**Effect of the Hydrodynamic Conditions on the Precipitation Process of Particles Generated from Electrochemical Cr(VI) Removal Process.**

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**Highlights**

* Precipitation process of particles generated from electrochemical Cr(VI) removal process is studied.
* The effect of the average velocity gradient on the sedimentation velocity was evaluated.
* The produced sludge form the Cr(VI) reduction was characterized.
* The sludge from the electrochemical process has chromite, which have potential reuse.

**1. Introduction**

Wastewaters from the chromate conversion coating have high concentrations of Cr(VI), which is a high toxic substance. Electrochemical process has been applied to remove the Cr(VI) from the industrial wastewaters [1]. During the process Fe(II) ions are released from a sacrifice iron electrode. These ions reduce the Cr(VI) to Cr(III) and the Fe(II) is oxidized to Fe(III) form. Both, Cr(III) and Fe(III) are precipitated at basic pH. There are no studies to evaluate the effect of the hydrodynamic conditions on the precipitation process of particles generated from electrochemical Cr(VI) removal process, which is important to reduce the sludge volumetric index (SVI) and optimize the coagulation and flocculation conditions, such as the reagents use, the agitation velocity and the precipitation pH. During flocculation the hydrodynamic behavior have important effects on the flocs characteristics. The velocity gradient is an important parameter that affects the flocs characteristics, because its size depends on the balance between the flocs agglomeration due to de mixing and the breaking of them because the energy kinetic dissipated [2]. Both effects depend on the agitation power supplied. To characterize the performance of agitated tanks used in fluctuation process, the average velocity gradient in the vessel (*Gave*), is used (equitation 1).

$G\_{ave}=\left(\frac{ε\_{ave}}{ν}\right)^{^{1}/\_{2}}=\left(\frac{N\_{p}N^{3}D^{5}}{Vν}\right)^{^{1}/\_{2}}$ (1)

where: *εave* = average energy dissipation rate, *ν* = kinematic viscosity, *NP* = power number, *ρ* = density of liquid, *N* = rotational speed of impeller, *D* = impeller diameter.

In this work, the effect of the *Gave* on the precipitation process of particles generated from electrochemical Cr(VI) removal process is studied. In addition, the sludge obtained was characterized.

**2. Methods**

The experimental tests were performed in a jar test apparatus with square transparent vessel of 2 L of capacity, with paddles of 7.6 cm of diameter. The sample was taken from a laboratory electrochemical reactor used to remove the Cr(VI) from wastewater. The wastewater was prepared with K2Cr2O7. The pH was increased with NaOH 8M. During the tests, a rapid mixing at 200 or 100 rpm during 60s was applied, followed of a slow mixing at 50 or 25 rpm during a flocculation time (*tf*). The *tf* tested were 5,10, 20 and 30 minutes. After this, the sedimentation velocity (*Vs*) was evaluated. The sludge obtained was characterized by Raman spectroscopy.

**3. Results and discussion**

Figure 1a, shows the results obtained of the *Vs* variation as a function of the accumulated *Gave* (*Gave*·*tf*). As can be seen, as *Gave*·*tf* (is reduced until about 200 the *Vs* drops, but it increases linearly until values of accumulated *Gave* of 75, reaching a *Vs*= 0,42ms-1, where after this value the *Vs* is almost the same (0.45ms-1) at lower *Gave*·*tf*, which means that the agglomeration and breaking flocs forces are in equilibrium [2]. On the other hand, figure 1b, shows the results of the characterization of the produced sludge form the Cr(VI) reduction electrochemical process.



**Figure 1.** a) *Vs* variation as a function of the accumulated *Gave* (*Gave·tf*), b) characterization of the produced sludge.

As it is shown, the sludge has chromite, which have potential reuse.

**4. Conclusions**

Based on the results, the *Gave* to operate satisfactorily the flocculation process were obtained. The sludge produced during the electrochemical process has chromate which can be reused.

**References**

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