



**UNIVERSITI PUTRA MALAYSIA**

**AMITRAZ EXPOSURE AND RISKS TO PESTICIDE APPLICATORS  
AND NEARBY RESIDENTS IN ZANGIABAD, IRAN**

**MAJID AGHASI**

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**By  
MAJID AGHASI**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,  
in fulfillment of the Requirements for the Degree of Doctor of Philosophy**

**August 2010**

The image features a large, semi-transparent watermark of the Universiti Putra Malaysia (UPM) logo. The logo is a shield-shaped emblem with a red and white color scheme. At the top left of the shield, the letters 'UPM' are written in white on a red rectangular background. The central part of the shield contains a stylized white 'U' shape with a red outline, and a white book is positioned behind it. The bottom of the shield is filled with vertical red and white stripes. The text 'Dedicated to my parents, my wife, and all researchers in the world' is centered over the middle of the shield.

**Dedicated to my parents, my wife, and all researchers in  
the world**

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment  
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**August 2010**

**Chairman : Professor Zailina Hashim, PhD**

**Faculty : Medicine and Health Sciences**

During and after the application of pesticides to crops in agriculture, residues may enter the atmosphere and be transported over varying distances downwind away from the target. As a result, pesticides may be inhaled in sufficient dose to be absorbed through the lungs and into the bloodstream. The exposure to amitraz may be of occupational origin or strongly related to environmental contamination. This study is believed to be the first ever survey for Iran, aimed to determine the concentration of amitraz and its metabolite in inhalation air and serum of pesticide applicators and general population in the Zangiabad area, a Pistachio-growing area, in Southeast of Iran.

This research is a cross-sectional descriptive study, based on interviews and collections of samples from pesticide applicators (70 blood samples and 70

individual air samples), from a residential population who has lived in Zangiabad area for at least two years (70 blood samples and 70 individual air samples), and from a non-exposed population who has lived in the other area which is not in contact with amitraz (70 blood samples and 70 individual air samples) and ambient air (24 samples). After air sampling, a solvent concentration step was made by a rotary-evaporator and then under a soft stream of nitrogen gas. Blood samples of each volunteer were centrifuged and then extracted using solid phase extraction cartridge and vacuum manifold. Finally, the extracts were analyzed using gas chromatography-mass spectrometry. As each participant was interviewed face to face, a questionnaire comprising of questions on socio-demographic characteristics, knowledge of safety practices in handling amitraz, characteristics of pesticide application and use of protective measures to avoid pesticide contamination was filled in.

Quality control of the analysis method was determined for the air and serum samples including recovery efficiency, limits of detection and quantification, accuracy and precision, as well as reproducibility and stability. The techniques used in this study were to validate selectivity, sensitivity, stability, precision, and accuracy. Amitraz and its metabolite were found in the inhalation air and serum samples of applicators and residents, as well as the ambient air samples in Zangiabad area. The mean concentration of amitraz and its metabolite in the applicator serum samples were 135.2 and 78.1ng/mL, respectively. Amitraz and its metabolite were also found in Zangiabad residents' serum with a mean concentration of 20.4 and 27.4ng/mL,

respectively. These data suggest that a large proportion of Zangiabad zone is continuously exposed to this pesticide with low doses from 0.02 to 0.15 $\mu\text{g}/\text{m}^3$ . In addition, all the applicators did not use any protection. The lack of use of protective measures in the study area was probably related to socio-demographic factors such as educational levels. Using the concentration of 11.51 $\mu\text{g}/\text{m}^3$ , the inhalational intake per working day calculated is equivalent to 0.057 mg. The acceptable daily intake of amitraz is 0.003 mg/kg body weight/day, representing 0.21 mg/day in a 70 kg adult. It appeared that poisoning would not occur due to amitraz exposure alone, but this chemical agent and its metabolite are toxic and may cause chronic adverse health effects. Pesticide exposure has been identified as a major environmental health problem in the Zangiabad area, which is a pistachio cultivated centre in Iran.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi sebahagian daripada syarat keperluan untuk Ijazah Doktor Falsafah

