

**BIOCHEMICAL STUDIES ON PESTICIDE  
RESIDUES BONDED WITH EGYPTIAN COTTON  
FIBERS AND SEEDS**

**By**

**YASSER ABD EL-HADY ABD EL-BASET**  
B.Sc. Agric. Sci. (Biochemistry), Fac. Agric., Cairo Univ., 2000  
M.Sc. Agric. Sci. (Biochemistry ), Fac. Agric., Cairo Univ., 2009

**THESIS**

**Submitted in Partial Fulfillment of the  
Requirements for the Degree of**

**DOCTOR OF PHILOSOPHY**

**In**

**Agricultural Sciences  
(Agricultural Biochemistry )**

**Department of Biochemistry  
Faculty of Agriculture  
Cairo University  
EGYPT**

**2016**

APPROVAL SHEET

**BIOCHEMICAL STUDIES ON PESTICIDE RESIDUES  
BONDED WITH EGYPTIAN COTTON FIBERS AND  
SEEDS**

**Ph.D. Thesis**

**In**

**Agric. Sci. (Agricultural Biochemistry)**

**By**

**YASSER ABD EL-HADY ABD EL-BASET**

**B.Sc. Agric. Sci. (Biochemistry ), Fac. Agric., Cairo Univ., 2000**

**M.Sc. Agric. Sci. (Biochemistry ), Fac. Agric., Cairo Univ., 2009**

APPROVAL COMMITTEE

**Dr. HOSNI MOHAMED SHAFIK ABDEL-SALAM**.....

**Professor of Biochemistry, Fac. Agric., Minia University**

**Dr. FOUAD ABDEL REHEIM AHMED** .....

**Professor of Biochemistry, Fac. Agric., Cairo University**

**Dr. SHERIF HELMY AHMED** .....

**Professor of Biochemistry, Fac. Agric., Cairo University**

**Dr. EMAM ABDEL-MOBDEI ABDEL-RAHIM**.....

**Professor of Biochemistry, Fac. Agric., Cairo University**

**Date: / /**

**SUPERVISION SHEET**

**BIOCHEMICAL STUDIES ON PESTICIDE RESIDUES  
BONDED WITH EGYPTIAN COTTON FIBERS AND  
SEEDS**

**Ph.D. Thesis**

**In**

**Agricultural Sci. (Agricultural Biochemistry)**

**By**

**YASSER ABD EL-HADY ABD EL-BASET**

**B.Sc. Agric. Sci. (Biochemistry ), Fac. Agric., Cairo Univ., 2000**

**M.Sc. Agric. Sci. (Biochemistry ), Fac. Agric., Cairo Univ., 2009**

**SUPERVISION COMMITTEE**

**Dr. EMAM ABDEL-MOBDEI ABDEL-RAHIM**  
**Professor of Biochemistry, Fac. Agric., Cairo University**

**Dr. SHERIF HELMY AHMED**  
**Professor of Biochemistry, Fac. Agric., Cairo University**

**Dr. SALAH MANSOUR SALEH**  
**Professor of Textile Chemistry, CRI, ARC, Giza**

**Name of Candidate:** Yasser Abd El-Hady Abd El-Baset **Degree:** Ph.D.

**Title of Thesis:** Biochemical Studies on Pesticide Residues Bonded with Egyptian Cotton Fibers and Seeds

**Supervisors:** Dr. Emam Abd El-Mobdei Abd El-Rahim  
Dr. Sherif Helmy Ahmed  
Dr. Salah Mansour Saleh

**Department:** Agricultural Biochemistry **Branch:**

**Approval:** / /

### **ABSTRACT**

Cotton still represents the most important crop and a main element in Egypt's national economy. Pests infesting cotton affect the crop's quality and yield. Pesticides are considered to be one of the major elements in protecting cotton production. The present work is to evaluate the effects of pesticides and their residues on the physical and chemical properties for fiber and seed on cotton varieties Giza 86 and Giza 90. The results indicated that pesticide residues in Giza 86 fiber and seed, were found also significant decrease in fiber length, fineness, brightness (Rd%), fiber strength, but significant increase in fiber elongation and yellowness (+b) with insignificant differences between Giza 86 and Giza 90 seasons 2012 and 2013. The present results showed significant increase in protein during the same season 2012 as well as insignificant variations between Giza 86 and Giza 90 varieties seasons of 2012 and 2013 in cottonseed constituents. The another results revealed that the quality of organically grown cotton was equal to or better than conventionally grown cotton. Fineness and maturity values for all the cultivars at 2012 and 2013 were satisfactory for the organic and conventional cotton and the oil content of cottonseed of Giza 86 and Giza 90 in seasons 2012 and 2013 was less than the organic samples and vice versa for protein content. These mean that the pesticides application produced pesticide residues and changes in the physical, chemical and mechanical properties.

