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# A Comprehensive Review on Pyrazole and It's Pharmacological Properties

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**Abstract:** Heterocyclic chemistry is very important aspects in organic chemistry. Heterocyclic system consists of one or more heteroatoms like nitrogen, oxygen, sulphur, etc with hydrogen atoms. The system can be classified as saturated as well as non saturated system or hydrocarbons. Another classification of this ring system is divided in some categories like three-membered, four-membered, five-membered, six-membered, seven-membered, fused heterocyclics etc. Some compounds under this classification are acidic or basic in nature. Examples of heterocyclic compounds are Pyrole, Furan, Thiophene, Pyridine, Quinoline, Isoquinoline, Indole, Purine, Pyrazole, etc. Pyrazole is very important under this heterocyclic ring system. Pyrazole is five membered heterocyclics. Pyrazole is basic and unsaturated in nature due to presence of double bonds in their ring structure. When two nitrogen atoms are associated with five membered heterocyclic ring in 1,2 positions called as Pyrazole structure. It is also known as 1,2-diazole. It is present in many drugs as well as organic compounds and Pharmaceutical compounds. The review study shown that the structure, physical and chemical properties, nomenclature, synthetic approaches, biological activities of Pyrazole heterocyclic ring structure.

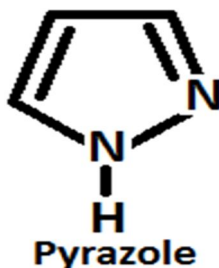
**Keywords:** Pyrazole, Physical & chemical properties, Structure, Nomenclature, Tautomerism, Biological activities.

## I. INTRODUCTION

Pyrazole is an one of the most important five membered heterocyclic compound contain three carbon atom and two adjacent nitrogen atoms which are ortho substitution. German chemist Ludwig Knorr use the term Pyrazole to identify to this class of compounds in 1883 [1] but it was firstly synthesized from acetylene and diazomethane by the German chemist Hans Von Pechmann in the year 1898 [2].

Now a day's derivatives of different compounds have huge application in medicine and industry [3] and engaged a huge area of interest for researcher in the field of medicinal chemistry[4]. Pyrazole ring is very important to develop a new class of drugs and present in large number of medicinal compounds[5-7]. Nitrogen containing heterocyclic core of pyrazole moiety shows different types of biological effects in different binding sites [8-11].

Pyrazole moiety shows a broad spectrum of biological activities like Antimicrobial , antiviral , antitumor , anti-histaminic , anti-depressant, insecticides and fungicides, due to this reasons many pharmaceutical industry synthesize vast number of compounds containing pyrazole nucleus using different synthetic routes.



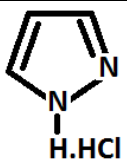
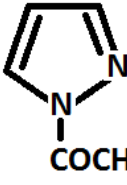
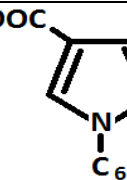
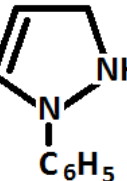
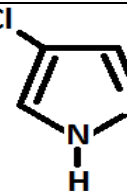
## II. PHYSICAL & CHEMICAL PROPERTIES

### A. Physical Properties of Pyrazole

| Property Name    | Property Value                    |
|------------------|-----------------------------------|
| Colour           | White to yellow                   |
| Chemical formula | C (52.93%), H (5.92%), N (41.15%) |
| Molar Mass       | 68.079 g mol <sup>-1</sup>        |
| Composition      | C (52.93%), H (5.92%), N (41.15%) |
| Density          | 1.4088                            |
| Refractive index | 1.4203                            |
| Melting point    | 66 – 70 <sup>0</sup> C            |
| Boiling point    | 186 – 188 <sup>0</sup> C          |
| pK <sub>a</sub>  | 2.48 at 25 <sup>0</sup> C         |
| Solubility       | Water, Chloroform , Methanol      |
| Sensitivity      | Hygroscopic                       |

Table 1: Physical properties of Pyrazole [12]

