Synthesis and Characterization of (Five, Six) Heterocyclic Derivatives from Imidazole and Studying of their Biological Activity

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Abstract
This research involves synthesis (Pyrazole, isoxazole, Oxazine, Thiazine, Pyridine, pyrimidine) derivatives by three different steps. The first step includes coupling reaction between 3-aminoacetophenone diazonium chloride with imidazole in alkaline alcoholic solution to form (1-(3-(1H-imidazol-2-yl)diazenyl)phenyl)ethan-1-one) (1), while second step includes reaction (1) with (3,4-Dimethoxy benzaldehyde) to get chalcone derivative (2), while the third step includes reaction (2) with (hydrazine, phenyl hydrazine, 2,4-dinitrophenyl hydrazine, hydroxylamine hydrochloride, urea, thiourea, ethyl cyanoacetate, malononitrile, guanidine hydrochloride) to get (five and six) heterocyclic derivatives, heterocyclic compounds have been characterized by FT-IR, 1H-NMR and 13C-NMR analysis and study the biological activity for all derivatives to word two types of bacteria.

Keywords: Azo, pyrazole, chalcone, oxazine, thiazine, pyridine, pyrimidine.

Introduction
Azo compounds are considered as type of organic pigments which consist of at least a conjugated chromophore azo (-N=N-) group in link with one or more aromatic or heterocyclic compound.¹ Chalcones are natural biocides and known as intermediates for synthesizing of several heterocycles which have different biological activities,² chalcones were prepared by condensation reactions of acetophenone or substituted acetophenone with benzaldehyde or substituted benzaldehyde³ by base catalyzed followed by dehydration chalone.⁴ Among their biological activity anti-fungal, anti-tuberculosis, anti-malarial, anti-invasive, anti-tumor, and antioxidant⁵ anti-obesity, anti-hypertensive,⁶ Chalcone serve as precursors for the synthesis of classes of flavonoids which are founds in plants, Depending upon the substitution of aromatic ring, the chalcone show various antimicrobial activity.⁷ Azo-chalcone compounds have important functional groups (conjugation) to increase color intensity to these compounds⁸ Azo-chalcones and Chalcones are suitable precursors for the synthesis of a broad variety of organic compounds as; pyrimidines, pyrazoline⁹ Cyclization of Chalcone leading to synthesis of pharmacologically-interesting heterocyclic compounds containing nitrogen, oxygen and sulfur such as thiazines, pyrimidines, and pyrazoline¹⁰ nitrogen, and oxygen atom constitute in Heterocyclic systems which include mainly five and six membered compounds such heterocyclic inserted into novel therapeutic agents and drug.¹¹ large number of them are five and six membered heterocyclic compounds having one to three hetero atoms in their nucleus have a vital role in the metabolism of all living cells.¹² Nitrogen containing heterocyclic play an significance function in medicinal chemistry and also share in different life processes.¹³ Heterocyclic azo compounds also have medicinal importance and used in advanced organic synthesis.¹⁴

Materials and Methods
3,4-Dimethoxy Benzaldehyde, Concentrated Hydrochloric Acid, Sodium Nitrite, Sodium Hydroxide, Imidazole, Ethanol, Hydrazine
Hydrate, Phenyl Hydrazine, 2,4-Dinitrophenyl Hydrazine, Hydroxylamine Hydrochlorid, Urea, Thiourea, Ethyl Cyanoacetate, Malononitrile, Guanidine Hydrochloride, Glacial Acetic Acid, Ammonium Acetate. All chemicals and solvents used were of highest purity from (BDH, Fluka, Aldrich, GCC,CDH).

Synthesis Azo Derivative (1)

A diazonium solution was prepared by dissolve (1.35 g, 0.01 mol) of m-aminoacetophenone in (40 mL) water and (4mL)concentrated HCl this solution was cooled to 0 °C, treated with (0.69 g, 0.01 mol) NaNO₂ in (30mL) of water were added gradually with stirring for 20 min at (0-5°C) to complete the diazotization. The mixture of diazonium chloride was then slowly added into the solution of (0.68 g, 0.01 mol) imidazol with 50mL of ethanol, which was dissolved in 5% Na OH (20 mL) at 5°C. The mixture was kept cool in the ice bath and stirred continuously for 1 hour, followed by adjusting the pH of solution to pH=6. The precipitate formed was filtered, recrystallized from ethanol, washed with water then dried in air. 

