# TABLE OF CONTENTS

	naga
	page
ACKNOWLEDGEMENT	
	111
ABSTRACT (ENGLISH)	iv
ABSTRACT (THAI)	vi
LIST OF TABLES	Х
LIST OF ILLUSTRATIONS	xi
ABBREVIATIONS	xiii
CHAPTER I INTRODUCTION	1
1. Statement and significance of the problem	1
2. Literature review	5
2.1 Structure of human chromosome	5
2.2 DNA damage and structural chromosome aberrations	8
2.3 Human biomonitoring studies	13
3. Objectives	
CHAPTER II MATERIALS AND METHODS	19
1. Study populations	19
2. Chromosomal aberration analysis	20
3. Alkaline single cell gel electrophoresis assay	23
3.1 Cell Preparation	23
3.2 Slides preparation and lysis	23
3.3 Alkali (pH>13) unwiding and electrophoresis	24
3.4 Neutralization and DNA staining	25
3.5 Evaluation of DNA damage	25
4. Statistical analysis	27

viii

### **TABLE OF CONTENTS (CONTINUED)**

	Page
CHAPTER III RESULTS	28
1. General characteristics of study populations	28
2. Results of chromosomal aberration analysis	28
3. Results of the comet assay	37
CHAPTER IV DISCUSSION	47
CHAPTER V CONCLUSION	53
REFERENCE	54
APPENDICIES	60
Appendix A	61
Appendix B	64
Appendix C	65
Appendix D	68
Appendix E	71
Appendix F	73
Appendix G	75
CURRICULUM VITAE	77

ลิฮสิทธิ์มหาวิทยาลัยเชียงใหม่ Copyright © by Chiang Mai University All rights reserved

# LIST OF TABLES

Table		Page
1.	Relevant general characteristics of the petrol pump workers	29
	and control subjects	
2.	Shows the frequency of cell with aberrations in individual subject	30
	of the control group	
3.	Shows the frequency of cell with aberrations in individual subject	31
	of the exposed group	
4.	Shows frequency of structural chromosome aberrations in the	33
	exposed and control groups	
5.	Frequency of structural chromosome aberrations in the exposed	33
	and control groups according to types of aberrations	
6.	The mean values of tail length and tail moment in the control subjects	37
7.	The mean values of tail length and tail moment in the petrol pump worke	rs 38
8.	The ranges and means of tail length and tail moment in the control	40
	and exposed groups	
9.	Summary of correlation between smoking habits and DNA damage	43
	among exposed workers	
10.	DNA damage of non-smoking in the petrol pump workers and	43
	control subjects	
11.	Summary of correlation between duration of exposure and DNA	44
	damage among exposed workers	
12.	Comparison of DNA damage in the workers who had been exposed to	45
	3-6 months and control subjects	
13.	Comparison of DNA damage in the workers who had been exposed to	46
	6-12 months and control subjects	

х

### LIST OF ILLUSTRATIONS

Figure	e 97818186	Page
1.	Structure of human chromosome	6
2.	Normal human metaphase chromosome prepared from lymphocytes	7
	culture and stained with G-banding technique	
3.	Shows different mechanisms of formation resulting from DNA	9
	damage in different stages of the cell cycle	
4.	Schematic representation of lymphocyte culture steps in	22
	chromosome aberration analysis	
	Shows the frosted part of microscope slides covered with microgel	24
6.	An electrophoresis set consisted of a power supply and	24
	electrophoresis chamber	
7.	A fluorescent microscope equipped with a computerized image	25
	analysis system	
8.	Schematic representation of critical steps in the comet assay	26
9.	Normal metaphase chromosomes of exposed donor	34
	prepared from lymphocyte culture	
10.	Metaphase chromosomes of exposed donor	35
	prepared from lymphocyte culture showing a chromatid break	
11.	Metaphase chromosomes of exposed donor	35
	prepared from lymphocyte culture showing a dicentric chromosome	
12.	Metaphase chromosomes of control donor	36
	prepared from lymphocyte culture showing an acentric fragment	

### LIST OF ILLUSTRATIONS (CONTINUED)

Figure	• 1818140 9	Page
13.	A normal cell of control donor embedded in agarose gel with undetectable	le41
	DNA fragmentation and no comet tail	
14.	Two comet cells of exposed donor embedded in agarose gel	41
	showing fragmentation of DNA, evidenced by migration of DNA	
	out of the comet head and the comet tails detected	
15.	Measurement of comet cell by a computerized image analysis system	42
16.	Mechanisms of the formation of chromatid and chromosome types	49
	aberration	

ลือสิทธิ์มหาวิทยาลัยเชียอใหม่ Copyright © by Chiang Mai University All rights reserved

#### **ABBREVIATIONS**

acentric fragment

ace ALS csb csd csg ctb ctd ctg dic DNA **DMSO** DSB **EDTA** Fig. FISH  $G_0$  $G_1$  $G_2$ H1 H<sub>2</sub>A H2B H3 H4 KCl KH<sub>2</sub>PO<sub>4</sub> LMA

alkaline labile site chromosome break chromosome deletion chromosome gap chromatid break chromatid deletion chromatid gap dicentric deoxyribonucleic acid dimethyl sulfoxide double-strand break ethylenediamine tetraacetic acid figure fluorescence in situ hybridization gap zero phase gap 1 phase gap 2 phase gram histone protein type 1 histone protein type 2A histone protein type 2B histone protein type 3 histone protein type 4 potassium chloride potassium dihydrogen phosphate low melting agarose

xiii

## **ABBREVIATIONS (CONTINUED)**

М	mole
mg.	milligram
ml.	milliliter
MI	mitotic index
MN	micronucleus
NO.	number
NaCl	sodium chloride
NaOH	sodium hydroxide
Na <sub>2</sub> HPO <sub>4</sub> .2H <sub>2</sub> O	sodium hydrogen phosphate dibasic
NMA	normal melting agarose
РАН	polycyclic aromatic hydrocarbon
PBL	peripheral blood lymphocyte
PBS	phosphate buffer saline
РНА	phytohaemagglutinin
r	ring chromosome
rpm	revolutions per minute
s AI IIII	synthesis phase
SCE	sister chromatid exchange
SCGE	single cell gel electrophoresis
S.D.	standard deviation
SSB	single-strand break
SPSS	Statistical Package for Social Science
TSPight O by Chia	total suspended particles
	microliter
μm. <b>ΓΙ<u>β</u>ΠΙΣ</b>	micrometer