### B. Chemical Properties of Pyrazole

| Types of reaction | Reaction                                                                                                       | Structure                                                                                                                                                                                                                                      | Reference |
|-------------------|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Basic Character   | Presence of inorganic acid like HCl Pyrazole form pyrazole hydrochloride salts.                                | <br>Pyrazole ring with an NH group and H.HCl below it.                                                                                                     | 13        |
| Acylation         | During acylation pyrazole nucleus is replaced by an acyl group, to give N-acetyl pyrazole.                     | <br>Pyrazole ring with a COCH <sub>3</sub> group attached to the nitrogen atom.<br>N-acetyl Pyrazole                                                      | 13        |
| Oxidation         | Presence of alkaline KMnO <sub>4</sub> Pyrazoles are oxidized and form corresponding carboxylic acid pyrazole. | <br>Pyrazole ring with a HOOC group at the 4-position and a C <sub>6</sub> H <sub>5</sub> group at the 1-position.<br>1-phenyl-4-pyrazole carboxylic acid | 14        |
| Reduction         | Presence of sodium-ethanol, N-phenyl derivative may be reduced to corresponding pyrazoline.                    | <br>Pyrazoline ring with an NH group and a C <sub>6</sub> H <sub>5</sub> group attached to the nitrogen atom.<br>N-Phenyl Pyrazoline                      | 15        |
| Halogenation      | Under controlled condition pyrazole gives 4-mono halo pyrazoles                                                | <br>Pyrazole ring with a Cl atom at the 4-position and an H atom at the 1-position.<br>4-Chloro Pyrazole                                                  | 16        |

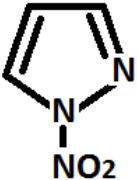
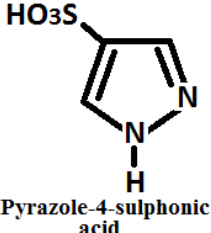
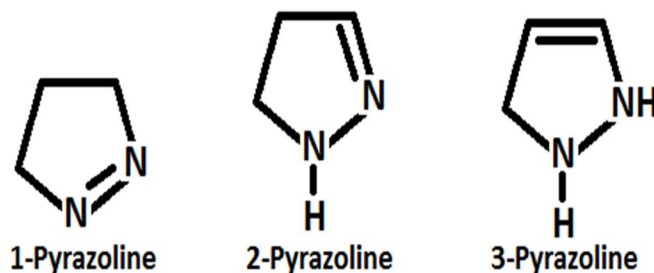
|              |                                                                                                            |                                                                                                                  |    |
|--------------|------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|----|
| Nitration    | Presence of Concentrated nitric acid Pyrazole undergo straight nitration at C-4, it gives 1-nitro-pyrazole | <br>1-Nitro-1H-Pyrazole       | 17 |
| Sulphonation | When Pyrazole reacts with fuming sulphuric acid to yield pyrazole 4-sulphonic acid.                        | <br>Pyrazole-4-sulphonic acid | 18 |

Table 2: Chemical properties of Pyrazole

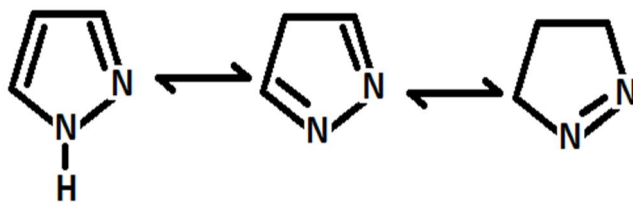
### III. AROMATICITY

Pyrazole contains six delocalized  $\pi$ -electrons and due to planar conjugated ring structure pyrazole shows aromaticity. Pyrazole shows many same properties when comparing with different benzene derivatives [19]. Pyrazoles shows three different tautomeric structure likely as other heterocyclic molecule contain nitrogen atom [20]. Pyrazoline, pyrazolidine and pyrazolone are reduce or oxidized form of pyrazole but they are not aromatic compounds due to the lack of delocalized  $\pi$  electrons and conjugation [21]. One of the two nitrogen atom of pyrazole molecule is pyrrole types and another one is pyridine types and between two nitrogen's one is basic in nature and another one is neutral. It is observed that bond length between position 3 and 4 atom has high value[22]. 2-Pyrazolines are most commonly examined pyrazoline-type heterocyclic systems[23] are observed among the three reduce form of pyrazole such as 1-pyrazoline, 2-pyrazoline and 3-pyrazoline[24].



