



**Faculty of Sciences**

**M.Sc. Thesis In Inorganic Chemistry**

**SYNTHESIS AND CHARACTERIZATION OF A NANO URANYL SCHIFF  
BASE COMPLEX AND SYNTHESIS, CHARACTERIZATION AND  
KINETIC STUDIES OF SOME URANYL SCHIFF BASE COMPLEXES**

**By**

**FAHIMEH DEHGHANI FIRUZABADI**

**Supervised by**

**Dr. Mozaffar Asadi and Dr. Zahra Asadi**

**September 2012**

# *In The Name of God*

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**FAHIMEH DEHGHANI FIRUZABADI**

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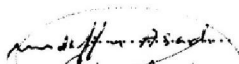
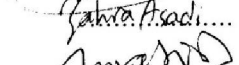
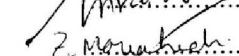

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**EVALUATED AND APPROVED BY THESIS COMMITTEE AS: EXCELLENT**

	M. Asadi, Ph.D., Prof of Chemistry (Supervisor and chairman).
	Z. Asadi, Ph.D., Assist, Prof of Chemistry (Supervisor and chairman).
	M. Rashidi, Ph.D., Prof of Chemistry.
	Z. Movahedi, Ph.D., Assist, Prof of Chemistry.

**SEPTEMBER 2012**

***DEDICATED TO:***

***MY PARENTS***

***MY SISTERS***

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## ABSTRACT

### SYNTHESIS AND CHARACTERIZATION OF A NANO URANYL SCHIFF BASE COMPLEX AND SYNTHESIS, CHARACTERIZATION AND KINETIC STUDIES OF SOME URANYL SCHIFF BASE COMPLEXES

BY

FAHIMEH DEHGHANI FIRUZABADI

In this work, Schiff base ligands were prepared by condensation of 2-hydroxy-1-naphthaldehyde with 1,2-ethylenediamine, 1,3-propylenediamine, 1,2-propylenediamine, 1,2-phenylenediamine, 1,4-butylenediamine, 4-methyl-1,2-phenylenediamine, 4-chloro-1,2-phenylenediamine, 4-nitro-1,2-phenylenediamine, 4-carboxyl-1,2-phenylenediamine and their  $\text{UO}_2\text{L}$  complexes were synthesized by the reaction of uranyl acetate with Schiff base ligands. These ligands and complexes were characterized by  $^1\text{H}$  NMR, IR spectroscopy, UV-vis. spectrophotometry, X-ray crystallography, TG (thermal gravimetry), CV (cyclic voltammetry), and elemental analysis (C.H.N). For the first time, a nano structure of  $[\text{UO}_2(\text{napht-1,2pr})(\text{MeOH})]$  was synthesized. Scanning electronmicroscopy (SEM) and transmission electron microscopy (TEM) image showed nano-particles with sizes 16-30 nano-meters. In anti-cancer studies of the uranyl Schiff base complexes, Cell culture and MTT assay were used. Kinetic data of eight uranyl Schiff base complexes were determined spectrophotometrically. In all cases (runs from  $10-40 \pm 0.1^\circ\text{C}$ ), the procedure involves adding a sample of  $\text{PBU}_3$  to solutions containing the uranyl complexes. The kinetics was followed at a predetermined wavelength, where the difference in absorption between the substrate and the product was the largest. The pseudo-first-order constants were calculated by fitting data to  $\ln[(A_t - A_\infty)/(A_0 - A_\infty)] = -k_{\text{obs}}t$  (where  $A_t$ =Absorbance at time  $t$ ;  $A_0$ =Absorbance at  $t=0$ ;  $A_\infty$ =Absorbance at  $t=\infty$ ). The second order rate constants  $k_2$  were obtained from the slope of the linear plots of  $k_{\text{obs}}$

vs.  $[\text{PBU}_3]$ .  $\Delta H^\ddagger$  and  $\Delta S^\ddagger$  were obtained from the Eyring plots of  $\ln(k_2/T)$  vs.  $1/T$  at four different temperatures.

The second order  $k_2$  rate constants show the following trend:

- 1)  $[\text{UO}_2(5\text{-Brsalbzph})(\text{CH}_3\text{CN})] > [\text{UO}_2(\text{salbzph})(\text{CH}_3\text{CN})] > [\text{UO}_2(5\text{-MeOsalbzph})(\text{CH}_3\text{CN})]$
- 2)  $[\text{UO}_2(4\text{-MeOsalbzph})(\text{CH}_3\text{CN})] > [\text{UO}_2(5\text{-MeOsalbzph})(\text{CH}_3\text{CN})] > [\text{UO}_2(3\text{-MeOsalbzph})(\text{CH}_3\text{CN})]$
- 3)  $[\text{UO}_2(5\text{-Brsalbzph})(\text{CH}_3\text{CN})] \approx [\text{UO}_2(5\text{-Clisalbzph})(\text{CH}_3\text{CN})]$
- 4)  $[\text{UO}_2(\text{napht-1,3pr})(\text{CH}_3\text{CN})] > [\text{UO}_2(\text{napht-1,2pr})(\text{CH}_3\text{CN})]$

The low  $\Delta H^\ddagger$  values and the large negative  $\Delta S^\ddagger$  values are compatible with (A) mechanism.



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