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PRECIPITATION OF THE UNSTABLE HYDRATED FORM OF CALCIUM OXALATE

Hamzić A.[1], Dorić J.[1], Živković K.[1], Banožić M.[2], Stanković A.[1*]

[1]Department od Chemistry, Cara Hadrijana 8/A, University of Osijek, 31000 Osijek, Croatia
[2]Faculty of Agriculture and Food Technology, University of Mostar, Biskupa Čule bb, 88000 Mostar, Bosnia and Herzegovina

INTRODUCTION

Pathological biomineralization is the process of the formation of undesirable biominerals, e.g. kidney stones. Their formation causes a chronic disease - urolithiasis. Kidney stones occur more and more frequently nowadays due to a fast-paced life and an unbalanced diet. The composition of kidney stones is calcium oxalate in 80% of cases. Calcium oxalate occurs in 3 different forms: the stable form calcium oxalate monohydrate (COM) and the unstable forms calcium oxalate dihydrate (COD) and calcium oxalate trihydrate (COT). In the composition of kidney stones, COM and COD are most frequently present, while COT is rare.
This work aims to synthesize COT and to study the morphology of the obtained crystals at three temperatures (25, 36.5 and 48 ℃) and three ionic strengths (0.1, 0.05 and 0.1 mol dm^{-3}).