### IV. CHEMICAL REACTIVITY

The chemical reactivity of the pyrazole moiety depends on the effect of individual atoms presence in ring system. Nitrogen atom at second position is basic in nature due to the presence of two electrons and hence react with electrophiles but nitrogen atom posit in one is unreactive but reduce or loses its proton in the presence of base. In pyrazole ring system C4 position is available for electrophilic attack due to the both nitrogen atom reduce charge density at C3 and C5 position. Presence of strong base C3 carbon leading to ring opening due to deprotonation. Electrophilic attack less likely occur at C4 position due to the protonation of pyrazole C3 position is also facilitated. Pyrazole anion shows more reactivity towards electrophiles rather than nucleophiles [25].

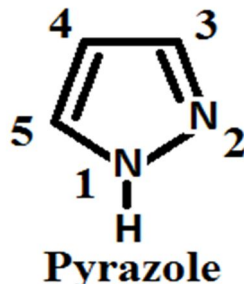


Three Tautomeric structure of pyrazole



## V. NOMENCLATURE

The nomenclature is started from the hydrogen attached with the nitrogen atoms in the Pyrazole ring. It is known as 1,2-diazole as because two nitrogen atoms attached with this ring. As per the heterocyclic criteria, nitrogen atom is called as aza as prefix. In this structure, two nitrogen atoms are present so the structure can be noted as 1,2-diazole. Due to presence of double bond in ring structure it can be classified under unsaturated derivative [12].



## VI. SYNTHETIC METHODOLOGIES

Pyrazole can be synthesized from  $\alpha,\beta$ -unsaturated aldehyde or ketones with hydrazines. Through dehydrogenation mechanism, Pyrazole was synthesized. 1,3-diketone is condensed with hydrazine to form pyrazoles. This condensation organic reaction is known as Knorr-pyrazole [26] condensation reactions. The mechanism of reaction is based upon some steps like attacking of entire hydrazine molecules on the carbonyl carbons of diketones and the imine derivatives formation to yield ultimately Pyrazole [27].

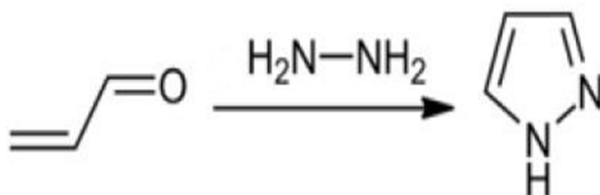


Figure: Synthetic scheme of Pyrazole [27]

## VII. STANDARD DRUGS CONTAINING THE PYRAZOLE RING

| Sl. No. | Drug                    | Activity          | References |
|---------|-------------------------|-------------------|------------|
| 1       | Pyrazofurin             | Anticancer        | 28 - 35    |
| 2       | Crizotinib              | Cytoprotective    |            |
| 3       | Celecoxib and Lonazolac | Antiinflammatory  |            |
| 4       | Difenamizole            | Analgesic         |            |
| 5       | Rimonabant              | Antiobesity       |            |
| 6       | Sildenafil              | Vasodilator       |            |
| 7       | Fezolamide              | Antidepressant    |            |
| 8       | Floxan                  | Anti-inflammatory | 36,37      |
| 9       | Pyrazomycin             | Anticancer        |            |
| 10      | Deramaxx                | NSAID             |            |

Table 3: Standard drugs containing the Pyrazole ring

### VIII. BIOLOGICAL ACTIVITY OF PYRAZOLE

| Sl. No. | Biological activity  | References |
|---------|----------------------|------------|
| 1       | Antitubercular       | 38         |
| 2       | Anti AIDS            | 39         |
| 3       | Anti malarial        | 40         |
| 4       | Anti microbial       | 41         |
| 5       | Anti tumor           | 42,43      |
| 6       | Anticancer           | 44         |
| 7       | Antifungal           | 45         |
| 8       | antihyperglycemic    | 46         |
| 9       | antidepressant       | 47         |
| 10      | anticonvulsant       | 48         |
| 11      | antipyretic          | 49         |
| 12      | antianxiety          | 50,51      |
| 13      | insecticidal         | 52         |
| 14      | Diuretic             | 50         |
| 15      | Cytotoxic            |            |
| 16      | Cardiovascular agent |            |

Table 4: Biological Activity of Pyrazole

### IX. CONCLUSION

Pyrazole is known as 1,2-diazole a five-membered heterocyclic compounds. It is basic and unsaturated. It is having very significant structure in modern heterocyclic organic chemistry as this structure is present in so many drugs containing antimalarials, antimicrobials, anticancer, antifungal, antidepressant, anticonvulsant, antipyretic, antianxiety, diuretic, antihyperglycemic, etc. This ring is showing very safe, stable and potent activities to improve the various efficacies against different diseases.

