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STUDY OF CLEANING PROCESS WITH CADMIUM IONS FROM RESIDUAL WATERS - Part two

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These studies propose an original method of cleaning waters with cadmium ions in form of cadmium oxalate, in optimal condition of extraction and establesches the suitable technological flux [1,2].

The cadmium residual solution, having on medium content of 5 – 6 g Cd/l was treat with on oxalic acid solution 0,5 M, under continuos stirring, on well determined pH, ratio cadmium/oxalicacid, temperature, as well as different concentrations of cadmium ions, which are suitable for extraction in these way.

The obtained precipitate, was washed, dried and analysed after followed the chemical and term analysis using an derivatograph type Paulik 2. Paulik&Erdely. In part two of these work, was established the optimal temperature, was made the thermic analysis of cadmium oxalate and, also, technological flux.

a) Temperature influence

Experimental data concerning temperature influence on Cd extraction degree at different concentrations and 70°C temperature are given in Table 1 and Figure 1.

Tab. 1

Extraction degree dependence on cadmium concentration in solution at 70°C temperature, pH=5,5, reaction time of 10 minutes, reactive excess 100%

Nr. crt.	C[M]	a ,%(70°C)	a ,%(20°C)
1.	0,001	88,62	87,25
2.	0,01	93,80	92,40
3.	0,016	96,56	95,33
4.	0,025	97,27	96,07
5.	0,033	98,45	97,25
6.	0,05	99,20	98,86
7.	0,1	99,20	98,86

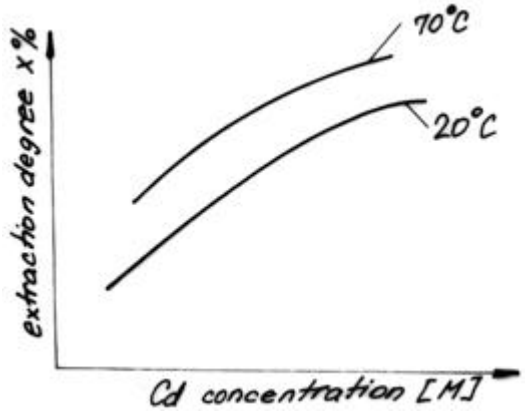

Fig. 1. Extraction degree dependence on cadmium concentration

From these data results that the two schedules have a closely configuration.

For the same concentration, extraction degree is bigger when temperature is higher.

The growth is relatively small, approximate 1%, therefore from economic point of view doesn't justify process development at 70°C temperature.

Consequently it may be considered 20°C, the optimal temperature of the process.

b) Thermogravimetric and thermodifferential studies[4].

The white and crystalline precipitate of cadmium oxalate was thermogravimetric and thermodifferential analysed on a Paulik&Paulik & Erdely derivatograph (MOM Hungary).

Technical parameters used were:

TG – 100 mg content

TG – sensibility, 100g

DTG – 1/5

DTA – 1/3

T – 5°/min, 500°C

Platinum cylindrical crucible, static air, condition for DTA, reference sample Al_2O_3.

Cadmium oxalate derivatograme is presented in Figura 2.

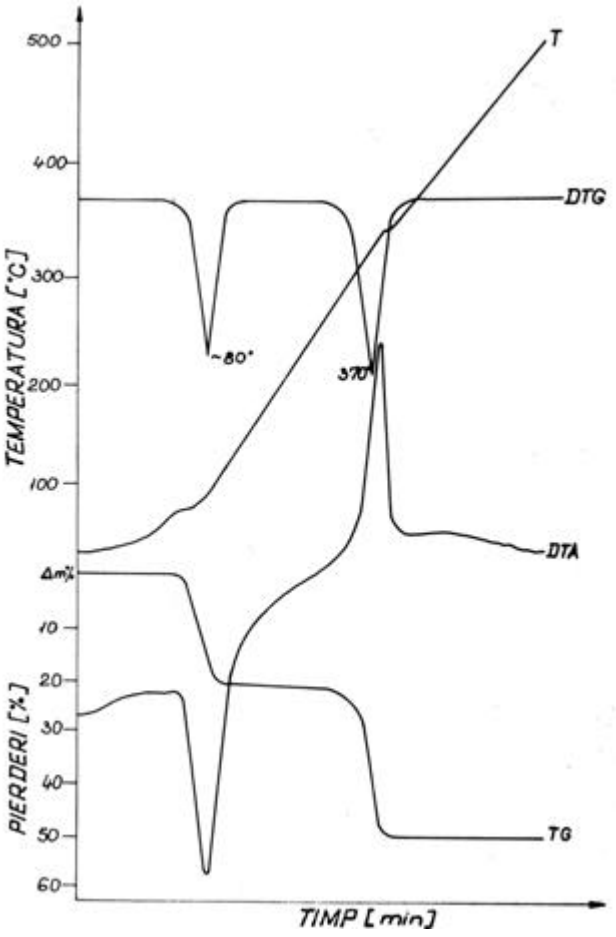

Fig. 2. TG, DTG and DTA curves of cadmium oxalate.