Synthesis Chalcone (2)

A mixture of azo compound (1) (0.214 gm, 0.001 mol) and benzaldehyde derivative (3,4-Dimethoxy Benzaldehyde) (0.001mol)(0.16 gm) was dissolved in 25 ml ethanol, after that was added drop wise to the above mixture 10mL of 10% NaOH solution followed vigorous stirring. After that the mixture was let to stand for (13 hrs), then the precipitation occurred by neutralized with HCl (0.2) N. The precipitate obtained was filtered, dried in air and Re-crystallized by solvent ethanol.

Synthesis of Pyrazoline Derivatives (3)

A mixture of of chalcone (2) (0.001 mol)(0.36gm) with (0.05ml) of hydrazine hydrate was dissolved in ethanol (25 mL) after that allow to refluxed for (15) hrs. The reaction mixture was cooled then filtered, dried and re-crystallization from ethanol solvent.

Synthesis of Pyrazoline Derivatives (4,5)

A mixture of of chalcone (2)(0.001 mol)(0.36gm) with (0.001 mol) of (0.1ml,0.2g) of (phenyl hydrazine, 2,4- dinitrophenyl hydrazine ) respectively then a few drops was added of glacial acetic acid, the mixture was dissolved in ethanol (35mL) after that allow to refluxed for (18,16) hrs, the product were poured into ice water then filtered, dried and re-crystallization from ethanol solvent.

Synthesis of Isoxazoline derivatives (6)

A mixture of chalcone(2)(0.001mol)(0.36 gm), hydroxylamine hydrochloride (0.001 mol) (0.07 gm) and aqueous sodium hydroxide (10%, 0.6 ml) were dissolved in (30 mL) ethanol then refluxed for (16) hrs and poured into ice cold water, Then filtered, washed and recrystallized for the precipitate obtained was from ethanol to give isoxazol derivative.

Synthesis of Thiazone /Oxazine derivatives (7, 8)

A mixture of chalcone(2)(0.001mol)(0.36gm), thiourea/urea (0.001 mol) (0.076g,0.06g) respectively were dissolved in (10 ml) anethanol sodium hydroxide solution then stirred for (18,19) hrs, The solid formed was filtered then washed and recrystallized from ethanol.

Synthesis of Pyridine Derivatives (9, 10)

Compounds of chalcone (2)(0.001mol) (0.36gm), ethyl cyano acetate/malononitrile (0.001 mol) (0.1g,0.066g) respectively and (0.15g, 0.002 mol) ammonium acetate dissolved in (30ml) absolute ethanol then refluxed for (16,15)hrs. Then cooling and the product was filtration, washed with ethanol, dried and crystallized from the proper solvent to give the title compounds.

Synthesis of Pyrimidine Derivative (11)

A mixture of compounds (2)(0.001mol) (0.36gm) and (0.095g, 0.001mol) guanidine hydrochloride then (5ml, 0.002 mole) sodium hydroxide in 30 ml ethanol then was added. The reaction mixture was refluxed for (16) hrs. After cooling, the precipitate was collected by filtration, dried and crystallized from the proper solvent to give the title compounds.

Preparation of Microbiology Culture Media

(38g) of nutrient agar is dissolved in (1L) of distillation water, then put in autoclave for (15)mins at (121°C) for sterilization. Pouring the media after becoming at (37°C) in Petri dishes, made ready for streaking by bacteria. It was getting (Escherichia coli) and (staphylococcus aurous) isolated bacteria from hospital. It was cultured and these...
plates were incubated at (37°C) for (24 h) for both bacteria, DMSO was used as a solvent to prepare solutions of the various compounds were examined (0.02 g) of compounds in (5ml) DMSO after that the inhibition zones were examined for all the compounds under test.\(^{(23)}\)

![Scheme 1: Synthesis of some heterocyclic compounds derivatives](image)

