

Synthesis of some 4-oxobenzotriazolo Hydrazones

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Abstract: New series of benzotriazolo hydrazones (15-19) were synthesized from the reaction of hydrazide of oxobenzotriazine (14) with some 4-aminobenzaldehydes (4-(pyrrolidin-1-yl)benzaldehyde (3), 4-(piperidin-1-yl)benzaldehyde (4), 4-morpholinobenzaldehyde (5) and 4-(1H-pyrazol-1-yl)benzaldehyde (6). These aldehydes were synthesized from the reaction of cyclic amines with 4-fluorobenzaldehyde. The other type of aldehyde (7-methyl-2-oxo-1,2-dihydroquinoline-3-carbaldehyde) (10) was synthesized in three steps starting from *m*-toluidine which was converted into amide (8), this amide was then transformed into (2-chloro-7-methylquinoline-3-carbaldehyde) (9) via Vilsmeier reaction and finally into (7-methyl-2-oxo-1,2-dihydroquinoline-3-carbaldehyde) (10). The synthesized compounds were studied using a combination of IR, NMR and Mass methods.

Keywords: oxobenzotriazol, hydrazone, 4-aminobenzaldehyde.

INTRODUCTION

Hydrazone is a class of organic compounds with the moiety $R_1R_2C=NNH_2$. This moiety plays an important key role in organic chemistry [1-7]. Generally, hydrazones can be synthesized by the reaction of the appropriate hydrazines/hydrazides with aldehydes or ketones in solvents such as ethanol, methanol, butanol tetrahydrofuran and glacial acetic acid [8-9]. A wide range of hydrazones have been proved to possess interesting biological activities including anticonvulsant [10], anti-inflammatory [11], antimalarial [12], antioxidant [13], antituberculous [14], anti-HIV [15,16] and anti-prion activities [17]. Due to the stability of hydrazones at the neutral pH they are used to couple with certain drugs. Hydrazones were also found to have applications in drug design and many heterocyclic synthesis [18]. Due to the ease of preparation of hydrazones and their reactivity toward electrophiles and nucleophiles they are used for the synthesis of variety of organic compounds such as heterocyclic compounds. Therefore, they have been studied for a long time although, much of their chemistry still unexplored [19]. It was known that Pyrrolidine, Morpholine and 1H-pyrazole have biological activities against many diseases [20-22]. Hydrazides themselves were also found to have significant biological activities against certain diseases [23], therefore converting these hydrazides into the corresponding hydrazones may increase their biological activities according to the well known C=N activity [18]. We reported here a new series of hydrazones containing these types of heterocyclic compounds. Furthermore, it was known that a large number of bioactive compounds and natural products containing the quinoline moiety in their skeletons have been investigated [24]. 3-substituted quinolone-2-one is one of the interesting moieties in compounds having anti-tumor activities was also investigated [25].

EXPERIMENTAL

All reagents were purchased from Sigma-Aldrich and used as supplied without further purification. Melting points were recorded on a Gallenkamp machine. $^1H/^{13}C$ NMR spectra were measured using a Bruker AV-1400 model NMR instrument at 400 MHz. Accurate mass measurements were achieved using a Water-Micromass LCT electrospray mass spectrometer. All reactions and measurements were accomplished at the chemistry department, university of Sheffield, United Kingdom. Aldehydes (3-6) were synthesized following the elsewhere procedure [26]. Aldehyde (10) was synthesized following the published procedure [27]. Compound (11) was synthesized according to the well-known procedure [28]. Ester (13) was synthesized following the published procedure [29]. Hydrazide (4) was synthesized following an earlier published procedure [30]. The structure of all compounds were confirmed based on their analytical and spectral NMR, mass & IR data and are well discussed.