**PENDEDAHAN AMITRAZ DAN RISIKO KEPADA PENYEMBUR  
PESTISID SERTA PENDUDUK BERDEKATAN DI ZANGIABAD, IRAN**

Oleh

**MAJID AGHASI**

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Semasa dan setelah racun serangga disemburkan kepada tanaman, sisa-sisa memasuki atmosfera dan diangkut jauh daripada sasaran oleh angin mengikut jarak yang berbeza-beza. Hasilnya, racun serangga mungkin disedut dalam dos yang mencukupi untuk diserapkan oleh paru-paru dan ke dalam aliran darah. Pendedahan kepada amitraz mungkin berkaitan dengan asal usul pekerjaan seseorang atau berkait rapat dengan pencemaran persekitaran. Kajian ini merupakan kajian yang pertama dijalankan di Iran, bertujuan untuk menentukan kepekatan amitraz dan metabolit dalam udara sedutan dan serum penyembur racun serangga dan populasi umum di kawasan Zangiabad yang merupakan satu kawasan penanaman kacang pistachio di Timur Selatan Iran. Kajian ini merupakan kajian deskriptif yang dilaksanakan secara keratan rentas berdasarkan temuduga dan koleksi sampel darah dari penyembur racun serangga (70 sampel darah dan 70 sampel udara tersendiri) yang telah tinggal di kawasan Zangiabad sekurang-kurangnya dua tahun (70 sampel darah dan 70

sampel udara tersendiri), dari populasi yang tidak didedahkan dengan amitraz dan yang tinggal di kawasan lain serta udara di sekeliling (12 sampel). Setelah sampel udara diambil, satu langkah pelarutan kepekatan dilakukan dengan menggunakan penyejat berputar dan di bawah satu aliran lembut gas nitrogen. Sampel darah daripada setiap individu diemparkan dan kemudian diekstrakkan dengan menggunakan kartrij pengekstrakan fasa pepejal dan pancaronnga vakum. Akhirnya, pengekstrakan dianalisa dengan menggunakan spektrometri jisim gas kromatografi. Apabila setiap peserta ditemuduga berhadapan muka, satu soalselidik yang mengandungi soalan berkenaan ciri-ciri sosio-demografik, pengetahuan amalan-amalan keselamatan dalam pengendalian amitraz, ciri-ciri penyemburan racun serangga dan penggunaan langkah-langkah keselamatan bagi mengelakkan pencemaran racun serangga diisi oleh peserta-peserta kajian. Kawalan mutu ke atas cara menganalisa udara dan sampel-sampel serum termasuk pemulihan kecekapan, had-had pengesanan dan penaksiran, ketepatan dan kejituan, serta kebolehulangan semula dan kestabilan ditentukan. Teknik-teknik yang digunakan dalam kajian ini adalah untuk mengesahkan pemilihan, kepekaan, kestabilan, kejituan dan ketepatan. Dapatan kajian menunjukkan bahawa amitraz dan metabolit terkandung dalam udara sedutan dan sampel-sampel serum penyembur racun serangga serta sampel udara di sekeliling kawasan Zangiabad. Purata kepekatan amitraz dan metabolit di dalam serum sampel darah penyembur serangga masing-masing adalah 135.2 dan 78.08ng/mL. Amitraz dan metabolit juga didapati dalam serum penduduk Zangiabad, masing-masing dengan purata kepekatan 20.4 dan 27.4 ng / mL. Data ini mencadangkan bahawa sebahagian besar penduduk di zon Zangiabad terdedah



kepada racun serangga dos yang rendah iaitu dari 0.02 hingga 0.15 g / m<sup>3</sup> secara berterusan. Tambahan pula, semua penyembur racun serangga tidak mengamalkan langkah-langkah keselamatan. Kekurangan pengamalan langkah-langkah keselamatan oleh penyembur racun serangga di kawasan kajian adalah mungkin berkait rapat dengan factor sosio-demografik seperti tahap pendidikan di kalangan penduduk. Dengan penggunaan kepekatan 11.51µg/m<sup>3</sup>, pengambilan udara sedutan setiap hari bekerja yang dikira adalah sama dengan 0.057 mg. Pengambilan amitraz yang boleh diterima pada setiap hari adalah 0.003 mg/kg berat badan/hari, mewakili 0.21 mg/hari bagi seorang dewasa yang seberat 70 kg. Adalah ditunjukkan bahawa keracunan tidak akan terjadi disebabkan oleh pendedahan kepada amitraz sahaja tetapi agen kimia ini dan metabolit adalah toksik dan boleh menyebabkan kesan-kesan kesihatan yang kronik. Pendedahan kepada racun serangga dikenalpasti sebagai punca utama kepada masalah kesihatan di kawasan Zangiabad yang merupakan pusat kepada penanaman kacang pistachio di Iran.

