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# Synthesis of quinazoline-2,4(1*H*,3*H*)-diones from carbon dioxide and 2-aminobenzonitriles using [Bmim]OH as a homogeneous recyclable catalyst

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ABSTRACT

A green protocol for the synthesis of quinazoline-2,4(1*H*,3*H*)-diones from carbon dioxide and 2-aminobenzonitriles using a basic ionic liquid, 1-butyl-3-methyl imidazolium hydroxide ([Bmim]OH) as a catalyst have been reported. The effects of various reaction parameters like catalyst screening, catalyst loading, reaction time, solvent, temperature and pressure on the reaction system were investigated. A wide variety of aromatic aminobenzonitriles and five/six member *N*-heterocyclic carbonitriles were synthesized using this protocol. All these reaction were carried out under solvent-free condition. The ionic liquid was recovered and reused successfully for the title reaction. 6,7-Dimethoxyquinazoline-2,4(1*H*,3*H*)-diones, which is a key intermediates for several drugs (Prazosin, Bunazosin and Doxazosin) was synthesized successfully.

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## 1. Introduction

Carbon dioxide ($CO_2$) is one of the cheap, abundant natural carbon source and important $C_1$ building block for the synthesis of organic compounds. It is one of the major green house gases and hence the synthesis of $CO_2$-based industrially important chemicals has gained much interest in view of the sustainable chemistry and "green chemistry" concepts [1]. Several efforts have been made to replace phosgene-based routes via catalytic incorporation of $CO_2$ into organic substrates for their functionalization [2].

Quinazoline-2,4(1*H*,3*H*)-diones are important intermediates in the pharmaceutical industry as a key building blocks in the synthesis of FK 366 (Zenarestat) and KF 31327 molecules. FK 366 (Zenarestat), which functions as an aldose reductase inhibitor and also useful as a remedy for complication of diabetes mellitus [3,4]. KF 31327 was developed as a remedial drug for heart disease and as an impotence medicine [5]. The 6,7-dimethoxyquinazoline-2,4(1*H*,3*H*)-dione derivatives are useful building blocks in the synthesis of alpha adrenergic receptor antagonists such as Prazosin (Minipress®) [6], Bunazosin (Detantol®) [7] and Doxazosin (Cardenalin®) [8] and are also useful as anti-hypertensive.

Several synthetic methodologies exists for the preparation of quinazoline-2,4(1*H*,3*H*)-diones, i.e. via reaction of anthranilic acid with urea [9,10], anthranilamide with phosgene [11], and anthranilic acid with potassium cyanate [12] or chlorosulfonyl isocyanate [13]. However, the scope of these methodologies for the preparation of quinazoline-2,4(1*H*,3*H*)-diones are often limited by the requirement for specialized reagents, and operational complexity due to the use of either toxic or cumbersome reagents like phosgene. Few efforts were made to replace toxic reagents using incorporation of $CO_2$ into quinazoline-2,4(1*H*,3*H*)-diones derivatives. Mizuno and co-worker reports the synthesis of quinazoline-2,4(1*H*,3*H*)-diones by reacting $CO_2$ with 2-aminobenzonitrile in presence of 1,8-diazabicyclo[5.4.0]undec-7-ene (DBU) [14–17]. Recently we have reported cesium carbonate ($Cs_2CO_3$) catalyzed efficient synthesis of quinazoline-2,4(1*H*,3*H*)-diones using $CO_2$ and 2-aminobenzonitriles [18]. However, most of these reports have drawbacks like the high catalyst loading, lower substrate compatibility, use of organic solvents and the use of non-recyclable homogeneous base, which limits their application. There is sufficient scope for the development of an active and recyclable base catalyst for this transformation. Hence, considering the economical value of the quinazoline-2,4(1*H*,3*H*)-diones derivatives still there is need to develop a truly catalytic and environmentally viable protocol which can minimizes the number of unit operations and waste streams. With increasing interest in the green chemistry concept, organic solvent are being replaced by ionic liquids (ILs). Initially, ionic liquids were introduced as an alternative green reaction media because of their unique chemical and physical properties such as nonvolatility, nonflammability, thermal stability, and controlled miscibility [19]. Today ionic liquids are extensively used as a catalyst for the organic transformations [20]. Ranu and co-workers have designed a task specific ionic liquid for various chemical transformations [21]. They also reports use of 1-butyl-3-methyl imidazolium hydroxide

