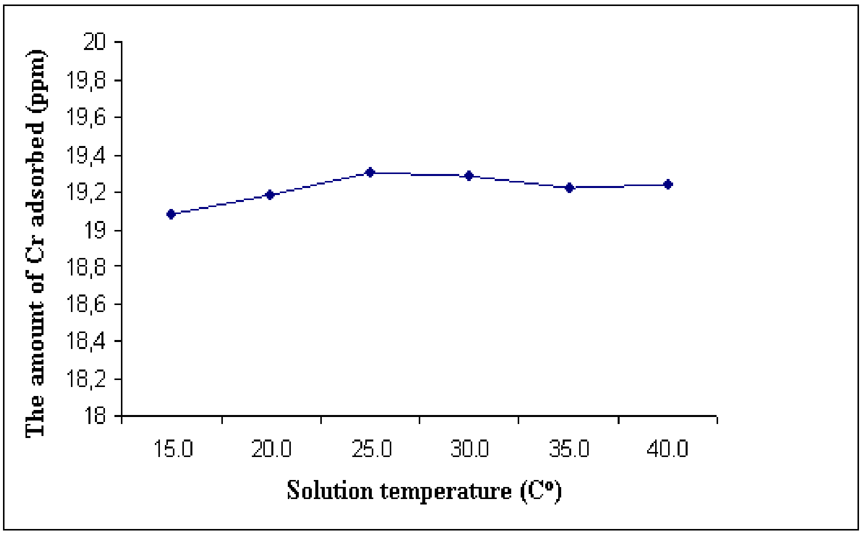

Figure 5. Absorbed chromium amount according to the varying temperatures of the solution.

Due to the observation that the temperature does not have a significant effect on absorption, it was decided to use the temperature 15 Co in economical terms.

Table 7. Absorbed chromium amount at varying pH values of the 100 ml, 200 ppm K2Cr2O7 solution prepared with gypsum amount = 15 g, gypsum size = 5 mesh, mixing speed = 500 rpm, t= 6 hours T = 15 Co

Ph	9	8	7	6	5
Absorbed Chromium Amount (ppm)	19,200	18,875	18,920	18,850	18,540

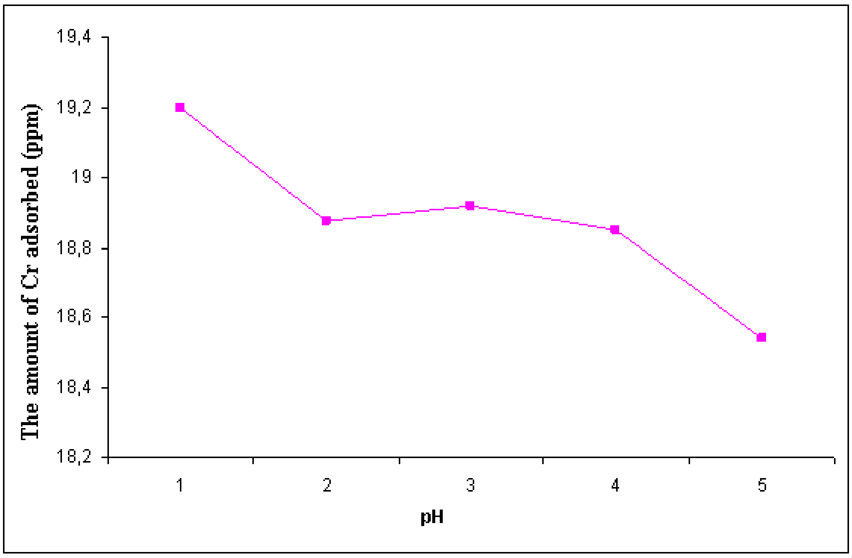

Figure 6. Chromium amount absorbed at varying levels of pH applied to the K2Cr2O7 solution.

The optimum absorption conditions obtained with the implementation of 6 different parameters to the 200 ppm, 100 ml K2Cr2O7 solution were determined as follows.

Granule size	Gypsum amount	pH	Mixing speed	t(time)	T CO
5 Mesh	150 g/L	9	500 rpm	6 hours	15 CO

When all these parameters are implemented on the 200 ppm, 100 ml K2Cr2O7 solution, the total absorbed amount of chromium was 18,252 ppm and exhibited that 91,26% of chromium can be absorbed. When the same parameters were implemented on the leather waste water sample taken before purification with pH = 9 and 14,82 ppm chromium content the absorbed amount of chromium was measured to be 13,894 ppm and the remaining chromium content in the solution was 0,926. With this, it was determined that 93,75% of chromium was absorbed.

Table 8. Absorbed amount of chromium in the standard solution and leather waste water under the optimum conditions are given in the table below.

pH = 9 Mixing Speed = 500 rpm Granule Size = 5 Mesh t = 6 hours T = 15 CO Gypsum amount = 150 g/L	Absorbed amounts in the 200 ppm, 100ml K2Cr2O7 solution	Absorbed amounts in the 14,82 ppm, leather waste water

	18,252 ppm 91,26%	13, 894 ppm 93,75%

3. DISCUSSION

For the purpose of achieving 90% tanning in leather industry CrCl3 component is used and oxidized to Cr(VI) with the various salts, oils and chemicals in the medium. While Cr(VI) is toxic for livings, a trace amount of Cr(III) is necessary for the main structure of glucose, fat and protein metabolism. Cr(VI) causes liver destruction in livings and defoliates plants and trees (4). Cr(VI) limits set forth by the water control regulation is zero for drinking waters, 20 ppb in utility waters and 50 ppb in irrigation waters (5).

The Cr(VI) amount was measured as 14,82 ppm and pH=9 in the waste water of Manisa Horozkoy leather industry. Examining the use of various natural absorbents on Cr(VI) shows that bone dust absorbs 66,6% (2), nutshell absorbs 80% (1), CACMM2 absorbs 83% (11), marl soil absorbs 86,3% (6) and activated clinoptilolite absorbs 0,624 mg/g (7) of Cr(VI). In our study it was aimed to absorb the Cr(VI) content in the waste waters of Horozkoy leather factory in our region, which pollutes Gediz river and is highly toxic for livings and plants, by means of the gypsum wastes of Serel ceramic factory that is not utilized in any way and that constitutes a stock problem.

After determining and applying the optimum conditions in terms of pH, temperature, gypsum amount, mixing speed, mixing duration and gypsum granule size parameters to leather water at solution temperature and pH, the 14,82 ppm of Cr(VI) was reduced to 0,926 ppm and an absorption of 93,75% was achieved. It was aimed to absorb a waste with another kind of waste and it was determined that gypsum substantially enabled this. It was observed that Cr(VI) can be absorbed by only breaking gypsum into nut size and after a mixing of 6 hours.

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Water Resources Conservation for Sustainable Agricultural Development

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1.INTRODUCTION

1.1.Water resources consumption

Increase of population and insufficient water resources has led to environmental pollution has reached substantial levels with use of synthetic and chemical inputs as a result of the increase in production. Decreasing available water resources brings on a serious water shortage problem. Allliving things are negative affected by theenvironmentalpollution. The loss of speciesin nature, instead of use of biological control use chemical control, thehormonesto increasefood production have a verynegativeforecology. The main reason for environmental pollution and degradation of the natural balance in ecosystem, consumption increased rapidly due to increasing population and increased use of fossil proliferation of products.

1.2.Water resources conservation

One of themostimportantaim of sustainableagricultureandruraldevelopment is toprotectandconservethecapacity of thenaturalresourcebasetocontinuetoprovideproduction, environmentalandculturalservices.