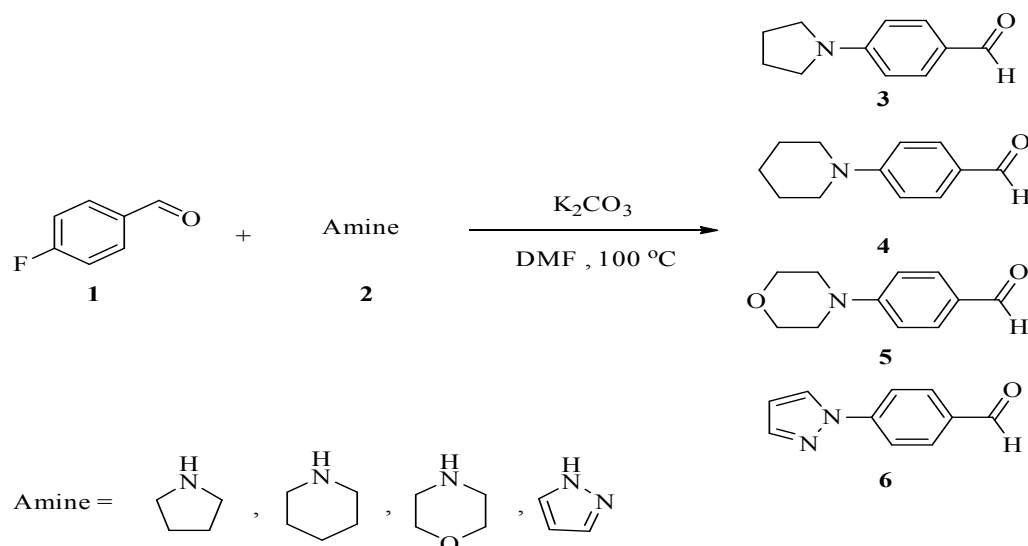
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GENERAL PROCEDURE FOR THE SYNTHESIS OF HYDRAZONES (15-19)

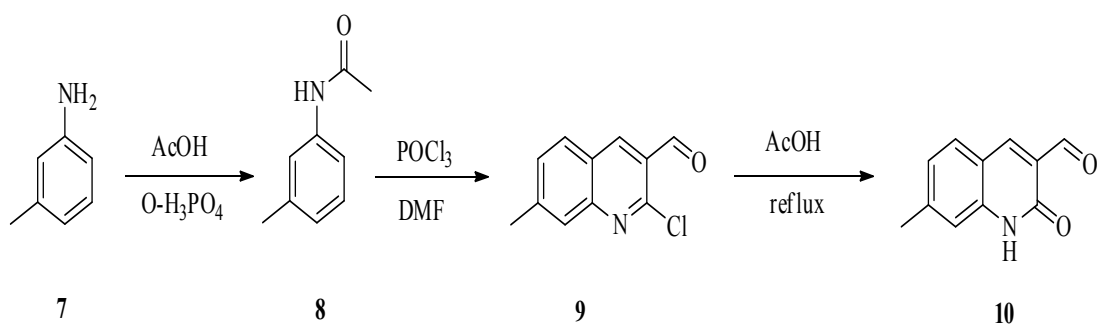
Equimolar quantities of hydrazide (14) and aldehydes 3, 4, 5, 6, or 10 were dissolved in 10 ml. absolute ethanol and refluxed for 3 hours. After the completion of the reaction (TLC monitoring), the mixture was allowed to cool to room temperature and concentrated by rotary evaporator. The residue was then purified by column chromatography using ethylacetate and petroleum ether 3:1 affording the pure product as a white solid. The physical and spectral data were presented below.

RESULTS AND DISCUSSION

New series of heterocyclic hydrazones were synthesized from the reaction of hydrazides of oxobenzotriazine with some 4-amino benzaldehyds. The reaction of 4-fluorobenzaldehyde with some cyclic amines afforded aldehydes (3-6) (Scheme 1) which were allowed to react with hydrazide (14) forming hydrazones (15-18) in good percentage yield (Scheme 3). On the other hand, an aromatic aldehyde containing quinoline moiety was synthesized in three steps (as it was mentioned before) in which the m-toluidine was treated with phosphoric acid to form the corresponding amide (8) (Scheme 2). The amide was then converted into 2-chloro-7-methylquinoline-3-carbaldehyde (9) via the Vilsmeier reaction using POCl_3 in DMF. Subsequently, the formed aldehyde was treated with concentrated acetic acid to form 7-methyl-2-oxo-1,2-dihydroquinoline-3-carbaldehyde (10) which was allowed to react with hydrazide (14) forming the new hydrazone (19), (Scheme 3).

