

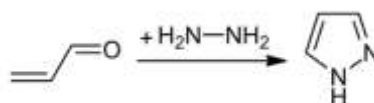
## Pyrazole Derivatives and their Synthesis - A review

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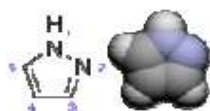
**ABSTRACT** : Pyrazoles have played a crucial part in the development of theory in heterocyclic chemistry and also used extensively in organic synthesis. Pyrazoles are five membered heterocyclic compounds. These are widely found as the core structure in a large variety of compounds that possess important agrochemical and pharmaceutical activities as well as biological activity such as antitumor, antibacterial, antifungal, antiviral, antiparasitic, anti-tubercular and insecticida. Different synthetic methodologies and the diverse antitumor, antibacterial, antifungal, antiviral, antiparasitic, anti-tubercular and insecticida activities of pyrazole moiety were discussed.



### INTRODUCTION

These heterocyclic compounds containing pyrazole derivatives are well-known and important nitrogen-containing five-membered heterocyclic compounds. Among the two nitrogen atoms; one is basic and the other is neutral in nature. These are aromatic molecules due to their planar conjugated ring structures with six delocalized  $\pi$ -electrons. The aromatic nature arises from the four  $\pi$  electrons and the unshared pair of electrons on the -NH nitrogen.

Pyrazole occupied a unique position in the design and of their synthetic and biological applications. They display various biological activities such as antibacterial, hypoglycaemic, sedative-hypnotic [1], antifungal [2], anticonvulsant, antiviral [3], antiparasitic [4], anti-tubercular and insecticidal [5].



Iupac Name: Pyrazole

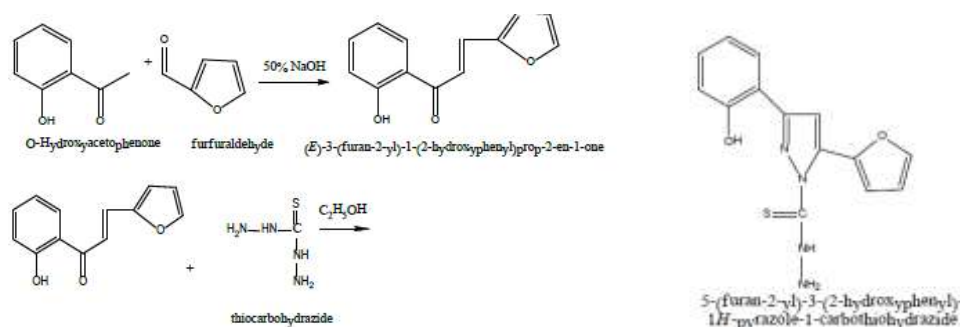
#### Properties

Molecular formula :	C <sub>3</sub> H <sub>4</sub> N <sub>2</sub>
Molar mass:	68.08 mol <sup>-1</sup>
Melting point:	66-70°C
Boiling point:	186-188°C
Acidity (pKa):	14.0

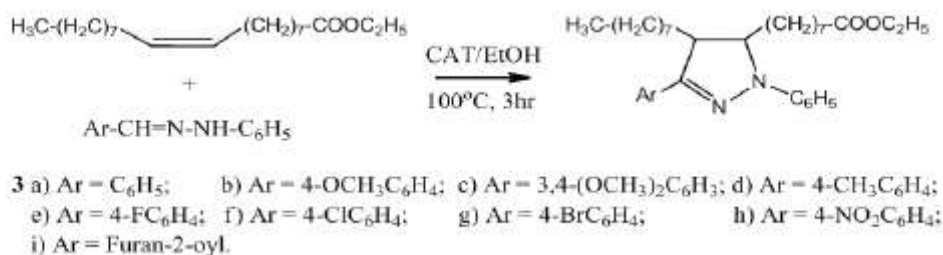
Some of these compounds also possess antioxidant [4,5], anti-inflammatory analgesic, antitumor[6], antiangiogenesis, anti-parasitic[7], and anti-angiogenic [8] activity. Pyrazole derivatives are also used as chelating agents and inhibitors for the corrosion of the steel. Due to these interesting activities of pyrazole derivatives, considerable attention has been focused on this class of compounds. Synthesis of pyrazole are employed for several types of synthetic transformations, in particular for synthesis of heterocyclic compounds such as pyrazole derivatives with antibacterial and antifungal activities.