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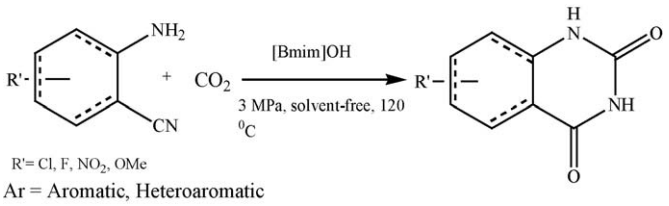



**Scheme 1.** Synthesis of quinazoline-2,4(1*H*,3*H*)-diones from substituted 2-aminobenzonitriles, five/six member *N*-heterocyclic carbonitriles and carbon dioxide.

([Bmim]OH) [22] for Michael addition [23] and Knoevenagel condensation [24]. Recently, Han and co-workers reported application of [Bmim]OH for the synthesis of disubstituted urea from amines and $CO_2$ [25]. Hence, in the framework of our effort on developing new methods based on $CO_2$ as a reagent [26,27], we herein report a facile protocol for the synthesis of quinazoline-2,4(1*H*,3*H*)-diones from $CO_2$ and 2-aminobenzonitriles using [Bmim]OH as an efficient base catalyst (Scheme 1).

[Bmim]OH showed a remarkable activity for the wide variety of substituted 2-aminobenzonitriles and five/six member *N*-heterocyclic carbonitriles with different steric and electronic properties. The recovery of the catalyst and separation of the product are easy. As per our knowledge this is the first homogeneous reusable catalyst for the title reaction.

## 2. Experimental

All chemicals were procured from firms of repute. Various substrate of 2-aminobenzonitrile were purchased from Sigma–Aldrich. All the chemicals were used as received without any further purification. [Bmim]OH was prepared by reported procedure and characterized by $^1$H NMR and IR [22].

### 2.1. Typical procedure for synthesis of quinazoline-2,4(1H,3H)-diones

A mixture of 2-amiobenzonitrile (20 mmol) and, [Bmim]OH (5 mmol) were place in a 100 mL stainless steel autoclave. The autoclave was flushed with carbon dioxide and then 3 MPa of carbon dioxide was taken. The reaction mixture was stirred at 120 °C for 18 h. After the completion of reaction, the autoclave was cooled to room temperature and the reaction mixture was poured in to water. The resulting precipitate was filter through Buckner funnel, washed with *t*-BuOMe (50 mL) and dried at 100 °C under vacuum. The [Bmim]OH in the filtrate was recovered by removing water under vacuum. The recovered [Bmim]OH was used directly for further recyclibility study. [Bmim]OH was characterized with Varian 400 MHz spectrometer. Isolated products were characterized by IR, $^1$H NMR, $^{13}$C NMR (Varian 300 MHz, 75 MHz) and MS.

### 2.2. Spectral data of selected products

*2.2.1. Table 3, entry* **2a***: (quinazoline-2,4(1H,3H)-diones)*

mp > 300 °C IR (KBr): 3252, 3056, 2840, 1720, 1704, 1668, 1621, 1444, 756 cm$^{-1}$ $^1$H NMR (300 MHz, DMSO, 25 °C, TMS): $\delta$ = 7.14–7.17 (m, 2H, 2 CH), 7.60 (t, $J$ = 7.5 Hz, 1H, CH), 7.87 (d, $J$ = 7.8 Hz, 1H, CH), 11.19 (s, 2H, NH) ppm. $^{13}$C NMR (75 MHz, DMSO, 25 °C, TMS): $\delta$ = 114.35, 115.33, 122.32, 126.96, 134.95, 140.88, 150.34, 162.86 ppm. MS: $m/z$ = 163.02 ($M^+$), 146.0, 90.0.