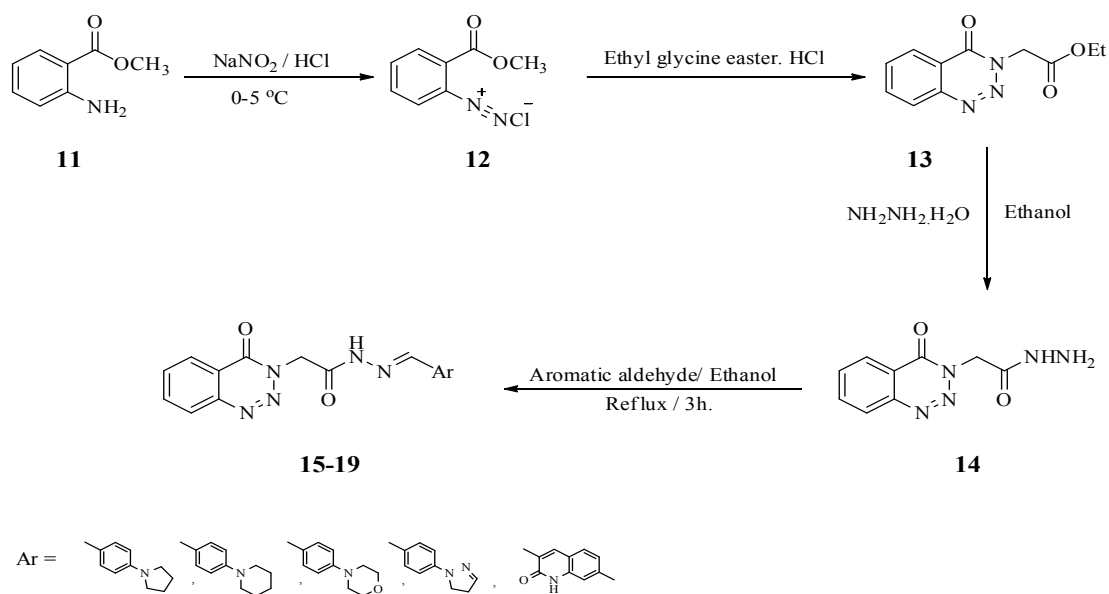


Scheme 1



Scheme 2

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Scheme 3

The ^1H NMR data of the formed hydrazone (15) showed a singlet at δ 11.6 for the NH group and two singlet at δ 5.6 and δ 5.2 for ($\text{CH}_2\text{C}=\text{O}$) resonating within the plane and out of the plane of the molecule respectively. While the ^{13}C NMR showed a signal at δ 167.3 for the ($\text{NHC}=\text{O}$), a signal at δ 155.3 for ($\text{NC}=\text{O}$) and a signal at δ 144.3 for the ($\text{C}=\text{N}$) which confirmed the formation of the hydrazone. Furthermore, the IR spectra showed a broad peak at 3330 cm^{-1} for (NH) group and two peaks at $1720, 1663\text{ cm}^{-1}$ for ($\text{C}=\text{O}$) and ($\text{C}=\text{N}$) group respectively. The other synthesized compounds showed nearly the same absorption bands of IR functional groups and also the values of ^1H and ^{13}C NMR signals showed nearly the same for the selected sample above (15). It is worth noting that the ^1H , ^{13}C NMR and the IR values for the synthesized hydrazones were found in agreement with the values mentioned in similar published compounds [31,32]. The high resolution mass spectra for all the synthesized hydrazones were agreed with their calculated mass as shown bellow.

(E)-2-(4-oxobenzotriazin-3(4H)-yl)-N'-(4-(pyrrolidin-1-yl)benzylidene) acetohydrazone (15).

White solid, mp: $146\text{--}147\text{ }^\circ\text{C}$. 67% yield. ^1H NMR (DMSO-d_6 , 400MHz): δ 11.6 (b, 1H, NH), 8.3-6.5 (m, 8 Ar-H), (s, 1H, CH), 5.5, 5.1 (s, 2H, CH_2 in and out of the plane), 3.3 (t, 4H, $J=4.0$ and 3.0 Hz , CH_2), 1.98 (m, 4H, CH_2). ^{13}C NMR (DMSO-d_6 , 100 MHz): δ 167.3, 155.3, 146.0, 144.3, 133.6, 133.5, 129.1, 128.9, 128.5, 125.0, 120.9, 112.0, 111.7, 51.1, 47.7, 25.4. ν_{max} (ATR) cm^{-1} 3330 (NH), 1720, 1663 ($\text{C}=\text{O}$), 1603 ($\text{C}=\text{N}$), 1337 ($\text{C}-\text{N}$). High resolution mass spectrum m/z % (ES): found 377.1742 requires for ($\text{C}_{20}\text{H}_{20}\text{N}_6\text{O}_2$ [$\text{M} + \text{H}$] $^+$) 377.1726.

(E)-2-(4-oxobenzotriazin-3(4H)-yl)-N'-(4-(piperidin-1-yl)benzylidene) acetohydrazone (16).