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I certify that an Examination Committee met on 6 August 2010 to conduct the final examination of Majid Aghasi on his Doctor of Philosophy thesis entitle “Analysis of amitraz in air and blood, its exposure and risk on pesticide applicators and the nearby residents in Zangiabad, Iran” in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Doctor of Philosophy.

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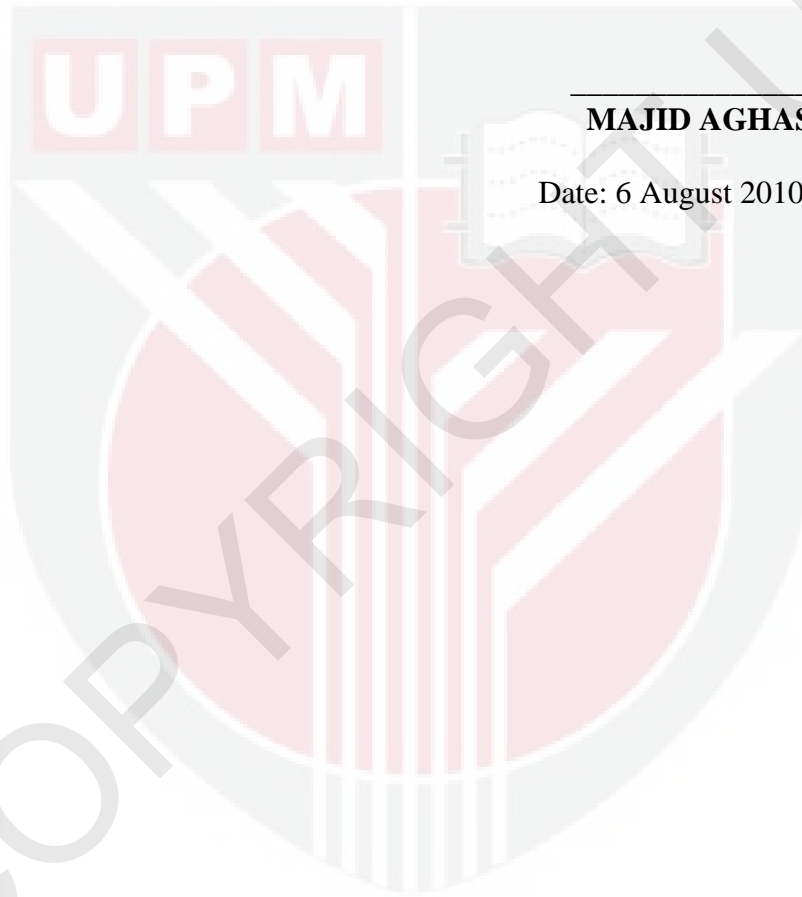
Date: 21 October 2010

## DECLARATION

I declare that the thesis is my original work except for the quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.

**MAJID AGHASI**

Date: 6 August 2010



## TABLE OF CONTENTS

	<b>Page</b>
<b>DEDICATION</b>	ii
<b>ABSTRACT</b>	iii
<b>ABSTRAK</b>	vi
<b>ACKNOWLEDGEMENTS</b>	ix
<b>APPROVAL</b>	xi
<b>DECLARATION</b>	xiii
<b>LIST OF TABLES</b>	xix
<b>LIST OF FIGURES</b>	xxii
<b>LIST OF APPENDICES</b>	xxiv
<b>LIST OF ABBREVIATIONS</b>	xxv
<b>CHAPTER</b>	
<b>1 INTRODUCTION</b>	<b>1</b>
1.1 General Introduction	1
1.2 Amitraz	3
1.2.1 Amitraz Exposure	4
1.2.3 Amitraz Use in Iran	4
1.2.4 Human Health Assessment of Amitraz	5
1.2.5 Degradation of Amitraz	8
1.3 2,4-dimethylaniline (2,4-xylidine)	9
1.4 Environmental Health Effects of Pesticides	12
1.5 Problem Statement	13
1.6 Importance of the Study	16
1.7 Main Objective	17
1.8 Specific Objectives	18
1.9 Research Hypothesis	19
1.10 Conceptual Framework	19
1.11 Ethical Consideration	21
<b>2 LITERATURE REVIEW</b>	<b>22</b>
2.1 Introduction	22
2.2 Amitraz	23
2.2.1 Trade or Other Names of Amitraz	24
2.2.2 Regulatory Status	24
2.2.3 Characteristics of Amitraz	24
2.2.4 Formulation	26
2.2.5 Mode of Action	27
2.2.6 Degradation of Amitraz	30
2.2.7 Toxicity	32
2.2.8 Amitraz Poisoning Symptoms	34
2.2.9 Reproductive Effects	36