**Results and Discussion**

**Compound** (1):1-(3-((1H-imidazol-2-yl)diazenyl)phenyl)ethan-1-one

The infrared spectrum data of compound (1) showed band at (1685) cm\(^{-1}\) for (C=O), 3066 cm\(^{-1}\) for (Ar-H), 3402 cm\(^{-1}\) for (N-H) imidazole, 1593 cm\(^{-1}\) for (C=N) inside imidazole ring, 2923 cm\(^{-1}\) for (C-H) for (CH\(_3\)), 1419 cm\(^{-1}\) for (N=N) and 1558 cm\(^{-1}\) due to aromatic (C=C). The \(^{1}\)H NMR (DMSO) spectrum data of compound (1) show δ: 7.4-8 (M, 4H, Ar-H), 2.6 (S, 3H, CH\(_3\)), 13.2 (S, 1H, NH imidazol ring), 8.3 (d, 2H, CH imidazol ring). The \(^{13}\)C NMR (DMSO) spectrum data of compound (1) show δ: 26.7 (C\(_{11}\)), 197.3 (C\(_{10}\)), 121.4 (C\(_2\), C\(_3\)), 154.4 (C\(_1\)), 152 (C\(_8\)), 137 (C\(_5\)), 130 (C\(_7\)), 126.5 (C\(_6\)), 126.1 (C\(_9\)).

![Fig 1: FT-IR spectra of compound (1)](image)
Compound (2): 1-(3-((1H-imidazol-2-yl)diazenyl) phenyl)-3-(3,4-dimethoxyphenyl)prop-2-en-1-one

The infrared spectrum data of compound (2) showed band at 1658 cm\(^{-1}\) for (C=O) chalcone, 3008 cm\(^{-1}\) for (Ar-H), 3448 cm\(^{-1}\) for (N-H) imidazole, 1589 cm\(^{-1}\) for (C=N) inside imidazole ring, 2962 cm\(^{-1}\) for (C-H) for (CH\(_3\)), 1419 cm\(^{-1}\) for (N=N), 1512 cm\(^{-1}\) due to aromatic (C=C) and 1458 cm\(^{-1}\) for aliphatic (C=C). The \(^1\)H NMR (DMSO) spectrum data of compound(2) show \(\delta\): 7.7.9(m,7H,Ar-H), 3.8 (S,6H, OCH\(_3\)), 13 (S,1H, NH imidazol ring), 8.5(d, 2H, CH imidazol ring), 8(d, 1H, CO=CH), 8.4 (d, 1H, CH-Ar) . The \(^13\)C-NMR (DMSO) spectrum data of compound (2) show \(\delta\): 189 (C\(_{10}\)), 139 (C\(_{11}\)), 122(C\(_{12}\)), 149 (C\(_{16,17}\)), 145 (C\(_1\)), 130 (C\(_8\)), 55 (C\(_{19,20}\)), 129-109 (C aromatic).
Fig 4: FT-IR spectra of compound (2)

Fig. 5: $^1$H NMR spectrum of compound (2)

Fig. 6: $^{13}$C-NMR spectrum of compound (2)
**Compound (3):** 3-(3-((1H-imidazol-2-yl)diazenyl)phenyl)-5-(3,4-dimethoxyphenyl)-4,5-dihydro-1H-pyrazole

The infrared spectrum data of compound (3) showed band at 1650 cm\(^{-1}\) for (C=N) inside pyrazoline, 3001 cm\(^{-1}\) for (Ar-H), 3440 cm\(^{-1}\) for (N-H) imidazole overlapping with band for (N-H) pyrazoline that show at 3425 cm\(^{-1}\), 1573 cm\(^{-1}\) for (C=N) inside imidazole ring, 2931 cm\(^{-1}\) for (C-H) for(CH\(_3\)), 1419 cm\(^{-1}\) for (N=N) and 1512 cm\(^{-1}\) due to aromatic (C=C).

The \(^1\)H NMR (DMSO) spectrum data of compound (3) show δ: 7.8-8.3 (m, 7H, Ar-H), 3.5 (s, 6H, OCH\(_3\)), 8.4 (d, 2H, CH imidazo ring), 3.8 (d, 2H, CH pyrazoline ring), 3.7 (t, 1H, CH pyrazoline ring), 4.1 (s, 1H, NH pyrazoline ring).