*2.2.2. Table 3, entry* **2e***: (6-nitroquinazoline-2,4(1H,3H)-dione)*

mp = 295–297 °C IR (KBr): 3241, 3016, 2868, 2823, 1712, 1624, 1500, 1336, 867 cm$^{-1}$ $^1$H NMR (300 MHz, DMSO, 25 °C, TMS): $\delta$ = 7.27 (d, 1H, CH), 8.41 (d, 1H, CH), 8.55 (s, 1H, CH), 11.7 (s, 2H, NH) ppm. $^{13}$C NMR (75 MHz, DMSO, 25 °C, TMS): $\delta$ = 114.51, 116.91, 123.12, 129.44, 141.60, 146.11, 150.26, 161.66 ppm. MS: $m/z$ = 206 ($M^+$), 163.0, 151.0, 94.9, 79.8.

*2.2.3. Table 3, entry* **2f***: (6-fluroquinazoline-2,4(1H,3H)-dione)*

mp > 300 °C IR (KBr): 3241, 3056, 2833, 1736, 1717, 1499, 1443, 828 cm$^{-1}$ $^1$H NMR (300 MHz, DMSO, 25 °C, TMS): $\delta$ = 7.17 (dd, 1H, CH), 7.56 (d, 1H, CH), 7.51 (d, 1H, CH), 11.29 (s, 2H, NH) ppm. $^{13}$C NMR (75 MHz, DMSO, 25 °C, TMS): $\delta$ = 115.53, 117.71, 122.77, 123.09, 137.61, 155.75, 158.92, 162.17 ppm. MS: $m/z$ = 179.0 ($M^+$), 135.0, 110.8, 94.9, 79.8.

*2.2.4. Table 3, entry* **2h***: (2,7-dihydro-pyrazolo[3,4-d]pyrimidine-4,6-dione)*

mp > 300 °C IR (KBr): 3150, 3000, 2829, 1714, 1684, 1478, 837 cm$^{-1}$ $^1$H NMR (300 MHz, DMSO, 25 °C, TMS): $\delta$ = 8.28 (s, 1H, CH), 10.68 (s, 2H, NH), 11.36 (s, 1H, NH) ppm. $^{13}$C NMR (75 MHz, DMSO, 25 °C, TMS): $\delta$ = 100.45, 129.76, 150.89, 152.07, 159.92 ppm. MS: $m/z$ = 151.0 (M−1), 107.0, 94.9.

## 3. Results and discussion

### 3.1. Influences of catalysts

Present work aims at the development of an efficient protocol for the synthesis of quinazoline-2,4(1*H*,3*H*)-diones derivatives from $CO_2$ and 2-aminobenzonitriles. Initially, the reaction of 2-aminobenzonitrile with $CO_2$ to afford quinazoline-2,4(1*H*,3*H*)-diones (**2a**), was chosen as a model reaction for the exploration of suitable catalyst. It is well known that bases can act as an effective catalyst for $CO_2$-based transformations and quest for the right basicity needs to be explored hence, activity of various organic and inorganic bases like $Cs_2CO_3$, *t*-BuOK, KF, and $Et_3N$ were tested for this reaction under solvent-free condition (Table 1).

It was observed that in the absence of a base, reaction did not proceed (entry 1). *t*-BuOK was found to be completely ineffective catalyst for this reaction (entry 3). Whereas, under the solvent-free conditions other bases like $Cs_2CO_3$, KF, and $Et_3N$ were found to give yield of **2a** in the range of 5–28% (entries 2, 4, 5). When the reaction was carried out using $Et_3N$ as a catalyst the reactant 2-aminobenzonitrile was dissolved due to which the reaction gave 28% of the desired product **2a**. Various ionic liquids such as [Bmim]$BF_4$, [Bmim]$HSO_4$ and [Bmim]OH were screened under solvent-free condition (entries 6–8). It was observed that acidic ILs such as [Bmim]$BF_4$ and [Bmim]$HSO_4$ were ineffective for this transformation. However, catalytic amount of [Bmim]OH was found to be most effective catalyst providing 90% yield of **2a** (entry 9). This shows the vital role of the hydroxyl counter anion of [Bmim]OH functionalized ionic liquid in this transformation.