Conflict of Interest: Nil

### REFERENCES

- [1] Knorr, L. Action of ethyl acetoacetate on phenylhydrazine. I. *Chemische Berichte*. 1883. 16. 2597–2599.
- [2] Von Pechmann, Hans. Pyrazol aus Acetylen und Diazomethan. *Berichte der deutschen chemischen Gesellschaft (in German)*. 1898. 31(3). 2950–2951.
- [3] Al-Omar, M. A. Synthesis and Antimicrobial Activity of New 5-(2-Thienyl)-1,2,4-Triazoles and 5-(2-Thienyl)-1,3,4-Oxadiazoles and Related Derivatives. *Molecules*. 2010. 15. 502–514.
- [4] Zhao, H. Scaffold Selection and Scaffold Hopping in Lead Generation: a Medicinal Chemistry Perspective. *Drug Discov. Today*, 2007.12 (3–4). 149–155.
- [5] Faria, J. V., Vegi, P. F., Miguita, A. G. C., Dos Santos, M. S., Boechat, N., and Bernardino, A. M. R. Recently Reported Biological Activities of Pyrazole Compounds. *Bioorg. Med. Chem*. 2017. 25(21). 5891–5903.
- [6] Patil, S. B. Medicinal Significance of Pyrazole Analogues: A Review. *J. Pharm. Sci. Res*. 2012. (3). 402–404.
- [7] Yet, L. “Privileged Structures in Drug Discovery: Medicinal Chemistry and Synthesis,” in *Methods and Principles in Medicinal Chemistry*. London; Hoboken, NJ: John Wiley & Sons. 2018.
- [8] Badavath, V. N., and Jayaprakash, V. MAO Inhibitory Activity of 4,5-dihydro-1HPyrazole Derivatives: A Platform to Design Novel Antidepressants. *Front. Drug Des. Discov*. 2020. 1, 45.
- [9] Faisal, M., Saeed, A., Hussain, S., Dar, P., and Larik, F. A. Recent Developments in Synthetic Chemistry and Biological Activities of Pyrazole Derivatives. *J. Chem. Sci*. 2019. 131, 70.
- [10] Ran, F., Liu, Y., Zhang, D., Liu, M., and Zhao, G. Discovery of Novel Pyrazole Derivatives as Potential Anticancer Agents in MCL. *Bioorg. Med. Chem. Lett*. 2019. 29(9). 1060–1064.
- [11] Taher, A. T., Mostafa Sarg, M. T., El-Sayed Ali, N. R., and Hilmy Elnagdi, N. Design, Synthesis, Modeling Studies and Biological Screening of Novel Pyrazole Derivatives as Potential Analgesic and Anti-inflammatory Agents. *Bioorg. Chem*. 2019. 89, 103023.
- [12] Faisal M., Saeed A., Hussain S., Dar P and Larik F, Recent developments in synthetic chemistry and biological activities of pyrazole derivatives : *J. Chem. Sci*. 2019. 131. 70
- [13] Finar IL, Lord GH, Formylation of the pyrazole nucleus. *J Chem Soc*. 1957. 3314–3315.
- [14] Morgan GT, Ackerman J, Substitution in the pyrazole series. Halogen derivatives of 3 : 5-dimethylpyrazole. *J Chem Soc. Trans*. 1923. 123. 1308-1318.
- [15] Knorr L, Ueber eine Bildungsweise des 4-Phenylpyrazols. *Ber Dtsch Chem Ges*, 1895. 28. 699-701.
- [16] Kamiya M, The  $\pi$ -Electronic Structures of Five-membered Heterocycles Containing Two or Three Heteroatoms and Their Benzo-derivatives, *Bulletin of the Chemical Society of Japan*. 1970. 43(11). 3344-3353.
- [17] Caton MPL, Jones DH, Slack R, Wooldridge KRH, Isothiazoles, Part III, Reactions of isothiazol-5-yl-lithium compounds. *J Chem Soc*. 1964, 446-451.