2.2.10	Teratogenic Effects	38
2.2.11	Carcinogenic and Mutagenic Effects	39
2.2.12	Misuses of Amitraz	39
2.2.13	Human Health	41
2.2.14	Environmental Fate	43
2.2.15	Ecological Effects on Non-target Species	43
2.3	Socio-demographic Data, Use of Protective Measures and Poisoning of Pesticide Applicators	45
2.3.1	Educational Level of Pesticide Operators and Training Programs	46
2.3.2	Reading and Understanding Labels	47
2.3.3	Avoiding Contamination	48
2.3.4	Personal Hygiene	48
2.3.5	Work Clothing	49
2.3.6	Recommended Protective Clothing for Amitraz Applicators	50
2.3.7	Protective Equipments	50
2.3.8	Safe Storage and Container Management of Pesticides	52
2.3.9	Pesticide Poisoning	53
2.3.10	Pesticide Poisoning in Developing Countries	54
2.3.11	Alternative Pest Control Methods	56
2.4	Air Pollution Due to Pesticides	57
2.4.1	Emission During Application	59
2.4.2	Emission from Crops	59
2.4.3	Emission from soil	60
2.4.4	Degradation in Air	60
2.4.5	Air Pollution Due to Amitraz	61
2.5	Air Sampling	61
2.5.1	Advantages of Impingers	64
2.5.2	Disadvantages of Impingers	65
2.5.3	Advantages of Filters	65
2.5.4	Disadvantages of Filters	65
2.5.5	Air Sampling Using Impinger	66
2.6	Pesticide Exposure Assessment	67
2.7	Chemical Analysis	71
2.7.1	Extraction and Clean up of Amitraz by Using SPE Column	73
2.7.2	Validation of Method	74
2.8	Biomonitoring of Pesticides	74
2.8.1	Definition and Background	75
2.8.2	Environmental Health and Biomonitoring	75
2.8.3	The Role of Laboratory Techniques in Biomonitoring	77
2.9	Biomonitoring of Amitraz in Animals and Human	79
<b>3</b>	<b>MATERIALS AND METHODS</b>	<b>83</b>
3.1	Study Design	83



3.2	Site Information	84
3.2.1	Study Area	84
3.2.2	Field Experiment Design	86
3.2.3	Regional Climate	86
3.2.4	Control Area	87
3.3	Socio-demographic Characteristics and Safety Practices of Amitraz	87
3.3.1	Data Collection	87
3.3.2	Health Effects of Amitraz	89
3.4	Air Pollution Assessment of the Amitraz Exposure	90
3.4.1	Quality Control of the Method	90
3.4.2	Air sampling/Monitoring	97
3.4.3	Calibration of Personal Sampling Pumps	100
3.4.4	Inhalation Exposure	101
3.4.5	Ambient Community Air	105
3.4.6	Procedures for Extracting Air Samples	106
3.4.7	Calibration Curves	108
3.4.8	Linearity	109
3.4.9	Calculation	109
3.5	Biomonitoring of Amitraz Exposure	110
3.5.1	Introduction	110
3.5.2	Quality Control of the Method	111
3.5.3	Population Recruitment	116
3.5.4	Ethical Aspects	117
3.5.5	Blood Sampling	118
3.5.6	Extraction Procedure	120
3.5.7	Calibration Curves	122
3.5.8	Linearity	123
3.6	GC-MS Analysis	123
3.6.1	Standard Solution of Chemicals	123
3.6.2	Injection	123
3.6.3	GC-MS Apparatus and Conditions	124
3.6.4	Measurement of the Peak Area	125
3.7	Data Analysis	125
3.7.1	Descriptive Data	126
3.7.2	Regression Analysis	126
3.7.3	One-sample Kolmogorov-Smirnov Test	126
3.7.4	Independent-sample t-test	127
3.7.5	One-way Analysis of Variance (ANOVA)	127
3.7.6	Analysis of Co-variance (ANCOVA)	127
3.7.7	Chi-squared Test	128
3.7.8	Relative Risk Test	128
4	<b>RESULTS</b>	129
4.1	Socio-demographic Characteristics and Safety Practices of Amitraz	129