**Table 1**
Influences of catalyst on the synthesis of quinazoline-2,4(1*H*,3*H*)-diones[a].

| Entry | Catalyst | Concentration of catalyst (mmol) | Yield[b] (%) |
|---|---|---|---|
| 1 | Without catalyst | 0 | 0 |
| 2 | $Cs_2CO_3$ | 5 | 10 |
| 3 | *t*-BuOK | 5 | 0 |
| 4 | KF | 5 | 5 |
| 5 | $Et_3N$ | 5 | 28 |
| 6 | [Bmim]$BF_4$ | 5 | 0 |
| 7 | [Bmim]$HSO_4$ | 5 | 0 |
| 8 | [Bmim]OH | 2.5 | 45 |
| 9 | [Bmim]OH | 5 | 90 |
| 10 | [Bmim]OH | 10 | 91 |
| 11 | [Bmim]OH | 15 | 89 |

[a] Reaction condition: 2-aminobenzonitriles (20 mmol), solvent-free, $CO_2$ (3 MPa), 18 h at 120 °C.
[b] Isolated yield.

**Table 2**
Influences of solvent on the synthesis of quinazoline-2,4(1*H*,3*H*)-diones[a].

| Entry | Catalyst | Solvent | Temperature (°C) | $CO_2$ (MPa) | Time (h) | Yield[b] (%) |
|---|---|---|---|---|---|---|
| Effect of solvent | | | | | | |
| 1 | [Bmim]OH | NMP | 120 | 3 | 18 | 0 |
| 2 | [Bmim]OH | DMF | 120 | 3 | 18 | 0 |
| 3 | [Bmim]OH | THF | 120 | 3 | 18 | 38 |
| 4 | [Bmim]OH | Toluene | 120 | 3 | 18 | 15 |
| 5 | [Bmim]OH | Acetonitrile | 120 | 3 | 18 | 0 |
| 6 | [Bmim]OH | Water | 120 | 3 | 18 | 65 |
| 7 | [Bmim]OH | Solvent-free | 120 | 3 | 18 | 90 |

[a] Reaction conditions: 2-aminobenzonitrile (20 mmol), [Bmim]OH (5 mmol), solvent (20 mL).
[b] Isolated yield.

Further, the effect of the amount of the catalyst on the reaction was optimized (entries 8–11). It was observed that the yield of **2a** was almost constant at 5, 10, and 15 mmol of [Bmim]OH. However, with lower amount of [Bmim]OH (2.5 mmol) gave lower yield of desired product **2a** (entry 8).

Thus using [Bmim]OH as a optimum base catalyst, we have examined the influences of other reaction parameters like solvent, temperature, pressure and time to evaluate the scope and limitation of the current catalyst system.

### 3.2. Influence of various solvents

The influence of various solvents on the reaction system was investigated (Table 2) (entries 1–6).

Solvents like NMP (*N*-methylpyrrolidone), DMF (*N*,*N*-dimethylformamide) and acetonitrile were found to be ineffective under the present condition, whereas, THF (tetrahydrofuran) and non-polar solvent like toluene were found to give only 38 and 15% yield of the **2a** respectively (entries 3–4). Water is a readily available, safe, cheap, and environmentally benign solvent so we tried to carry out reaction in water and it gave 65% yield of the **2a** (entry 6). It was observed that reaction gives 90% yield of the **2a** under solvent-free condition (entry 7). These results revealed that ionic liquid [Bmim]OH plays a significant role as a catalyst under solvent free conditions.

### 3.3. Influence of temperature

The influence of temperature on the yield of **2a** was investigated and the results obtained are shown in Fig. 1. The reaction was carried out at different temperatures (i.e. 100, 120, and 140 °C). It was observed that at 100 °C the yield of desired product was too low. With increasing the temperature to 120 °C, the desired product was obtained in 90% yield within 18 h. With further increase in temperature there is no pronounced effect on the yield of the product. Thus 120 °C was considered to be optimum temperature.

### 3.4. Influence of pressure

The influence of $CO_2$ pressure on reaction outcome was studied (Fig. 2), $CO_2$ pressure showed a significant effect on the synthesis of **2a**. It was observed that at 1 MPa of $CO_2$ pressure the yield of the desired product is too low 25%. At 2 MPa of $CO_2$ pressure 48% yield of the product **2a** was obtained. With further increase in the $CO_2$ pressure increase in the yield of the product was observed. When 3 MPa of $CO_2$ pressure applied 90% yield of the **2a** was obtained. Therefore, the 3 MPa of $CO_2$ pressure was optimal for the synthesis of the **2a**.