**Key words:** pesticide residues, cottonseed, physical, mechanical, chemical properties

## **LIST OF ABBREVIATION**

C.R.I: Cotton research institute

DP: Degree of polymerization

A.C.H: American Cotton Handbook

WHO: World Health Organization

NIOH: National Institute of Occupational Health

ChE: Cholinesterase

OCPs: Organochlorine pesticides

OP: Organophosphate pesticides

MRL: Maximum residual level

TPs: Transformation products

GOTS: Organic Textile Standard

OE: Organic Exchange

DDT: Dichloro-Diphenyl-Trichloroethane

DDE: Dichloro-Diphenyl-Dichloroethylene

DDD: Dichloro-Diphenyl-Dichloroethane

HCH:  $\beta$ -hexachlorocyclohexane

BHC: Benzene Hexachloride

PCBs: Polychlorinated Biphenyls

OC: Organochlorine

HCB: Hexachlorobenzene

# CONTENTS

	page
<b>INTRODUCTION</b> .....	<b>1</b>
<b>REVIEW OF LITERATURE</b> .....	<b>5</b>
<b>1. Cotton</b> .....	<b>6</b>
1. Egyptian cotton varieties.....	<b>7</b>
2. Chemical structure of cotton fibers.....	<b>8</b>
3. Physical properties of cotton fibers.....	<b>14</b>
a. Fiber length.....	<b>14</b>
b. Fiber fineness (micronaire reading).....	<b>16</b>
c. Fiber color.....	<b>17</b>
d. Moisture regain%.....	<b>18</b>
e. Accessibility percent.....	<b>19</b>
4. Mechanical properties.....	<b>20</b>
a. Fiber strength.....	<b>20</b>
b. Fiber elongation.....	<b>21</b>
c. Fiber toughness and stiffness.....	<b>21</b>
5. Chemical properties.....	<b>22</b>
a. Total soluble sugars%.....	<b>22</b>
b. Wax content .....	<b>22</b>
c. Water retention%.....	<b>23</b>
d. Cellulose crystallinity%.....	<b>23</b>
e. Degree of polymerization.....	<b>25</b>
6. Scouring.....	<b>25</b>
7. Direct dyes.....	<b>26</b>
<b>2. The Pesticides</b> .....	<b>26</b>
a. Benefits of pesticides.....	<b>29</b>
b. Protection of crop losses/yield reduction.....	<b>29</b>
c. Quality of food.....	<b>30</b>

d. Hazards of pesticides.....	30
1. Direct impact on humans.....	30
2. Impact through food commodities.....	35
3. Impact on environment.....	36
4. Soil contamination.....	37
5. Effect on soil fertility (beneficial soil microorganisms) .....	39
6. Contamination of water.....	40
7. Contamination of Fish.....	41
e. Distribution of OCP residues in aquatic ecosystems....	42
f. Pest Resistance.....	43
<b>3. Organic Cotton.....</b>	<b>44</b>
<b>MATERIALS AND METHODS.....</b>	<b>47</b>
<b>1. Materials.....</b>	<b>47</b>
a. Egyptian cotton samples.....	47
b. Soil Samples.....	47
<b>2. Methods.....</b>	<b>48</b>
a. Determination of pesticide residues.....	48
b. Pretreatment processes.....	50
1. Scouring.....	50
2. Dyeing process.....	51
c. Physical, mechanical and chemical properties.....	51
(1). Determination physical properties.....	51
(a). Fiber length.....	51
(b). Fiber fineness (Micronaire reading).....	52
(c). Fiber toughness and stiffness.....	52
(d). Accessibility percent.....	52
(e). Cotton color Reflectance {(Rd%) and Yellowness (+b)}.....	53
(2). Mechanical Properties .....	53
(a). Fiber tenacity and elongation .....	53
(3). Chemical Properties.....	53
(a). Total Wax and Total Soluble Sugars %.....	53
(b). Fiber Moisture regain .....	55
(c). Ash content .....	56
(d). Cellulose crystallinity percent.....	56

(e). Degree of polymerization.....	57
(1). Determination of fluidity.....	57
(2). Determination of relative viscosity .....	58
(d). Dye ability measurements.....	58
(e). Cotton Seeds Compositions.....	59
(1). Determination of oil content.....	59
(2). Determination of protein content.....	60
(3). Determination of moisture content .....	62
(4). Determination of Ash content.....	62
(5). Free nitrogen extracts (carbohydrate).....	63
f. Statistical Analysis.....	63
<b>RESULTS AND DISCUSSION.....</b>	<b>65</b>
<b>1- Results of pesticides residues.....</b>	<b>65</b>
a. Soil samples.....	65
b. Pesticides residues in seeds and fibers Giza 86 cotton variety.....	74
c. Pesticides residues in seeds and fibers Giza 90 cotton variety.....	80
<b>2. Physical and mechanical properties.....</b>	<b>86</b>
<b>3. Fiber chemical properties.....</b>	<b>98</b>
<b>4. Color measurements .....</b>	<b>107</b>
<b>5. Cotton seed contents.....</b>	<b>111</b>
<b>CONCLUSIONS.....</b>	<b>119</b>
<b>SUMMARY.....</b>	<b>121</b>
<b>REFERENCES .....</b>	<b>127</b>
<b>ARABIC SUMMARY.....</b>	