**Compound (4):** 3-(3-((1H-imidazol-2-yl)diazenyl)phenyl)-5-(3,4-dimethoxyphenyl)-1-phenyl-4,5-dihydro-1H-pyrazole

The infrared spectrum data of compound (4) showed band at 1666 cm\(^{-1}\) for (C=N) inside pyrazoline ring, 3001 cm\(^{-1}\) for (Ar-H), 3417 cm\(^{-1}\) for (N-H) imidazole, 1589 cm\(^{-1}\) for (C=N) inside imidazole ring, 2931 cm\(^{-1}\) for (C-H) for(CH\(_3\)), 1419 cm\(^{-1}\) for (N=N) and 1512 cm\(^{-1}\) due to aromatic (C=C).
**Compound (5):** 3-(3-((1H-imidazol-2-yl)diazenyl)phenyl)-5-(3,4-dimethoxyphenyl)-1-(2,4-dinitrophenyl)-4,5-dihydro-1H-pyrazole

The infrared spectrum data of compound (5) showed band at 3001 cm\(^{-1}\) for (Ar-H), 3425 cm\(^{-1}\) for (N-H) imidazole, 1620 cm\(^{-1}\) for (C=N) inside pyrazoline ring, 1589 cm\(^{-1}\) for (C=N) inside imidazole ring, 2939 cm\(^{-1}\) for (C-H) for (CH\(_3\)), 1419 cm\(^{-1}\) for (N=N), and 1519 cm\(^{-1}\) due to aromatic (C=C).

**Compound (6):** 3-(3-((1H-imidazol-2-yl)diazenyl)phenyl)-5-(3,4-dimethoxyphenyl)-4,5-dihydro isoxazole

The infrared spectrum data of compound (6) showed band at 1666 cm\(^{-1}\) for (C=N) isoxazoline, 3008 cm\(^{-1}\) for (Ar-H), 3386 cm\(^{-1}\) for (N-H) imidazole, 1604 cm\(^{-1}\) for (C=N) inside imidazole ring, 2977 cm\(^{-1}\) for (C-H) for (CH\(_3\)), 1404 cm\(^{-1}\) for (N=N), 1512 cm\(^{-1}\) due to aromatic (C=C) and 1149 cm\(^{-1}\) (C-O) in isoxazoline ring.
**Compound (7):** 4-(3-((1H-imidazol-2-yl)diazenyl)phenyl)-6-(3,4-dimethoxyphenyl)-6H-1,3-oxazin-2-amine

The infrared spectrum data of compound (7) showed band at 1666 cm\(^{-1}\) (C=N) oxazine, 3001 cm\(^{-1}\) for (Ar-H), 3440 cm\(^{-1}\) for (N-H) imidazole with band for (NH\(_2\)) of oxazine that show at 3348 cm\(^{-1}\), 1604 cm\(^{-1}\) for (C=N) inside imidazole ring, 2939 cm\(^{-1}\) for (C-H) for (CH\(_3\)), 1419 cm\(^{-1}\) for (N=N), 1566 cm\(^{-1}\) due to aromatic (C=C) and 1141 cm\(^{-1}\) (C-O)oxazine ring. The \(^1\)H NMR (DMSO) spectrum data of compound (7) show δ: 8.4-6.7 (m, 8H, Ar-H), 3.4 (s, 6H, OCH\(_3\)), 13 (s, 1H, NH imidazol ring), 8.4 (d, 2H, CH imidazol ring), 5.5 (s, 2H, NH\(_2\) oxazine ring), 4.2 (d, 1H, O-CH oxazine ring). The C\(^{13}\)-NMR (DMSO) spectrum data of compound (7) show δ: 138 (C\(_1\)), 55 (C\(_{21,20}\)), 148 (C\(_{17,18}\)), 60 (C\(_{12}\)), 129.8 (C\(_1\)), 109-129 (C aromatic).
Fig 14: 13C-NMR spectrum of compound (7)

**Compound (8):** 4-(3-((1H-imidazol-2-yl)diazenyl)phenyl)-6-(3,4-dimethoxyphenyl)-6H-1,3-thiazin-2-amine

The infrared spectrum data of compound (8) showed band at 1634 cm$^{-1}$ (C=N) thiazine, 3001 cm$^{-1}$ for (Ar-H), 3440 cm$^{-1}$ for (N-H) imidazole with band for (NH$_2$) of thiazine that show at 3286 cm$^{-1}$, 1589 cm$^{-1}$ for (C=N) inside imidazole ring, 2939 cm$^{-1}$ for (C-H) for (CH$_3$), 1450 cm$^{-1}$ for (N=N) and 1558 cm$^{-1}$ due to aromatic (C=C).