### LITERATURE REVIEW

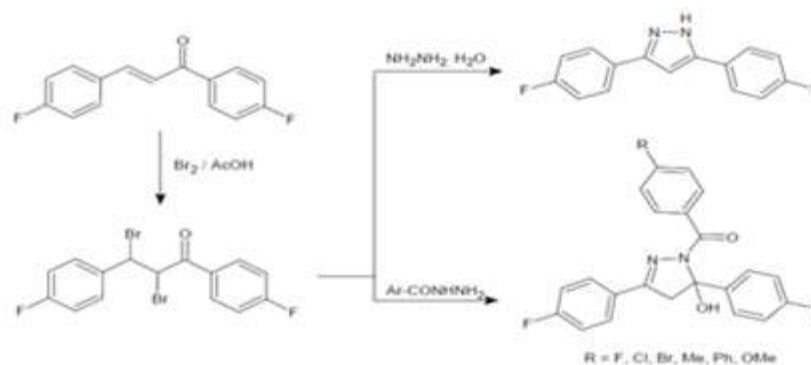
5-(furan-2-yl)-3-(2-hydroxyphenyl)-1H-pyrazole-1-carbothiohydrazide [9] have been synthesized by substituted O-Hydroxyacetophenone, furfuraldehyde and thiocarbohydrazide. The synthesized compounds were investigated for antifungal & antimicrobial activities.



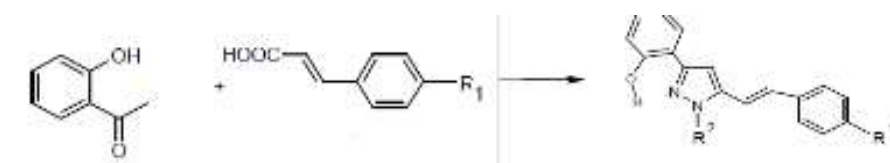
8-(4-Octyl-5-aryl-2-phenyl-3, 4-dihydro-2H-pyrazol-3-yl)-octanoic acid ethyl esters [10] was formed by nitrile imines and ethyl oleate. The synthesized compounds were investigated for antioxidant and antimicrobial activities.



Synthesis of 3,5-bis(4-fluorophenyl)-1H-pyrazole has been synthesized by using mixture of 2,3-dibromo-1,3-bis(4-fluorophenyl)propan-1-one and hydrazine hydrate [11]. Antimicrobial activities were also performed as antioxidant properties.



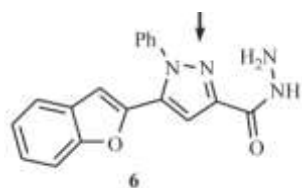
Some pyrazoles and their novel derivatives have been synthesized by 2'-cinnamoyl- oxyacetophenones from commercially available 2-hydroxyacetophenone [12]. Antifungal & antibacterial activities were also performed as in-vitro antimicrobial screening against fungal strains & bacterial strain respectively



There results has been represented in a table

Compound	R <sub>1</sub>	R <sub>2</sub>	M.P.(°C)	Yield (%)
11	Cl	Ph	108-110	98.3
12	OCH <sub>3</sub>	Ph	115-116	97.5
13	Cl	H	129-130	98.7
14	H	H	124-125	100
15	H	Ph	110-111	99.6

5-(benzofuran-2-yl)-1-phenyl-1H-pyrazole-3-carbohydrazide [13] has been prepared by carrying out the reactions of Methyl-4-(benzofuran-2-yl)-2,4-dioxobutanoate reacted with various nucleophilic reagents such as hydroxylamine hydrochloride, semicarbazide hydrochloride, hydrazine hydrate and phenyl hydrazine. The compounds exhibited promising antibacterial activity *in vitro* against both Gram-positive and Gram-negative strains of bacteria along with a fungus.