The product lose crystallisation water ?mH_2O=20% (theoretically 21%) in the 100°C – 140°C internal and in 310 – 360°C interval of temperature the product decompose in cadmium oxide following reaction equation.

$$CdC_2O_4 \rightarrow CdO + CO + CO_2$$

From analysed product mass the cadmium oxide obtained is in 50% percentage by weight.

These data shows that cadmium oxalate obtained in cleaning process like sub-product may be used to obtain cadmium oxide for different utilisation.

3. Cadmium ion recovery technological process from waste residual solutions[5].

Based on experimental data a product recovery flow sheet diagram is proposed, according to Fig. 3.

In this process oxalic acid excess, also remnant cadmium too, is removed in shape of calciumoxalate and cadmium hydroxide by 10% lime cream precipitation.

Cleared water can be overflow in effluent. An ecological technologic process with cadmium recovery in 99,2% is assured.

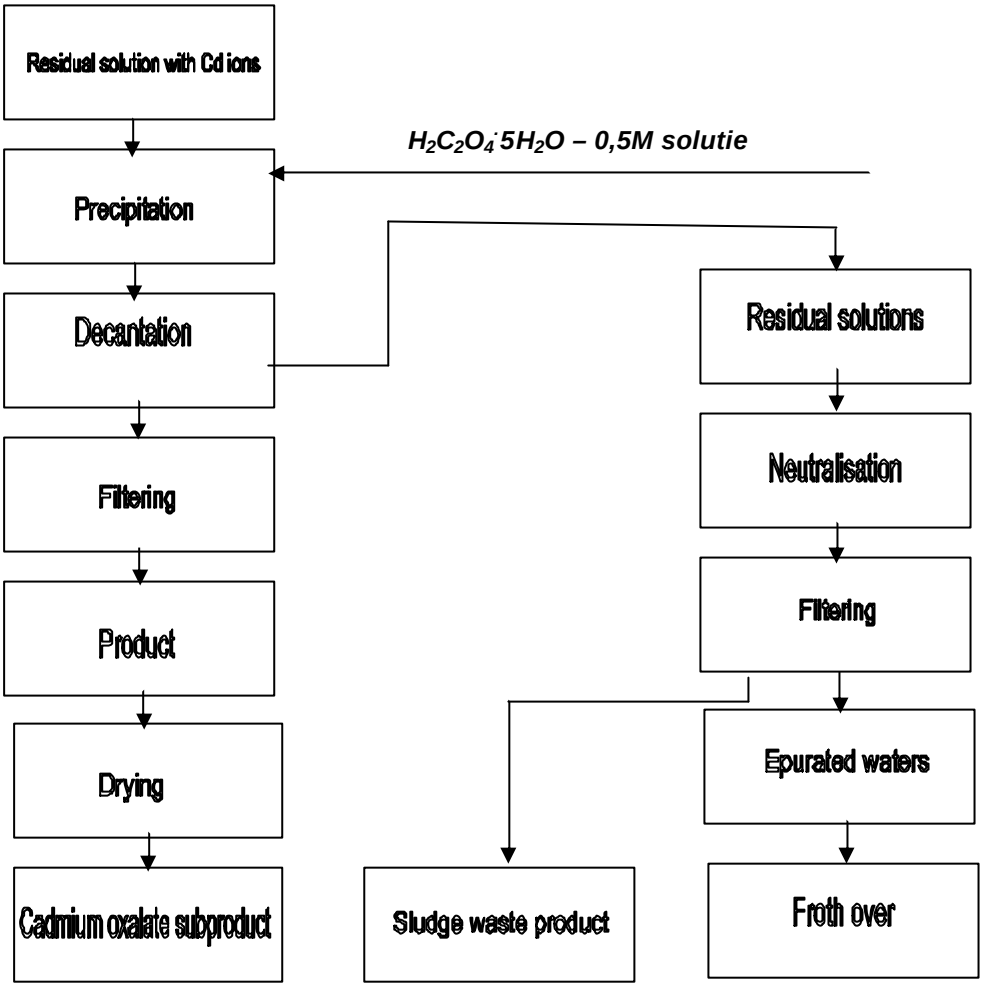

Fig. 3. Cadmium recovery flow sheet from waste solutions in shape of cadmium oxalate

4. Conclusions

The cleaning waste solutions with Cd ions process, goes with 99% efficiency in the following optimal conditions:

pH=4, precipitating reagent close 100% in excess concentration range 0,001÷0,1M, 20^{o}C temperature, 10 min reaction time, mechanic stirring conditions 300rot/min.

Extraction degree % is the same from 0,05M Cd^{2+} concentration to 0,1MCd^{2+} concentration.

Thermogravimetric study relives the fact that Cd oxalate trihydrate is the obtained product which correspond with the analyse of chemical composition.

Based on experimental data it can be done Cd oxalate recovery technological flow sheet.

5. References

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