Fig 15: FT-IR spectra of compound (8)

**Compound (9):** 6-(3-((1H-imidazol-2-yl)diazenyl)phenyl)-4-(3,4-dimethoxyphenyl)-2-oxo-1,2-dihydropyridine-3-carbonitrile

The infrared spectrum data of compound (9) showed band at 1735 cm$^{-1}$ for (C=O), 3001 cm$^{-1}$ for (Ar-H), 3332 cm$^{-1}$ for (N=H) imidazole overlapping with band for (N-H) of pyridine that show at 3252 cm$^{-1}$, 1650 cm$^{-1}$ for (C=N) inside imidazole ring, 2931 cm$^{-1}$ for (C-H) for (CH$_3$), 1419 cm$^{-1}$ for (N= N), 1573 cm$^{-1}$ due to aromatic (C=C) and 2268 cm$^{-1}$ for(C≡N). The $^1$H NMR (DMSO) spectrum data of compound (9) show δ: 7.2-8.4 (m, 7H, Ar-H), 3 (S,6H, OCH$_3$), 13(S,1H, NH imidazol ring), 8.5(S, 2H, CH imidazol ring), 7(S,1H, CH pyridine ring), 10.5(S,1H, NH pyridine ring). The $^{13}$C-NMR (DMSO) spectrum data of compound (9) show δ: 175 (C$_{11}$), 55 (C$_{22,23}$), 112 (C$_{21}$), 154(C$_{18,17}$),162 (C$_{10}$), 126-109 (C aromatic).
Fig 16: FT-IR spectra of compound (9)

Fig. 17: $^1$H NMR spectrum of compound (9)

Fig. 18: $^{13}$C-NMR spectrum of compound (9)
**Compound (10):**6-(3-((1H-imidazol-2-yl)diazenyl)phenyl)-2-amino-4-(3,4-dimethoxyphenyl) nicotinonitrile

The infrared spectrum data of compound (10) showed band at 1650 cm\(^{-1}\) for (C=N) pyridine, 3085 cm\(^{-1}\) for (Ar-H), 3440 cm\(^{-1}\) for (N-H) imidazole with band for (NH\(_2\)) of pyridine that show at 3425 cm\(^{-1}\), 1596 cm\(^{-1}\) for (C=N) inside imidazole ring, 2931 cm\(^{-1}\) for (C-H) for (CH\(_3\)), 1419 cm\(^{-1}\) for (N=N), 1512 cm\(^{-1}\) (C=C) aromatic ring and 2206 cm\(^{-1}\) for(C≡N).

The \(^1\)H NMR (DMSO) spectrum data of compound (10) show \(\delta\): 7.1-7.5 (m, 8H, Ar-H), 3.9 (s, 6H, OCH\(_3\)), 7.6 (d, 2H, CH imidazol ring), 6.9-6.6 (s, 2H, NH\(_2\)pyridine ring) The \(^{13}\)C-NMR (DMSO) spectrum data of compound (10) show \(\delta\): 170 (C\(_{11}\)), 55 (C\(_{22,21}\)), 111 (C\(_{23}\)), 154 (C\(_{18,19}\)), 149 (C\(_{10}\)), 131-109 (C aromatic).
**Compound** (11):4-(3-((1H-imidazol-2-yl) diazenyl) phenyl)-6-(3,4-dimethoxyphenyl)pyrimidin-2-amine