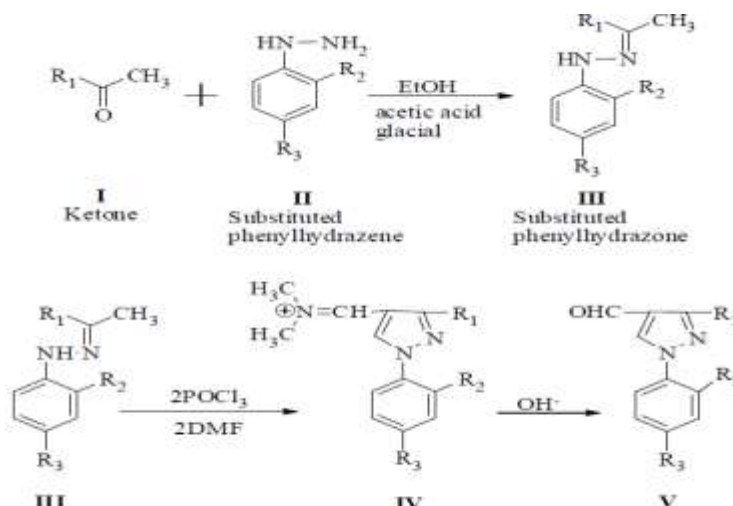


Compound no.	Minimum inhibitory concentration (MIC) µg mL <sup>-1</sup>				
	<i>B. subtilis</i> (NCIM 2439)	<i>S. aureus</i> (NCIM 2079)	<i>E. coli</i> (NCIM 2064)	<i>F. aeruginosa</i> (NCIM 2053)	<i>A. niger</i> (NCIM 301)
1	62	125	250	125	62
2	125	250	125	62	31
3	500	125	250	250	25
4	250	62	31	125	250
5	125	15.5	15.5	500	125
6	250	500	62	125	12.5

3-aryl-1, 4-diphenyl-1H-pyrazol-5-yl (phenyl) methanone [14] was formed by a mixture of 1, 3-diphenylprop-2-yn-1-one, aldehyde phenylhydrazones, and Chloramine-T which acts as potential antifungal and antibacterial agents.



1, 3-diphenyl-1H-pyrazole-4-carbaldehyde derivatives [15] have been synthesized by the treatment of two moles of cold solution of Vilsmeier-Haack (VH) reagent (DMF-POCl<sub>3</sub> adduct) in DMF with substituted phenylhydrazones. The synthesized compounds were investigated for antioxidant and antimicrobial activities.



### CONCLUSIONS

This review has attempted to summarize different synthesis methods and reactions of pyrazole. Many biologically active heterocyclic compounds have been synthesized from these heterocycles. All the synthesized products such as 1, 3-diphenyl-1H-pyrazole-4-carbaldehyde, 3-aryl-1, 4-diphenyl-1H-pyrazol-5-yl (phenyl) methanone, 5-(benzofuran-2-yl)-1-phenyl-1H-pyrazole-3-carbohydrazide, 3,5-bis(4-fluorophenyl)-1H-pyrazole, 5-(furan-2-yl)-3-(2-hydroxyphenyl)-1H-pyrazole-1-carbothiohydrazide were screened for their *in vitro* as antibacterial, hypoglycaemic, sedative-hypnotic, antifungal, anticonvulsant, antiviral, antiparasitic, anti-tubercular, insecticidal, antioxidant, anti-inflammatory analgesic properties antitumor, antiangiogenesis, anti-parasitic, and anti-angiogenic properties. These reactions greatly extended synthesis possibilities in organic chemistry.

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