- [18] Perez J, Riera L, Pyrazole Complexes and Supramolecular Chemistry, *European Journal of Inorganic Chemistry*, 2009. (33). 4913-4925
- [19] Krygowski TM, Anulewicz R, CyrafiskiMK, Puchala A, Rasata D. Separation of the energetic and geometric contribution to the aromaticity. Part IX. Aromaticity of pyrazoles in dependence on the kind of substitution. *Tetrahedron* .1998. 54. 12295.
- [20] Behr L C, Fusco R and Jarboe C H. *The Chemistry of Heterocyclic Chemistry: Pyrazoles, Pyrazolines, Pyrazolidines, Indazoles and Condensed Rings*. Wiley & Sons: London. 1967. p. 113.
- [21] Ansari A, Ali A and Asif M biologically active pyrazole derivatives. *New J. Chem.* 2017. 41. 16.
- [22] Dewangan D, Kumar T, Alexander A, Nagori K and Tripathi D K. Pyrazole: Their Chemistry and Pharmacological Potentials: A Review. *Curr. Pharmac. Res. Sat.* 2003. 4. 369.
- [23] Arunachalam S, Gowrishankar N L, Krishnan A, Prakash M, Muhsin T, NaseenaU and Poornima G. A brief review on pyrazole derivatives possessing various pharmacological and biological evaluation. *World J. Pharm. Pharma. Sci.* 2018. 5. 1496.
- [24] Md J A, Ozair A, Perwaiz A and Mohammad J N. A Review on Pyrazole chemical entity and Biological Activity. *International J. Pharm. Sci. Res.* 2015. 6. 1433.
- [25] Raj K B. *Heterocyclic Chemistry 4th edn.* (New International Publishers). 2007.
- [26] Knorr Synthesis, Pathak, RB, Chovatia PT and Parekh, HH. Synthesis, antitubercular and antimicrobial evaluation of 3-(4-chlorophenyl)-4-substituted pyrazole derivatives. *Bioorg. Med. Chem. Lett.* 2012; 22(5). 129-5133.
- [27] Poudyal B and Bharghav G; A review of pyrazole an its derivative ; *National Journal of Pharmaceutical Sciences.* 2021; 1(1). 34-41.
- [28] Hill, B. T., and Whelan, R. D. H. (1980). Antitumour Activity and Cell Kinetic Effects of Pyrazofurin In Vitro. *Eur. J. Cancer.* 1965. 16 (12). 1633-1638.
- [29] Kameyama, T., Nabeshima, T., Yoshida, N., and Yamaguchi, K. Neurochemical Studies of an Analgesic, 1,3-Diphenyl-5-(2-Dimethylaminopropionamide) - Pyrazole [difenamizole]. *Res. Commun. Chem. Pathol. Pharmacol.* 1981. 31 (1). 31-53.
- [30] Clemett, D., and Goa, K. L. Celecoxib. *Drugs.* 2000. 59. 957-980.
- [31] Samat, A., Tomlinson, B., Taheri, S., and Thomas, G. Rimonabant for the Treatment of Obesity. *Recent Pat. Cardiovasc. Drug Discov.* 2008. 3(3). 187-193.
- [32] Straube, S. Anti-inflammatory and Antipyretic Analgesics and Drugs Used in Gout. *Side Effects Drugs. Annu.*, 2012. 181-193.
- [33] Dopp, J. M., Agapitov, A. V., Sinkey, C. A., Haynes, W. G., and Phillips, B. G. Sildenafil Increases Sympathetically Mediated Vascular Tone in Humans. *Am. J. Hypertens.* 2013. 26 (6). 762-769.
- [34] Mitou, G., Frenzel, J., Desquesnes, A., Le Gonidec, S., AlSaati, T., Beau, I., et al. Targeting Autophagy Enhances the Anti-tumoral Action of Crizotinib in ALK-Positive Anaplastic Large Cell Lymphoma. *Oncotarget* 2015. 6 (30). 30149-30164.
- [35] Karrouchi, K., Radi, S., Ramli, Y., Taoufik, J., Mabkhot, Y., Al-aizari, F., et al. Synthesis and Pharmacological Activities of Pyrazole Derivatives: A Review. *Molecules.* 2018. 23(1). 134.
- [36] Faisal M, Saeed A, Larik F A, Ghumro S A, Rasheed S and Channar P A. WOWS Sol-Gel Based Synthesis and Structural, Morphological, Electrical and Magnetic Characterization of Co-Sm Doped M-Type Barium Hexaferrite Materials *J. Electron. Mater.* 2018.. 47. 7011.