### 3.5. Influence of reaction time

Effect of reaction time was also studied and it was observed that the [Bmim]OH catalyst exhibits high activity (Fig. 3). It can be seen that almost quantitative yield 90% was achieved within 18 h. Further increase in reaction time to 20 h does not affect the yield of **2a**. Therefore, the reaction time of 18 h was optimal for the synthesis of **2a** at 120 °C. Hence the optimum reaction parameters are: catalyst: [Bmim]OH (5 mmol), solvent-free, temperature: 120 °C, $CO_2$ pressure: 3 MPa, and time: 18 h.

### 3.6. Catalyst recyclibility

The reusability of the catalyst was also examined for the synthesis of **2a** derivatives from $CO_2$ and 2-aminobenzonitriles. The recycling of [Bmim]OH was performed with the catalyst used

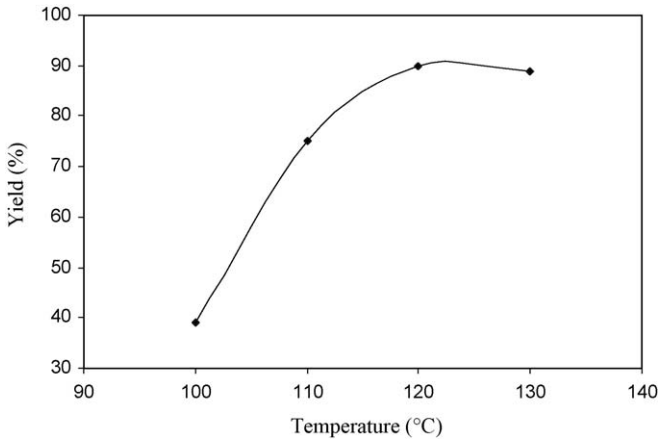



**Fig. 1.** Influence of temperature on the synthesis of quinazoline-2,4(1*H*,3*H*)-diones. Reaction conditions: 2-aminobenzonitrile (20 mmol), ([Bmim]OH) (5 mmol), solvent-free, $CO_2$ (3 MPa), time (18 h). Isolated yield.

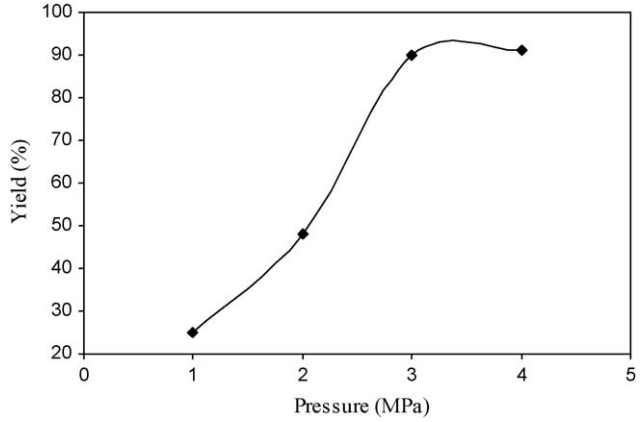



**Fig. 2.** Influence of pressure on the synthesis of quinazoline-2,4(1*H*,3*H*)-diones. Reaction conditions: 2-aminobenzonitrile (20 mmol), ([Bmim]OH) (5 mmol), solvent-free, temperature (120 °C), time (18 h). Isolated yield.

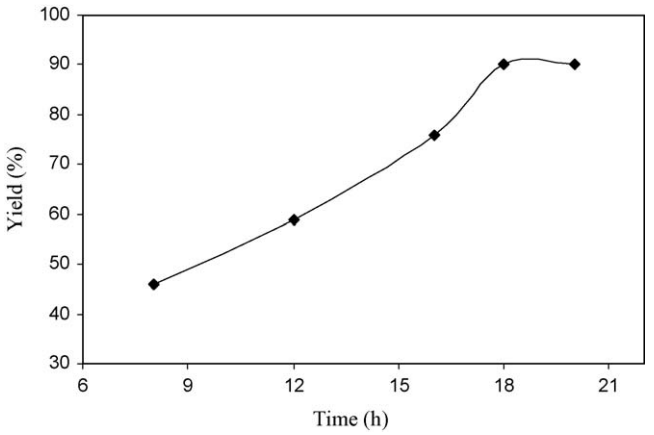



**Fig. 3.** Influence of reaction time on the synthesis of quinazoline-2,4(1*H*,3*H*)-diones. Reaction conditions: 2-aminobenzonitrile (20 mmol), ([Bmim]OH) (5 mmol), solvent-free, $CO_2$ (3 MPa), temperature (120 °C). Isolated yield.

in (Table 2, entry 7). The result showed that catalyst can be successfully recycled and the reusability procedure was tested up to four times (Fig. 4). The used [Bmim]OH was characterized using IR and $^1$H NMR, and it was observed that the structure of the used [Bmim]OH was the same as the original one.