SYNTHESIS

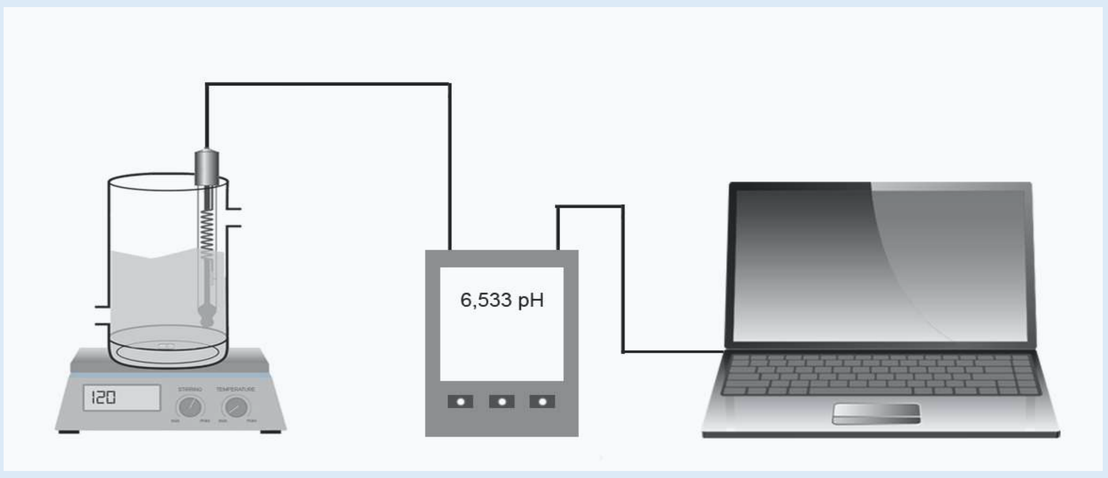
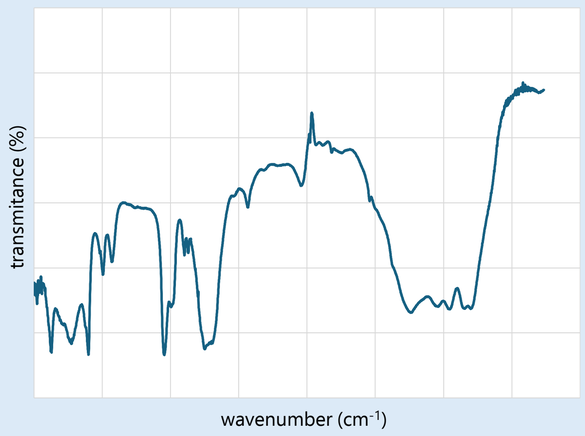
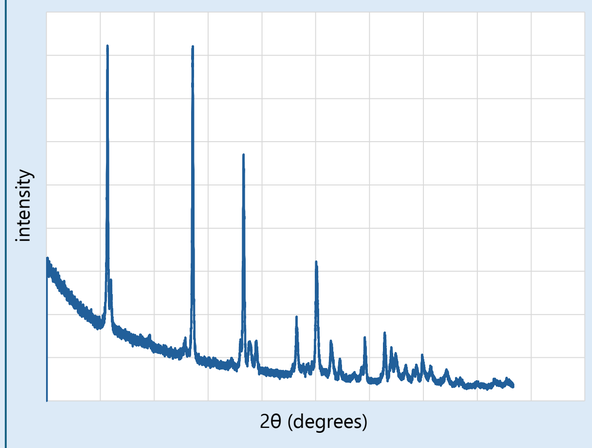
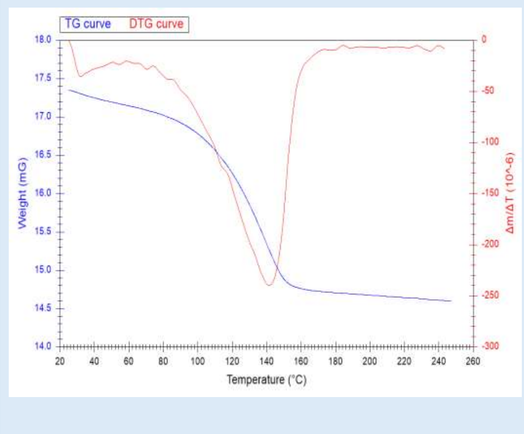
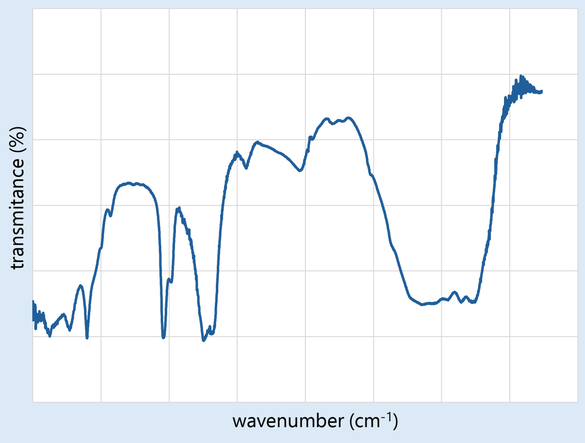
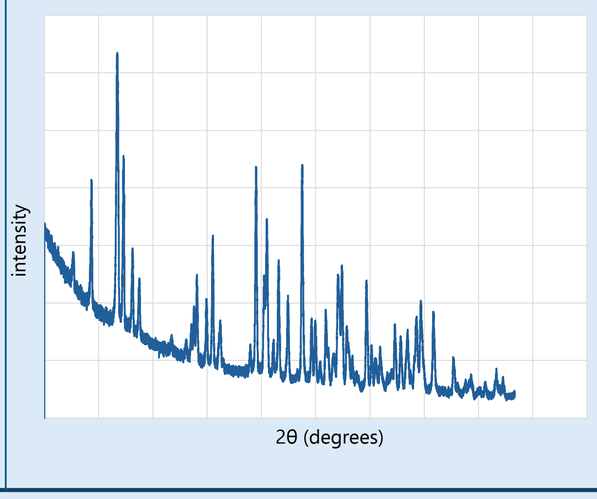
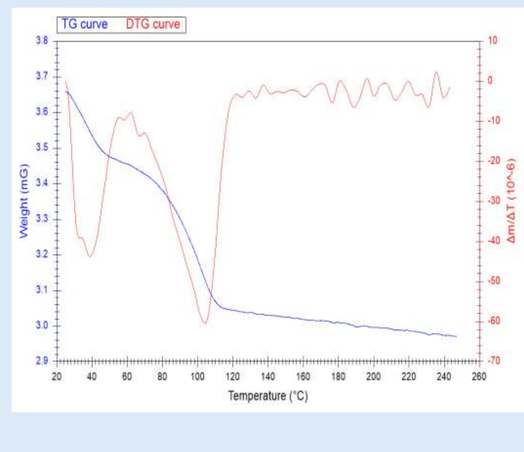


Figure 1. System for the synthesis of calcium oxalate trihydrate (COT)

Conducted synthesis		Temperature (℃)		
		25 ℃	36.5 ℃	48 ℃
Ionic strength (I_c/mol dm^{-3})	0.01	COT	COT	COM
	0.05	COT	COT	COM
	0.1	COT	COT	COM

RESULTS

TYPE	MICROSCOPE	FTIR	XRD	TGA
COM t = 48 ℃, I_c = 0.05 mol dm^{-3}				
COT t = 36.5 ℃, I_c = 0.05 mol dm^{-3}				

CONCLUSIONS

Analysis of the synthesized crystals by optical microscopy, Fourier transform infrared spectroscopy (FTIR), X-ray powder diffraction (XRD) and thermogravimetric analysis (TGA) shows that COT is formed at temperatures of 25 and 36.5 ℃. In contrast, COM is formed at 48 ℃. For all systems, the ionic strength was shown to have no effect on the formation of crystals or their appearance.

In summary, temperature has the greatest influence on the formation of an unstable phase (COT), while ionic strength has no influence on the formation of an unstable phase.