- [37] Wyde P R, Gilbert B E and Ambrose M W. Comparison of the anti-respiratory syncytial virus activity and toxicity of papaverine hydrochloride and pyrazofurin in vitro and in vivo *Antiviral Res.* 1989. 11-15.
- [38] Bekhit A A, Hassan AM, Abd El Razik H A, El-Miligy M M, El-Agroudy E J and Bekhit Ael-D. New heterocyclic hybrids of pyrazole and its bioisosteres: Design, synthesis and biological evaluation as dual acting antimalarial-antileishmanial agents *Eur. J. Med. Chem.* 2015. 94. 30.
- [39] Sony J K and Ganguly S. A battle against AIDS: New pyrazole key to an older lock-reverse transcriptase *Int. J. Pham Pharm. Sci.* 2016. 8. 75.
- [40] Pai G and Chattopadhyay A P. N-arylation of nitrogen containing heterocycles with aryl halides using copper nanoparticle catalytic system *Tetrahedron Lett.* 2016. 57. 3140.
- [41] Surendra Kumar R, Arif I A, Ahamed A and Idhayadhulla A. Antiinflammatory and antimicrobial activities of novel pyrazole analogues *Saudi J. Biol. Sci.* 2016. 23. 614.
- [42] Alam R, Wahi D, Singh R, Sinha D, Tandon V, Grover A and Rahisuddin. Design, synthesis, cytotoxicity, Hu Topoll $\alpha$  inhibitory activity and molecular docking studies of pyrazole derivatives as anticancer agents *Bioorg. Chem.* 2016. 69. 77.
- [43] Shamsuzzaman S, Siddiqui T, AlamMG and Dar AM. Synthesis, characterization and anticancer studies of new steroidal oxadiazole, pyrrole and pyrazole derivatives *J. Saudi Chem. Soc.* 2015. 19. 387.
- [44] Faisal M, Hussain S, Haider A, Saeed A and Larik FA. Assessing the effectiveness of oxidative approaches for the synthesis of aldehydes and ketones from oxidation of iodomethyl group *Chem. Pap.* 2018. 73. 1053.
- [45] Ardiansah B. Recent reports on pyrazole-based bioactive compounds as candidate for anticancer agents *Asian J. Pharm. Clin. Res.* 2017. 12. 45.
- [46] Kees K L, Fitzgerald J J, Steiner K E, Mattes, Mihan B, Tosi T, Mondoro D and McCalebML. New potent antihyperglycemic agents in db/db mice: synthesis and structure-activity relationship studies of (4-substituted benzyl) (trifluoromethyl)pyrazoles and -pyrazolones *J. Med. Chem.* 1996. 39. 3920.
- [47] Bailey D M, Hansen P E, Hlavac A G, Baizman E R, Pearl J, Defelice A F and Feigenson M E. 3,4-Diphenyl-1H-pyrazole-1-propanamine antidepressants. *J. Med. Chem.* 1985. 28. 256.
- [48] Michon V, Penhoat C H D, Tombret F, Gillardin J M, Lepage F and Berthon L. Preparation, structural analysis and anticonvulsant activity of 3- and 5-aminopyrazole N-benzoyl derivatives *Eur. J. Med. Chem.* 1995. 30. 147.
- [49] Wiley R H and Wiley P. *Pyrazolones, Pyrazolidones and Derivatives* (New York: Wiley) 1964. p. 102.
- [50] Jamwal A, Javed A and Bhardwaj V. A review on pyrazole derivatives of pharmacological potential *J. Pharm. BioSci.* 2013. 3. 114.
- [51] Haufel J, Breitmaier E. Synthesis of Pyrazolo Heteroaromatic Compounds by Means of 5-Amino-3-methyl-1-phenylpyrazole-4-carbaldehyde *Angew. Chem.* 1974, 13. 604.
- [52] Heller S T and Natarajan S R. 1,3-Diketones from Acid Chlorides and Ketones: A Rapid and General One-Pot Synthesis of Pyrazoles *Org. Lett.* , 2006. 8. 2675.





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