## CONTENTS

<table>
<thead>
<tr>
<th>Chapter No.</th>
<th>Description</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Introduction</strong></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1.1 Introductory</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1.2 Brief review about Pyrazole Derivatives</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1.3 Brief review about 1(H)-Benzotriazole and its Mannich reaction</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>1.4 Aryl azo pyrazoles</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>1.5 Objectives of the Work</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>1.6 The Present Work</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>1.7 References</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td><strong>Characterization Techniques and Synthesis,</strong></td>
<td>47</td>
</tr>
<tr>
<td></td>
<td><strong>Characterization of ethyl 4-((1H-benzotriazol-1-yl) methyl amino) benzoate and 4-((1H-benzotriazol-1-yl)methylamino) benzohydrazide</strong></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td><strong>Section-A</strong></td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>2.1 Elemental Analysis</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>2.2 Introduction to Spectrometry</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>2.3 Infrared Spectroscopy</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>2.4 Proton Nuclear Magnetic Resonance Spectroscopy</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>2.5 Carbon-13 Spectroscopy</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>2.6 Mass Spectroscopy</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>2.7 General Remarks for the Experimental Techniques</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td><strong>Section-B</strong></td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>2.8 Introduction</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>2.9 Materials</td>
<td>58</td>
</tr>
</tbody>
</table>
### 2.10 General procedure for synthesis of 1H-benzotriazole

### 2.11 General procedure for synthesis of ethyl-p-amino benzoate

**Section-C**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.12 Introduction</td>
<td>60</td>
</tr>
<tr>
<td>2.13 Materials</td>
<td>60</td>
</tr>
<tr>
<td>2.14 General procedure for synthesis of ethyl-4-((1H-benzotriazol-1-yl)methylamino)benzoate</td>
<td>60</td>
</tr>
<tr>
<td>2.15 General procedure for synthesis of 4-((1H-benzotriazol-1-yl)methylamino)benzo hydrazide</td>
<td>60</td>
</tr>
<tr>
<td>Reference</td>
<td>67</td>
</tr>
</tbody>
</table>

### 3 Synthesis and characterization various ethyl-2-substituted phenylhydrazono-3-oxobutyrates and 1-[4-(1H)-benzotriazoyl methyl amino benzoyl]-3-methyl-4-(substituted phenyl hydrazono)-2-pyrazoline-5-ones

**Section-A**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Materials</td>
<td>69</td>
</tr>
<tr>
<td>3.2 General procedure for synthesis of various ethyl-2-substituted phenyl hydrazono-3-oxobutyrates</td>
<td>72</td>
</tr>
</tbody>
</table>

**Section-B**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3 Materials</td>
<td>98</td>
</tr>
<tr>
<td>3.4 General procedure for synthesis of 1-[4-(1H)-benzotriazoyl methyl amino benzoyl]-3-methyl-4-(substituted phenyl hydrazono)-2-pyrazoline-5-ones</td>
<td>98</td>
</tr>
<tr>
<td>3.5 Results and Discussion</td>
<td>122</td>
</tr>
<tr>
<td>Reference</td>
<td>123</td>
</tr>
</tbody>
</table>
Synthesis and characterization of various ethyl-3-oxo-2-(2-(3-(N-alkylsulfamoyl) phenyl) hydrazono)butanoates and 3-(2-(1-(4-((1H-benzotriazol-1-yl) methyl amino) benzoxy)-3-methyl-5-oxo-1H-pyrazol-4(5H)-ylidene)hydrazinyl)N-alkyl benzenesulfonamides

Section-A

4.1 Materials 126
4.2 General procedure for synthesis of various ethyl-3-oxo-2-(2-(3-(N-alkylsulfamoyl) phenyl) hydrazono)butanoates 128

Section-B

4.3 Materials 144
4.4 General procedure for synthesis of 3-(2-(1-(4-((1H-benzotriazol-1-yl) methylamino) benzoxy)-3-methyl-5-oxo-1H-pyrazol-(5H)-ylidene)hydrazinyl)N-alkylbenzene sulfonamides 144
4.5 Results and Discussion 159
Reference 160

Synthesis and characterization of various ethyl 2-(2-(3-(4-substituted piperazin-1-yl sulfonyl) phenyl) hydrazono)-3-oxobutanoate and 1-(4-((1H-benzotriazol-1-yl) methyl amino) benzoxy)-3 methyl-4-(2-(4-(4-alkylpiperazin-1-yl sulfonyl) phenyl) hydrazono)-1H-pyrazol-5(4H)-ones

Section-A

5.1 Materials 163
5.2 General procedure for various ethyl 2-(2-(3-(4-substituted piperazin-1-yl sulfonyl) phenyl) hydrazono)-3-oxobutanoate 165
<table>
<thead>
<tr>
<th>Section-A</th>
<th>202</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1</td>
<td>Materials</td>
</tr>
<tr>
<td>6.2</td>
<td>General procedure for synthesis of various ethyl 3-oxo-2-(2-(substituted phenyl thiazol-2-yl)hydrazono)butanoate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section-B</th>
<th>210</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.3</td>
<td>Materials</td>
</tr>
<tr>
<td>6.4</td>
<td>General procedure for synthesis of 1-(4-((1H-benzotriazol-1-yl)methylamino)benzoyl)-3-methyl-4-(2-(substituted phenyl thiazol-2-yl)hydrazono)-1H-pyrazol-5(4H)-one</td>
</tr>
<tr>
<td>Section-C</td>
<td>218</td>
</tr>
<tr>
<td>-----------</td>
<td>-----</td>
</tr>
<tr>
<td>6.5 Materials</td>
<td>218</td>
</tr>
<tr>
<td>6.6 General procedure for synthesis of various ethyl 3-oxo-2-(2-(substituted-3aH-thiazolo [3,2-b] [1,2,4] thiadiazol-2-yl) hydrazono) butanoate</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section-D</th>
<th>226</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.7 Materials</td>
<td>227</td>
</tr>
</tbody>
</table>
| 6.8 General procedure for synthesis of 1-((4-

(1H-benzotriazol-1-yl)methylamino) benzoyl)-3-methyl-4-(2-(Substituted-3aH-thiazolo[3,2-b][1,2,4]thiadiazol-2-yl) hydrazono)-1H-pyrazol-5(4H)-one |
| 6.9 Results and Discussion | 234 |
| Reference | 236 |

<table>
<thead>
<tr>
<th>7 Evaluation of Antimicrobial Activity of Compounds</th>
<th>237</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1 Introduction</td>
<td>237</td>
</tr>
<tr>
<td>7.2 Classification of Antimicrobial Drugs</td>
<td>238</td>
</tr>
<tr>
<td>7.3 Bacteria</td>
<td>239</td>
</tr>
<tr>
<td>7.4 Evaluation Techniques</td>
<td>239</td>
</tr>
<tr>
<td>7.5 Experimental</td>
<td>240</td>
</tr>
<tr>
<td>7.6 Results and Discussion</td>
<td>241</td>
</tr>
<tr>
<td>7.7 Antifungal activity</td>
<td>249</td>
</tr>
<tr>
<td>Reference</td>
<td>256</td>
</tr>
</tbody>
</table>

**List of Publications** | 257 |