Ain Shams University
Faculty of Science
Chemistry Department

EFFECT OF NATURAL PRODUCT EXTRACTS IN CALCIUM OXALATE MONOHYDRATE CRYSTALLIZATION

A Thesis
Submitted to
Chemistry Department
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For
The Degree of Doctor of Philosophy in Science (Ph.D.)
(Inorganic Chemistry)

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This thesis has been approved for submission by supervisors

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Amany M. K. Yassin

ABSTRACT

Kidney stone formation is a major health problem all over the world. Calcium oxalate monohydrate (COM) kidney stones are the most common type of kidney stone (renal calculi); about 70% to 80% of kidney stones are formed from COM crystals. The mechanism underlying calcium oxalate stone formation is complex and not completely understood. Therefore, better understanding of calcium oxalate monohydrate crystallization is in urgent need to find out much efficient drug for inhibition kidney stone formation.

This study was carried out using herbal extracts as crystallization inhibitors of kidney stone. Crystallization kinetics of calcium oxalate monohydrate (COM) was studied with and without an aqueous *Ammi Visnaga* (Khella) and *Nigella Sativa*(Habbet El-Barakah) extracts individually.

To our knowledge, it is the first time to study the effect of an aqueous Nigella Sativa extract on COM crystallization as well as it is the first time to compare Nigella Sativa extract effect with the effect of an aqueous Khella extract on the COM crystallization. The induction period was determined under different supersaturation ratios at 37 ^{o}C using the conductivity method. The induction time decreased exponentially with increasing super saturation ratio whereas the induction time was increased with addition of an aqueous Egyptian khella and

Nigella Sativa extracts individually compared to without additives. By using theory of classical homogenous nucleation, the calculated surface energy was increased from 7.97 mJ/m^2 without additive to 9.15 mJ/m^2 and 10.31 mJ/m^2 with Khella and Nigella Sativa extracts, respectively. However, the nucleation rate at a supersaturation ratio of 3.26 corresponding to 3.27 and 5.44 with Khella and Nigella Sativa extracts, respectively was decreased from 3.9 x 10^{29} $nuclei/cm^3.s$ (without additive) to 2.4 x 10^{29} $nuclei/cm^3.s$ and 1.3 x 10^{29} $nuclei/cm^3.s$ with Khella and Nigella Sativa extracts, respectively. The results indicate that increasing surface energy leads to decreasing nucleation rate. The number of molecules required for the formation of stable nucleus was calculated with and without addition of extracts at different supersaturation ratios. COM crystals were investigated by X Ray Diffraction (XRD), Scanning Electron Microscopy (SEM) and Energy Dispersive X Ray Spectroscopy (EDX). SEM photomicrographs show formation of small crystals, less aggregated with extracts inhibitor compared with the baseline. This study can help us to find out much efficient medicine from herbs extract for removal/inhibition kidney stone formation.

Keywords: Calcium oxalate monohydrate; Crystallization; Crystal morphology; Induction time; Crystal growth inhibitor.

ABBREVIATIONS

COM	Calcium oxalate monohydrate
CaOx	Calcium oxalate
CaP	Calcium Phosphate
RS	Relative supersaturation
S	Supersaturation
W/O	Without
K.E.	Khella Extract
N.S.	Nigella Sativa
UTI	Urinary tract infection
GAG	Glycols amino glycan
GAGS	Glycols amino glycans
M	Molarity
mM	Milli molar
mL	Milliliter
XRD	X-ray powder diffraction
SEM	Scanning electron microscopy
EDX	Energy-dispersive X-ray spectroscopy

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CHAPTER IV

LIST OF TABLES