White solid, mp: $152\text{ }^\circ\text{C}$. 63% yield. ^1H NMR (DMSO-d_6 , 400MHz): δ 11.7 (b, 1H, NH), 8.3-6.9 (m, 8 Ar-H), (s, 1H, CH), 5.5, 5.12 (s, 2H, CH_2 in and out of the plane), 3.4 (m, 4H, CH_2), 1.51 (m, 6H, CH_2). ^{13}C NMR (DMSO-d_6 , 100 MHz): δ 167.5, 162.7, 152.8, 145.4, 144.3, 136.1, 133.6, 132.1, 125.0, 123.4, 119.6, 115.0, 113.5, 51.8, 51.1, 25.3, 24.3. ν_{max} (ATR) cm^{-1} 3481 (NH), 1711, 1653 ($\text{C}=\text{O}$), 1598 ($\text{C}=\text{N}$), 1331 ($\text{C}-\text{N}$). High resolution mass spectrum m/z % (ES): found 391.1869 requires for ($\text{C}_{21}\text{H}_{22}\text{N}_6\text{O}_2$ [$\text{M} + \text{H}$] $^+$) 391.1882.

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(E)-N'-(4-morpholinobenzylidene)-2-(4-oxobenzo[d][1,2,3]triazin-3(4H)-yl)acetohydrazide (17).

White solid, mp: 141 °C. 66% yield. ¹H NMR (DMSO-d₆, 400MHz): δ 11.7 (b, 1H, NH), 8.3-7.0 (m, 8 Ar-H), (s, 1H, CH), 5.5, 5.12 (s, 2H, CH₂ in and out of the plane), 3.75 (t, 4H, J=4.0Hz, CH₂), 3.2 (t, 4H, J=4.0 and 3.0Hz, CH₂). ¹³C NMR (DMSO-d₆, 100 MHz): δ 167.6, 155.3, 152.6, 145.3, 144.3, 136.1, 133.6, 128.8, 128.6, 125.0, 124.6, 119.6, 114.8, 66.4, 51.1, 47.9, 24.3. ν_{max} (ATR) cm⁻¹ 3194 (NH), 1702, 1665 (C=O), 1564 (C=N), 1331 (C-N). High resolution mass spectrum m/z % (ES): found 393.1691 requires for (C₂₀H₂₀N₆O₃ [M + H]⁺) 393.1675.

(E)-N'-(4-(1H-pyrazol-1-yl)benzylidene)-2-(4-oxobenzo[d][1,2,3]triazin-3(4H)-yl)acetohydrazide (18).

White solid, mp: 147-148 °C. 64% yield. ¹H NMR (DMSO-d₆, 400MHz): δ 11.9 (b, 1H, NH), 8.6-6.6 (m, 11 Ar-H), (s, 1H, CH), 5.62, 5.2 (s, 2H, CH₂ in and out of the plane). ¹³C NMR (DMSO-d₆, 100 MHz): δ 168.1, 163.3, 155.3, 147.0, 144.3, 144.1, 141.9, 141.0, 136.2, 133.6, 132.0, 128.8, 128.7, 128.6, 128.4, 125.0, 51.1. ν_{max} (ATR) cm⁻¹ 3124 (NH), 1699, 1670 (C=O), 1528 (C=N), 1336 (C-N). High resolution mass spectrum m/z % (ES): found 374.1370 requires for (C₁₉H₁₅N₇O₂ [M + H]⁺) 374.1365.

(E)-N'-((7-methyl-2-oxo-1,2-dihydroquinolin-3-yl)methylene)-2-(4-oxobenzo[d][1,2,3]triazin-3(4H)-yl)acetohydrazide (19).

White solid, mp: 168 °C. 64% yield. ¹H NMR (DMSO-d₆, 400MHz): δ 12.0 (b, 2H, NH, overlapped on each other), 8.5-7.0 (m, 8 Ar-H), (s, 1H, CH), 5.62, 5.2 (s, 2H, CH₂ in and out of the plane), 2.4 (s, 3H, CH₃). ¹³C NMR (DMSO-d₆, 100 MHz): δ 168.1, 161.5, 155.4, 144.3, 142.1, 140.2, 139.7, 136.2, 135.3, 133.6, 129.2, 128.6, 125.0, 124.4, 119.5, 117.4, 115.3, 51.2, 22.0. ν_{max} (ATR) cm⁻¹ 3387 (NH, quinolin), 3083 (NH) 1673, 1645 (C=O), 1566 (C=N), 1334 (C-N). High resolution mass spectrum m/z % (ES): found 389.1376 requires for (C₂₆H₂₀N₆O₃ [M + H]⁺) 389.1362.

CONCLUSION

From the above study, we conclude that the new hydrazide was successfully synthesised by hydrazenolysis of the corresponding ester. The structure of the final hydrazone compounds were also confirmed by the spectral methods stated above. These compounds might be important in medical applications especially as anti-prion diseases agents which will be investigated in our next work.

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