

## TABLE OF CONTENT

	<b>Page</b>
ACKNOWLEDGEMENT	iii
ABSTRACT (ENGLISH)	iv
ABSTRACT (THAI)	vi
TABLE OF CONTENTS	vii
LIST OF TABLES	ix
LIST OF FIGURES	x
LIST OF SCHEMES	xiii
<b>CHAPTER 1 INTRODUCTION</b>	
1.1 Principles, rationale and hypothesis	1
1.2 Research objectives	5
1.3 Usefulness of the research	5
1.4 Research location	5
<b>CHAPTER 2 LITERATURE REVIEW</b>	
2.1 Bentonite	7
2.2 Organoclay	14
2.3 <i>Coscinium fenestratum</i>	17
2.4 Carbamate pesticide	23
<b>CHAPTER 3 MATERIALS AND METHODS</b>	
3.1 Equipments and chemicals	31
3.2 Samples	32
3.3 Sample preparation	33
3.3.1 Alkaloid extraction of <i>C. fenestratum</i>	33
3.3.2 Identification of <i>C. fenestratum</i> extracts using HPLC	36
3.3.3 Saturated Na-bentonite preparation	37
3.4 Experimental of organoclays	39
3.5 Adsorption of carbamate pesticides	41
3.6 Adsorption analysis	43
3.7 Scanning electron microscopy (SEM)	43

	<b>Page</b>
CHAPTER 4 RESULTS AND DISCUSSION	
RESULTS	44
4.1 Alkaloid extraction of <i>C. fenestratum</i>	44
4.2 Identification of <i>C. fenestratum</i> extract using HPLC	46
4.3 Saturated Na-Bent preparation	49
4.4 Experimental of organoclay	50
4.5 Adsorption of carbamate pesticide	52
4.6 Adsorption analysis	53
4.7 Scanning electron microscopy (SEM)	61
DISSCUSION	64
CHAPTER 5 CONCLUSION	72
REFERENCES	73
APPENDICES	85
APPENDIX A Composition of Ca and Na ion containing in bentonite clay	86
APPENDIX B Calculation of berberine content in Alk precipitate	87
APPENDIX C Preparation of Dragendroff's reagent	88
APPENDIX D Standard curve of pesticides	89
APPENDIX E Table of pesticides residue adsorption from HPLC analysis	90
CURRICULUM VITAE	104

## LIST OF TABLES

Table		Page
2.1	Carbaryl structure and information	25
2.2	Methomyl structure and information	27
2.3	Methiocarb structure and information	29
3.1	Optimization condition for HPLC analysis	36
4.1	HPLC condition for determination of berberine content in Alk	47
4.2	Pesticide residue concentration of carbamate pesticides	59
4.3	Adsorption capability of organobentonite after experiment	60
A-1	Determination of compositions containing in bentonite clay	86
D-1	Standard curve of carbaryl pesticide	89
D-2	Standard curve of methomyl pesticide	92
D-3	Standard curve of methiocarb pesticide	95
E-1	Organobentonite adsorption of carbaryl pesticide obtained from HPLC analysis	98
E-2	Organobentonite adsorption of methomyl pesticide obtained from HPLC analysis	99
E-3	Organobentonite adsorption of methiocarb pesticide obtained from HPLC analysis	100

## LIST OF FIGURES

Figure		Page
2.1	The structure of clay minerals	6
2.2	Physical property of bentonite	7
2.3	The crystal structure of bentonite	9
2.4	Diagrammatic sketch showing single octahedral unit and portion of an octahedral sheet structure	10
2.5	Diagrammatic sketch showing single silica tetrahedron and portion of silica tetrahedron sheet structure.	10
2.6	Diagrammatic sketch of the structure of bentonite	11
2.7	Physical properties of <i>C. fenestratum</i>	18
2.8	Phytoconstituents of <i>C. fenestratum</i>	19
2.9	General structure of carbamate pesticide	23
3.1	Dried stem of <i>C. fenestratum</i>	32
3.2	Commercial bentonite powder	33
4.1	Stem of <i>C. fenestratum</i> extraction and extracted solution	45
4.2	Alk precipitate using precipitation of NaCl	45
4.3	Chromatogram of berberine content in BbrCl standard compound with extracted berberine in Alk	48
4.4	Difference color property of Alk compared with BbrCl	49
4.5	Comparison the saturated bentonite swelling	50

<b>Figure</b>	<b>page</b>
4.6	Suspension samples after treatment of Na-Bent with BbrCl-Bent 51
4.7	Physical property for organobentonite 52
4.8	Clear yellow solution collected after centrifugation 53
4.9	Chromatogram standard of carbaryl and sample chromatogram of carbaryl residue in organobentonite aqueous solution 55
4.10	Chromatogram standard of methomyl and sample chromatogram of methomyl residue in organobentonite aqueous solution 56
4.11	Chromatogram standard of methiocarb and sample chromatogram of methiocarb residue in organobentonite aqueous solution 57
4.12	Physical structure of commercial bentonite 61
4.13	Physical structure on Na-Bentonite 62
4.14	Physical structures of modified Alk-Bent and BbrCl-Bent 63
5.1	Hydrolysis mechanism of degradation in methomyl and methiocarb experiment 69
D-1	Standard curve of carbaryl pesticide 89
D 1.1	Chromatogram of carbaryl sample from HPLC analysis 90
D-2	Standard curve of methomyl pesticide 92
D 2.1	Chromatogram of methomyl sample from HPLC analysis 93
D-3	Standard curve of methomyl pesticide 95
D 3.1	Chromatogram of methiocarb sample from HPLC analysis 96

<b>Figure</b>		<b>Page</b>
E-1	Example chromatogram from HPLC of carbaryl organoclay samples with different ratio adsorption	101
E-2	Example chromatogram from HPLC of methomyl organoclay samples with different ratio adsorption	102
E-3	Example chromatogram from HPLC of methiocarb organoclay samples with different ratio adsorption	103

<b>Scheme</b>		<b>Page</b>
3.1	Maceration extraction in ethanol and precipitation of <i>C. fenestratum</i>	35
3.2	Na-bentonite preparation	38
3.3	Modification of Na-bentonite using berberine chloride and Alk	40
3.4	Pesticide adsorption method	42