CONTENTS

			P	age
CONT	ΓENTS			vi
LIST	OF TAE	BLES		viii
LIST	OF FIG	URES		X
CHAI	PTER			
1	INTRODUCTION		1	
	1.1	Introd	uction	1
	1.2	Backg	round of chromium	1
	1.3	Literature reviews		
	1.4	Object	ives	14
2	EXPERIMENTAL		15	
	2.1	Chemi	icals and materials	15
	2.2	Instruments and apparatus		16
	2.3	Methodology		17
	2.4	Chromium (VI) removal by using iron oxide-coated sand (IOCS)		21
	2.5	Removal of chromium (VI) spiked in wastewater samples by IOCS		25
3	RESULTS AND DISCUSSION		27	
	3.1	Optim	ization of graphite furnace atomic absorption	27
		spectrometer (GFAAS)		
		3.1.1	Pyrolysis temperature	27
		3.1.2	Atomization temperature	29
		3.1.3	Detection limit	30
		3.1.4	Linear dynamic range (Linearity)	32
		3.1.5	Accuracy and precision	34

CONTENTS (CONTINUED)

				Page
	3.2	Chrom	ium (VI) removal by using iron oxide-coated sand (IOCS)	35
		3.2.1	Effect of sand size on removal Cr (VI) by IOCS	35
		3.2.2	Comparison between uncoated and FeCl ₃ coated sand	36
		3.2.3	Effect of pH on removal Cr (VI) by IOCS	37
		3.2.4	Effect of concentration of FeCl ₃ on removal Cr (VI)	38
			by IOCS	
		3.2.5	Effect of flow rate through IOCS on removal Cr (VI)	39
			by IOCS	
		3.2.6	Effect of time for coating FeCl ₃ on sand on removal	41
			Cr (VI) by IOCS	
		3.2.7	Effect of weight of sand on removal Cr (VI) by IOCS	42
		3.2.8	Effect of anion on removal Cr (VI) by IOCS	43
		3.2.9	The comparison between the calibration and standard	45
			addition method for determination of Cr (VI) spiked	
			in wastewater samples	
		3.2.10	Removal of Cr (VI) spiked in wastewater samples by IOCS	S 46
4	CONC	LUSIO	N	47
BIBLIC	OGRAI	PHY		48
APPEN	NDIX			50
VITAE	E			55

LIST OF TABLES

Table		Page
1-1	Chemical and physical property of chromium	1
1-2	Chromium concentration in industries effluent standards	5
1-3	Techniques for determination of chromium	6
2-1	Graphite furnace program	16
2-2	The pH of wastewater samples	25
3-1	The absorbance of the pyrolysis temperature at 30 $\mu g \ L^{-1} \ Cr \ (VI)$,	28
	20 μL	
3-2	The effect of the atomization temperature on the absorbance of 30	29
	$\mu g L^{-1} Cr (VI), 20 \mu L$	
3-3	The data of the blank measurements of Cr (VI), n = 10	31
3-4	The relationship between the peak area and the various Cr (VI)	32
	standard concentration (µg L ⁻¹)	
3-5	The percent recovery of Cr (VI) at concentration of 30.0 $\mu g \ L^{1}$	34
3-6	Summarises the percentage removal of 10 mg L ⁻¹ Cr (VI) by IOCS	35
	at the difference sizes of sand	
3-7	The percentage removal of 10 mg L^{1} Cr (VI) by uncoated and FeCl ₃	36
	coated sand	
3-8	The percentage removal of 10 mg L ⁻¹ Cr (VI) by IOCS at different pH	Is 3 7
3-9	The percentage removal of 10 mg L ⁻¹ Cr (VI) by IOCS at different	38
	concentrations of FeCl ₃	
3-10	The percentage removal of 10 mg L ⁻¹ Cr (VI) by IOCS at various	40
	flow rates	
3-11	The percentage removal of 10 mg L ⁻¹ Cr (VI) by IOCS at various	41
	times for coating FeCl ₃ on sand	
3-12	The percentage removal of 10 mg L ⁻¹ Cr (VI) by IOCS at various	42
	weights of sand	
3-13	The percentage removal of 10 mg L ⁻¹ Cr (VI) by IOCS at various	44
	types of anion	

LIST OF TABLES (CONTINUED)

Table		Page
3-14	The comparison of peak area between calibration and standard addition	45
	method for determination of Cr (VI) spiked in wastewater	
3-15	The percentage of removal $Cr(VI)$ in four $Cr(VI)$ spike in wastewater	46
	samples	

LIST OF FIGURES

Figure		
1-1	pE-pH diagrarm Cr in aquatic systems	3
1-2	Possible forms of chromium (VI) in solution in the presence of iron	4
	particles. Cr (VI) can be in solution (soluble), Cr (VI) can stick (sorb)	
	to the surface of iron oxide particles, or Cr (VI) can be held deep	
	inside the iron in a form of "fixed" Cr	
1-3	HGA and THGA graphite tubes with integrated L'vov platform	8
	for larger sample volumes	
1-4	The transversely heated graphite tube provides a uniform temperature	9
	profile	
3-1	The relationship between absorbance of 30 µg L ⁻¹ Cr (VI) standard	28
	working solution and the pyrolysis temperature (°C)	
3-2	The relationship between absorbance of 30 µg L ⁻¹ Cr (VI) standard	29
	working solution and the atomization temperature (°C)	
3-3	Peak shape of 30 µg L ⁻¹ Cr (VI) standard working solution at optimum	n 30
	temperature	
3-4	The calibration curve of Cr (VI)	31
3-5	The linear dynamic range of Cr (VI) standard concentration at	33
	$1\text{-}300~\mu\mathrm{g}~\mathrm{L}^{\text{-}1}$	
3-6	The linear dynamic range of Cr (VI) standard concentration at	33
	$1\text{-}100~\mu\mathrm{g}~\mathrm{L}^{\text{-}1}$	
3-7	The relationship between size of sand and the percentage of removal	35
	10 mg L ⁻¹ Cr (VI) by IOCS	
3-8	The percentage removal of 10 mg L^{-1} Cr (VI) by uncoated and FeCl ₃	36
	coated sand	
3-9	The relationship between pH of solution and the percentage of	37
	removal 10 mg L ⁻¹ Cr (VI) by IOCS	
3-10	The relationship between concentration of FeCl ₃ and the percentage	39
	of removal 10 mg L ⁻¹ Cr (VI) by IOCS	

LIST OF FIGURES (CONTINUED)

Figur	e	Page
3-11	The relationship between flow rate and the percentage of removal	
	10 mg L ⁻¹ Cr (VI) by IOCS	
3-12	The relationship between time for coating FeCl ₃ on sand and the	
	percentage of removal 10 mg L ⁻¹ Cr (VI) by IOCS	
3-13	The relationship between weight of sand and the percentage of removal	1 43
	10 mg L ⁻¹ Cr (VI) by IOCS	
3-14	The relationship between type of anion and the percentage of removal	44
	10 mg L ⁻¹ Cr (VI) by IOCS, $1 = NO_3^-$, $2 = SO_4^{2-}$, $3 = PO_4^{3-}$	
3-15	The comparison of calibration curve and standard addition for Cr (VI)	45
	determination in wastewater	