Characterisation of the Zinc Carbonate Obtained from Zinc Chloride Residual Solution

L. Lupa, P. Negrea, A. Iovi, A. Negrea, M. Ciopec, G. Mosoarca

Faculty of Industrial Chemistry and Environmental Engineering, Victoria square, no. 2, Timisoara, 300006, ROMANIA (lavinia.lupa@chim.upt.ro)

INTRODUCTION

An increasing world population makes finding new and efficient methods to satisfy the need of food, qualitatively and quantitatively, a priority. One of the methods with a higher efficiency is using fertilisers with microelements. These fertilisers provide the required nutrients that can not be found or are insufficient in the soil to plants.

Plants assimilate Zn in the Zn^{2+} form. Zinc promotes the synthesis of vitamins from the B, C and P group, the content of sugar, starch, assimilable nitrogen and organic acids, and Zn participates in the ATP acid formation. This indicates that Zn has multiple physiological functions in plants. In this paper, we studied obtaining zinc carbonate from residual $ZnCl_2$ solutions that contained less than 20 g L^{-1} $ZnCl_2$.

METHODS

A well-determined volume of residual solution that contained 10 g L^{-1} $ZnCl_2$ was neutralised with 31 g L^{-1} Na_2CO_3 under continuous stirring at a well-defined value of mass reaction pH and constant temperature. The precipitated product was separated by filtration and dried at 50˚C. The residual concentration of Zn in the filtrate was measured by Atomic Absorption Spectrophotometry (AAS) with a Varian SpectrAA 110. The solid product was subjected to a complex study (chemical analysis, diffraction X-ray pattern, IR spectrum and thermo-gravimetric and differential-thermal analysis).

RESULTS AND DISCUSSION

The experimental data revealed that the Zn separation degree depended on the mass reaction pH. The Zn separation degree increased with increasing pH until pH 6.5. It increased slowly in the pH range 6.5 - 8 and became constant above pH 8. The optimum pH for a maximum Zn separation degree was above pH 8.

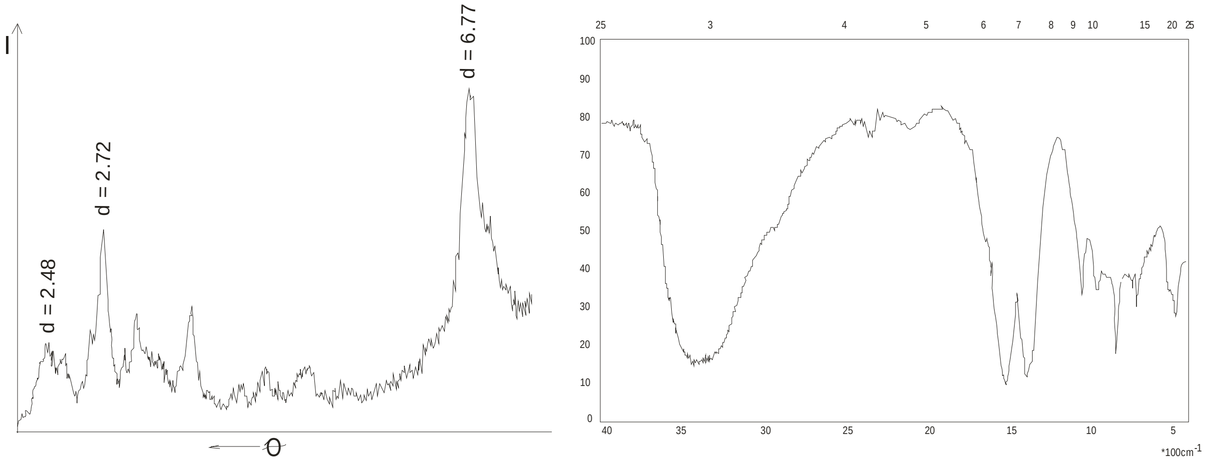
The separation degree of Zn depended on the molar $Na_2CO_3 : Zn^{2+}$ ratio and reached a maximum at molar ratios that were higher than 1.2 : 1 (α~99.9%).

The experimental data regarding the chemical composition of products obtained at different temperatures are presented in table 1.

Table 1. The chemical composition of products obtained at different temperatures and pH 8.

No.	Temperature, ˚C	Content, %		Molar ratio
		Zn	CO_2	$Zn:CO_2$
1.	25	59.34	15.61	2.55
2.	35	59.97	15.15	2.66
3.	45	59.73	15.61	2.57
4.	55	59.19	15.61	2.55
5.	65	59.22	15.25	2.61

The main component of the product obtained from the treatment of residual $ZnCl_2$ solution with Na_2CO_3 is $2ZnCO_3 \cdot 3Zn(OH)_2$. This was confirmed by diffraction X-ray pattern, IR spectrum and thermo-gravimetric and differential-thermal analysis (Fig. 1 and 2).



(a) (b)

Fig.1. (a) Diffraction X-ray pattern and (b) IR spectrum for the obtained product.

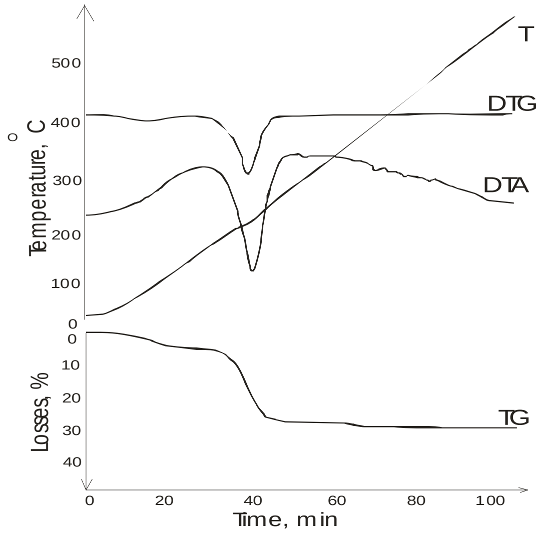


Fig. 2. The TG, ATD and DTG curves for the obtained product.

CONCLUSIONS

The researches allowed optimum conditions to obtain basic zinc carbonate in the process. The chemical and the phase composition, thermo gravimetric and differential thermal analysis show that the obtained product is basic zinc carbonate in the $2ZnCO_3 \cdot 3\ Zn(OH)_2$ form. These data are in accordance with literature data.

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