# Contents

Dedication I  
Acknowledgments II  
List of figures III  
List of tables IV  
Abbreviations V  
Abstract VII

## CHAPTER-1

### INTRODUCTION

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Pesticide and their classification</td>
<td>1</td>
</tr>
<tr>
<td>1.2</td>
<td>Applications of pesticides</td>
<td>2</td>
</tr>
<tr>
<td>1.2.1</td>
<td>Applications of pesticides in Pakistan</td>
<td>3</td>
</tr>
<tr>
<td>1.3</td>
<td>Toxicity and Potential Health Effects of Pesticides</td>
<td>5</td>
</tr>
<tr>
<td>1.4</td>
<td>Levels of Pesticides in Food and Food Safety Aspects</td>
<td>7</td>
</tr>
<tr>
<td>1.5</td>
<td>Analysis of pesticide residues in vegetables, fruits and human blood samples….</td>
<td>9</td>
</tr>
<tr>
<td>1.5.1</td>
<td>Contemporary analytical methods and techniques for pesticide residues in food and human biological fluids</td>
<td>11</td>
</tr>
</tbody>
</table>

## CHAPTER-2

### LITRATURE REVIEW

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Assessment of pesticide residues in vegetables and fruits</td>
<td>13</td>
</tr>
<tr>
<td>2.2</td>
<td>Investigation of pesticide residues in human biological fluids (blood, urine)</td>
<td>23</td>
</tr>
<tr>
<td>2.3</td>
<td>Analytical techniques and methodologies used for pesticide residues in fruits and vegetables</td>
<td>26</td>
</tr>
<tr>
<td>2.3.1</td>
<td>Analysis of fruits and vegetables for pesticide residues</td>
<td>30</td>
</tr>
<tr>
<td>2.3.2</td>
<td>Application of Gas chromatography (GC) for pesticide residues in fruits and vegetables</td>
<td>29</td>
</tr>
<tr>
<td>2.3.3</td>
<td>Applications of High pressure / performance liquid chromatography for pesticide residues in fruits and vegetables</td>
<td>32</td>
</tr>
<tr>
<td>2.3.4</td>
<td>Application of thin layer chromatography (TLC) for pesticide residues in fruits and vegetables</td>
<td>35</td>
</tr>
<tr>
<td>2.4</td>
<td>Analytical techniques and methodologies used for pesticide residues in human biological fluids (blood, urine)</td>
<td>37</td>
</tr>
<tr>
<td>2.4.1</td>
<td>Application of Gas chromatography for pesticide residues in human biological fluids (blood, urine)</td>
<td>37</td>
</tr>
<tr>
<td>2.4.2</td>
<td>Application of High performance liquid chromatography for pesticide residues in human biological fluids (blood, urine)</td>
<td>40</td>
</tr>
</tbody>
</table>
CHAPTER-3

EXPERIMENTAL

3.1 Assessment of pesticide residues in commonly used vegetables 43
  3.1.1 Vegetable samples 43
  3.1.2 Chemical standards and reagents 43
  3.1.3 Extraction procedure 43
  3.1.4 GC-MS analysis 44
3.2 Method developed for the assessment of pesticide residues in commonly used fruits 45
  3.2.1 Reagents 45
  3.2.2 Instruments 45
  3.2.3 Instrumental conditions 46
  3.2.4 Fruit samples 47
  3.2.5 Extraction and clean-up procedure 47
3.3 Monitoring of pesticide residues in commonly used fruits 48
  3.3.1 Sample collection and preparation 48
  3.3.2 Extraction procedure 48
  3.3.3 Gas chromatographic analysis 48
3.4 Assessment of pesticide residues in human blood samples 49
  3.4.1 Selection and description of sampling population 49
  3.4.2 Sample collection 49
  3.4.3 Reagents 50
  3.4.4 Extraction and cleanup 50
  3.4.5 Instrumentation 51

CHAPTER-4

RESULTS AND DISCUSSION

4.1 Assessment of pesticide residues in commonly used vegetables 52
4.2 Method developed for the assessment of pesticide residues in commonly used fruits 59
  4.2.1 Gas chromatographic determination 59
  4.2.2 Optimization of extraction procedure 60
  4.2.3 Method Validation 63
    4.2.3.1 Linearity 63
    4.2.3.2 Repeatability 63
    4.2.3.3 Recovery 67
    4.2.3.4 Detection and Quantification limits 67
    4.2.3.5 Confirmation by GC-MS 70
    4.2.3.6 Evaluation of method 70
  4.2.4 Monitoring of pesticide residues in human blood samples 72
4.4 Assessment of pesticide residues in human blood samples 83

CONCLUSIONS

RECOMMENDATIONS

REFERENCES

AUTHOR’S PUBLICATIONS