The infrared spectrum data of compound (11) showed band at $1666 \text{ cm}^{-1}$ for (C=N) pyrimidine, $3085 \text{ cm}^{-1}$ for (Ar-H), $3440 \text{ cm}^{-1}$ for (N-H) imidazole with band for (NH$_2$)of pyrimidine that show at $3363 \text{ cm}^{-1}$, $1581 \text{ cm}^{-1}$ for (C=N) inside imidazole ring, $2939 \text{ cm}^{-1}$ for (C-H) for (CH$_3$), $1411 \text{ cm}^{-1}$ for (N=N) and $1542 \text{ cm}^{-1}$ due to aromatic (C=C) . The 1H NMR (DMSO) spectrum data of compound (11) show δ: 7.7-7.3(m, 8H, Ar-H), 3.4(S,6H,OCH$_3$), 13(S,1H,NH imidazol ring), 7.8(d, 2H, CH imidazol ring), 3.8 (S,2H,NH$_2$pyrimidine ring). The C$^{13}$NMR (DMSO) spectrum data of compound (11) show δ: 145 (C$_1$), 56(C$_{20, 21}$), 150 (C$_{10}$), 175 (C$_{13}$), 139 (C$_6$), 150 (C$_{17,18}$), 130-119(C aromatic).
Conclusions

From the above studies it can be concluded that the synthesized compounds exhibit significant antibacterial activity against bacteria *staphylococcus aurous* and *Escherichia coli*, the compounds that appeared good activity are (1) against *staphylococcus aurous* on other hand, compound (1,2,3,7) show good activity against *Escherichia coli*, the results of the antibacterial activity are shown in the Fig.(25, 26).

![Fig. 25: Biological activity of compounds prepared against *Escherichia coli* bacteria](image)

![Fig. 26: Biological activity of compounds prepared against *Staphylococcus aureus* bacteria](image)

**Table 1: Show Biological activity for compounds (1-11)**

<table>
<thead>
<tr>
<th>Compounds No.</th>
<th>E. coli</th>
<th>Bacterial species</th>
<th>Staph. aureus</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+++</td>
<td></td>
<td>+++</td>
</tr>
<tr>
<td>2</td>
<td>+++</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>3</td>
<td>+++</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>++</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>6</td>
<td>++</td>
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<tr>
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<td></td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>++</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- = No inhibition = inactive, + = (5-10) mm = slightly active, ++ = (11-20) mm = moderately active, +++ = (more than 20) mm = Good active.

**Table 2: Physical properties of compounds (1-11)**

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of comp.</th>
<th>M. F</th>
<th>M. W</th>
<th>M.P (°C)</th>
<th>R.f</th>
<th>Colour</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1-(3-((1H-imidazol-2-yl)diazenylyphenyl)ethan-1-one)</td>
<td>C19H15N4O2</td>
<td>314.23</td>
<td>177-175</td>
<td>0.3</td>
<td>Orange</td>
<td>88</td>
</tr>
<tr>
<td>2</td>
<td>1-(3-((1H-imidazol-2-yl)diazenylyphenyl)-3-(3,4-dimethoxyphenyl)prop-2-en-1-one</td>
<td>C20H21N4O3</td>
<td>362.39</td>
<td>159-161</td>
<td>0.3</td>
<td>Light orange</td>
<td>61</td>
</tr>
<tr>
<td>3</td>
<td>3-(3-((1H-imidazol-2-yl)diazenylyphenyl)-5-(3,4-di methoxyphenyl)-4,5-dihydro-1H-pyrazole</td>
<td>C16H14N2O2</td>
<td>376.42</td>
<td>119-117</td>
<td>0.3</td>
<td>Dark orange</td>
<td>65</td>
</tr>
<tr>
<td>4</td>
<td>3-(3-((1H-imidazol-2-yl)diazenylyphenyl)-5-(3,4-di methoxyphenyl)-1-phenyl-4,5-di hydro-1H-pyrazole</td>
<td>C17H15N2O2</td>
<td>452.52</td>
<td>101-99</td>
<td>0.4</td>
<td>Brown</td>
<td>67</td>
</tr>
<tr>
<td>5</td>
<td>3-(3-((1H-imidazol-2-yl) di azenylyphenyl)-5-(3,4-dime thoxy phenyl)-1-(2,4-dinitrophenyl)-4,5-di hydro-1H-pyrazole</td>
<td>C20H15N4O3</td>
<td>542.51</td>
<td>119-121</td>
<td>0.2</td>
<td>Reddish orange</td>
<td>77</td>
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<td>3-(3-((1H-imidazol-2-yl) diazeny lphenyl)-5-(3,4-dimethoxy phenyl)-4,5-dihydroisoxazole</td>
<td>C20H15N4O3</td>
<td>377.40</td>
<td>134-136</td>
<td>0.2</td>
<td>Brown</td>
<td>72</td>
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References


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