## LIST OF TABLES

NO.	Title	Page
1.	Chemical composition of cotton fibers.....	7
2.	Pesticides used in spraying program in the official spraying program of ministry of agricultural against cotton pest.....	48
3.	The mobile phase, flow rate and wave length of HPLC used for HPLC analysis.....	50
4.	Pesticide residues in Soil samples for conventional and organic cotton in Al-Mataana (Upper Egypt), and Al- Gemmaiza (Delta).....	66
5.	Pesticide residues in organic and conventional fibers for Giza 86 cotton, (season 2012).....	75
6.	Pesticides residues in organic and conventional fibers for Giza 86 cotton, (season 2013).....	76
7.	Pesticide residues in organic and conventional cottonseeds for Giza 86 cotton, (season 2012).....	78
8.	Pesticides residues in organic and conventional cottonseeds for Giza 86 cotton,(season 2013).....	79
9.	Pesticides residues in organic and conventional fibers for Giza 90 cotton varietiy (season 2012).....	81
10.	Pesticides residues in organic and conventional fibers for Giza 90 cotton varietiy (season 2013).....	82
11.	Pesticides residues in organic and conventional cottonseeds for Giza 90 cotton varietiy,(season 2012).....	83
12.	Pesticides residues in organic and conventional cottonseeds for Giza 90 cotton varietiy, (season 2013).....	84
13.	Effect of pesticide treatment on physical and mechanical properties of Giza 86 and Giza 90 cotton varieties seasons 2012 and 2013.....	88
14.	Effect of pesticide treatment on chemical properties	

	of Giza 86 and Giza 90 cotton varieties seasons 2012 and 2013.....	99
15.	Effect of pesticide treatment on color measurements of Giza 86 and Giza 90 cotton varieties seasons 2012 and 2013.....	108
16.	Effect of pesticide treatment on cotton seed contents of Giza 86 and Giza 90 cotton varieties seasons 2012 and 2013.....	112

## LIST OF FIGURES

<b>NO.</b>	<b>Title</b>	<b>Page</b>
1.	Molecular structure of cellulose.....	9
2.	Structure of cotton fibers.....	11
3.	Rate of change for effect of pesticide treatment on fiber length of Giza 86 and Giza 90 cotton varieties seasons 2012 and 2013 .....	89
4.	Rate of change for effect of pesticide treatment on fiber fineness of Giza 86 and Giza 90 cotton varieties seasons 2012 and 2013 .....	89
5.	Rate of change for effect of pesticide treatment on fiber strength of Giza 86 and Giza 90 cotton varieties seasons 2012 and 2013.....	90
6.	Rate of change for effect of pesticide treatment on fiber elongation of Giza 86 and Giza 90 cotton varieties seasons 2012 and 2013.....	90
7.	Rate of change for effect of pesticide treatment on fiber toughness of Giza 86 and Giza 90 cotton varieties seasons 2012 and 2013.....	91
8.	Rate of change for effect of pesticide treatment on fiber stiffness of Giza 86 and Giza 90 cotton varieties seasons 2012 and 2013.....	91
9.	Rate of change for effect of pesticide treatment on brightness of Giza 86 and Giza 90 cotton varieties seasons 2012 and 2013.....	92
10.	Rate of change for effect of pesticide treatment on yellowness of Giza 86 and Giza 90 cotton varieties seasons 2012 and 2013.....	92
11.	Effect of pesticide treatment on soluble sugar % of Giza 86 and Giza 90 cotton varieties seasons 2012 and 2013.....	103
12.	Effect of pesticide treatment on wax % of Giza 86 and Giza 90 cotton varieties seasons 2012 and 2013.....	104
13.	Effect of pesticide treatment on moisture regain % of Giza 86 and Giza 90 cotton varieties seasons 2012 and 2013.....	104
14.	Effect of pesticide treatment on accessibility % of Giza 86 and Giza 90 cotton varieties seasons 2012 and 2013.....	105
15.	Effect of pesticide treatment on ash content of Giza 86 and	

	Giza 90 cotton varieties seasons 2012 and 2013.....	105
16.	Effect of pesticide treatment on cellulose crystallinity of Giza 86 and Giza 90 cotton varieties seasons 2012 and 2013.....	106
17.	Effect of pesticide treatment on degree of polymerization (D.P) of Giza 86 and Giza 90 cotton varieties seasons 2012 and 2013.....	106
18.	Effect of pesticide treatment on color strength (K/S) of Giza 86 and Giza 90 cotton varieties seasons 2012 and 2013.....	109
19.	Effect of pesticide treatment on reflectance (R%) of Giza 86 and Giza 90 cotton varieties seasons 2012 and 2013.....	110
20.	Effect of pesticide treatment on total color difference ( $\Delta E$ ) of Giza 86 and Giza 90 cotton varieties seasons 2012 and 2013.....	110