

Table of Contents

	page
Acknowledgments	iv
Abstract (in English)	vi
Abstract (in Thai)	viii
Table of Contents	x
List of Table	xi
List of Figures	xiii
Chapter 1 Introduction	1
Chapter 2 Literature Review	7
2.1. Heavy Metals : Definition, Nature, and Sources.....	7
2.2. Heavy Metal Emissions from Coal-Fired Power Plants	8
2.3. Soil Contamination by Heavy Metals.....	10
2.4. Risk of Soil Contamination by Heavy Metals.....	12
2.5. The Role of Soil Arthropods in Terrestrial Ecosystems	14
2.6. Soil-Arthropods as Bioindicators	15
Chapter 3 Study Area	19
3.1. Location : Geography and Topography	19
3.2. Climate	20
3.3. Study Site	25
3.4. Vegetation	25
3.5. History of the Mae Moh Power Plant.....	29
Chapter 4 Materials and Methods	31
4.1. Materials	31
4.2. Methods	32
4.3. Data analysis	38
Chapter 5 Results and Discussion	42
5.1. Soil physicochemical parameters.....	42
5.2. Heavy metal contamination in soil	49
5.3. Biological parameters	57
5.4. Assessment of soil contamination	67
Chapter 6 Conclusions and Recommendations	71
REFERENCES	73
APPENDICES	81
<i>Curriculum vitae</i>	109

List of Tables

	page	
Table 2.1	Estimates of atmospheric emission of elements at coal fired power plants	9
Table 2.2	Concentration of various heavy metals in fly ash (mg/kg)	9
Table 2.3	Background concentration (mg/kg) of heavy metals in sediments and soils	11
Table 2.4	Normal ranges and typical levels of heavy metal concentrations in uncontaminated soils (mg/kg)	12
Table 3.1	Details of the study sites	28
Table 3.2	Concentrations of heavy metals in fly ash of the Mae Moh Power Plant	30
Table 5.1	Averages of soil physicochemical parameters at different study sites irrespective of the observation period	42
Table 5.2	Correlation coefficients and two-tailed significant values among soil physicochemical parameters	47
Table 5.3	Averages of heavy metal concentrations in soil (mg/kg) irrespective the observation period	50
Table 5.4	Correlation coefficients and two-tailed significant values between heavy metal concentration and other soil physicochemical parameters ($P \leq 0.05$)	56
Table 5.5	Correlation coefficients and two-tailed significant values between soil physicochemical parameters and the total number of individuals per order	59
Table 5.6	Correlation coefficients and two-tailed significant values between heavy metal concentrations and the total number of individuals per order	59
Table 5.7	Correlation coefficients and two-tailed significant values between heavy metal concentration and the total number of individuals per family	61

Table 5.8	Correlation coefficients and two-tailed significant values between soil physicochemical parameter and the total number of individuals per family	62
Table 5.9	Ecological indices of the soil-inhabiting arthropod communities at the study sites	63
Table 5.10	Correlation coefficients and two-tailed significant values between soil physicochemical parameters and the total number of individuals, species, families, and orders	64
Table 5.11	Correlation coefficients and two-tailed significant values between heavy metal concentration and the total number of individuals, species, families, and orders	65
Table 5.12	Correlation coefficients and two-tailed significant values between heavy metal concentrations and evenness indices (E5)	66
Table 5.13	Similarity coefficients (Sorensen's indices) of the soil-inhabiting arthropod communities between the study sites	66
Table 5.14	Chord distance coefficients (CRD) of the soil-inhabiting arthropod communities between the study sites	67

List of Figures

	page
Figure 2.1 Relationship of concentration of various heavy metals in soil and parent material	11
Figure 3.1 Average monthly rainfall in the Mae Moh Power Plant area	21
Figure 3.2 Average monthly temperature in the Mae Moh Power Plant area	21
Figure 3.3 Map showing location of Mae Moh Power Plant and Lignite Mine	22
Figure 3.4 The geological map of the Mae Moh Basin area	23
Figure 3.5 Windrose diagram showing annual wind directions in Mae Moh Basin Area	26
Figure 3.6 Map showing the study sites	27
Figure 5.1 Average Soil pH at the study sites	43
Figure 5.2 Average organic matter at the study sites	44
Figure 5.3 Average soil moisture content at the study sites	45
Figure 5.4 Average soil field capacity at the study sites	46
Figure 5.5 Average of the arsenic (As) concentration in soil at the study sites	50
Figure 5.6 Average of the nickel (Ni) concentration in soil at study sites	51
Figure 5.7 Average of the cobalt (Co) concentration in soil at the study sites	52
Figure 5.8 Average of the chromium(Cr) concentration in soil at the study sites	51
Figure 5.9 Total number of individuals, species, families and orders of soil-inhabiting arthropods at the study sites	57
Figure 5.10 Total number of individuals per class at the study sites	58
Figure 5.11 Species diversity indices of the soil-inhabiting arthropod communities at the study sites	62

Figure 5.12 Evenness indices (E5) of the soil-inhabiting arthropod communities at the study sites 65

Figure 5.13 Cluster analysis of the study sites based on heavy metal (As, Co, Cr, Ni) concentrations 68

มหาวิทยาลัยเชียงใหม่
Chiang Mai University