4.1.1	Type of Pesticide Used	129
4.1.2	Socio-demographic Characteristics	131
4.1.3	Amitraz Occupational Exposure	133
4.2	Amitraz in Air	136
4.2.1	Calibration Curves	136
4.2.2	Linearity	137
4.2.3	Validation of Method	138
4.2.4	Inhalation Exposure of Amitraz in Applicators	144
4.2.5	Inhalation Exposure of Amitraz in Residences of the Zangiabad	146
4.2.6	Inhalation Exposure of Amitraz in Residences of the Sirch	148
4.2.7	Amitraz and 2,4-dimethylaniline Residue Levels in the Inhalation Air Samples of Applicators and Community	149
4.2.8	Ambient Air Exposure in the Zangiabad	150
4.2.9	Ambient Air Exposure in the Sirch	152
4.3	Biomonitoring of Amitraz Exposure	152
4.3.1	Calibration Curves	152
4.3.2	Linearity	153
4.3.3	Validation of Method	154
4.3.4	Biomonitoring of Amitraz in Applicators	159
4.3.5	Biomonitoring of Amitraz in the Residents of the Zangiabad	161
4.3.6	Biomonitoring of Amitraz in the Residents of the Sirch	163
4.3.7	Amitraz and 2,4-dimethylaniline Residue Levels in the Serum Samples of Applicators and Community	164
4.3.8	Relationship between Amitraz Concentrations in the Inhalation Air and Serum Samples	165
4.4	Health risk Assessment of Amitraz Exposure	166
4.4.1	Comporison on the Number of Children of the Respondents	166
4.4.2	Health Symptoms Perceived by Applicators	167
4.4.3	Blood-amitraz Level in the Applicators and the Score of Amitraz Exposure Symptoms	168
4.4.4	Relationship between Blood-amitraz Level in the Applicators and the Symptoms of Amitraz Exposure	170
4.4.5	Health Risk Assessment of Amitraz Exposure	172
4.4.6	Relative Risk of Amitraz Exposure	175
5	<b>DISCUSSIONS</b>	177
5.1	Socio-demographic Characteristics and Safety Practices of Amitraz	177
5.1.1	Type of Pesticide Used	177
5.1.2	Socio-demographic Data	178
5.1.3	Amitraz Exposure	179
5.2	Atmospheric Exposure	184

5.2.1	Air Sampling	184
5.2.2	Validation of Method	186
5.2.3	Retention Efficiency Test	188
5.2.4	Amitraz Exposure on Applicators	189
5.2.5	Exposure to the General Population	191
5.2.6	Ambient Air Exposure	193
5.3	Biomonitoring of Amitraz	198
5.3.1	Extraction of Human Serum	199
5.3.2	Validation of Method	200
5.3.3	Applicators' Exposure to Amitraz	202
5.3.4	Public Exposure	203
5.4	Health Risk of Amitraz Exposure	206
5.4.1	Health Effects of Amitraz	206
5.4.2	Symptoms of Amitraz Exposure in the Applicators	207
5.4.3	Relative Risk of Amitraz Exposure	209
5.4.4	Infertility Effect of Amitraz	209
5.4.5	Methods to Reduce Amitraz Exposure	211
6	<b>SUMMARY, GENERAL CONCLUSION AND RECOMMENDATION FOR FUTURE RESEARCH</b>	214
6.1	Summary	214
6.2	General Conclusion	218
6.3	Recommendations for Future Research	224
	<b>REFERENCES</b>	227
	<b>APPENDICES</b>	245
	<b>BIODATA OF STUDENT</b>	261
	<b>PUBLICATIONS</b>	262