### 3.7. Substrate study

Optimized reaction conditions were then applied for the synthesis of quinazoline-2,4(1*H*,3*H*)-diones **2a**–**2h** from various substituted 2-aminobenzonitrile which provides moderate to good yields (Table 3).

Various electron-donating and electron-withdrawing groups such as –OMe, –$NO_2$, –F, –Cl, were well tolerated to give the desired quinazoline-2,4(1*H*,3*H*)-diones in good to excellent yields. The reaction of 2-aminobenzonitrile **1a** with $CO_2$ provided 90% yield of quinazoline-2,4(1*H*,3*H*)-dione **2a** under optimum reaction conditions (entry 1). When 2-amino-4-5-dimethoxybenzonitrile **1b** was allowed to react with $CO_2$ under the present reaction conditions it gave an excellent yield of 6-7-dimethoxyquinazoline-2,4(1*H*,3*H*)-dione **2b** (85%) (entry 2). Compound **2b** is a key intermediate for the synthesis of Prazosin (Mini-press), Bunazosin (Detantol) and Doxazosin (Carde-nalin). Effect of electron withdrawing substituents like –Cl, –$NO_2$, and –F on 2-amino-benzonitrile was

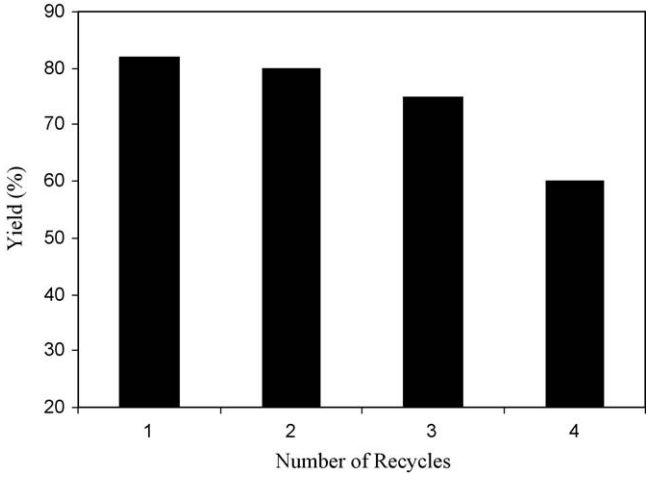
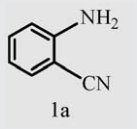
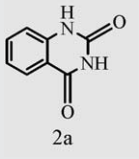
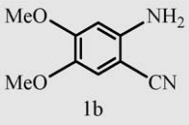
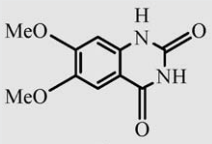
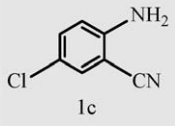
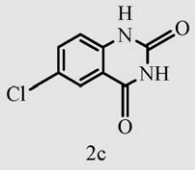
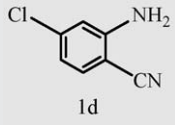
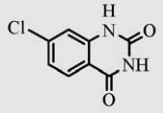
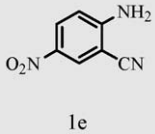
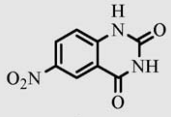
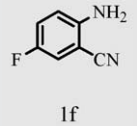
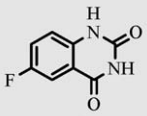
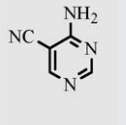
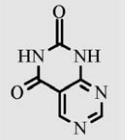
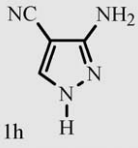
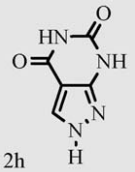
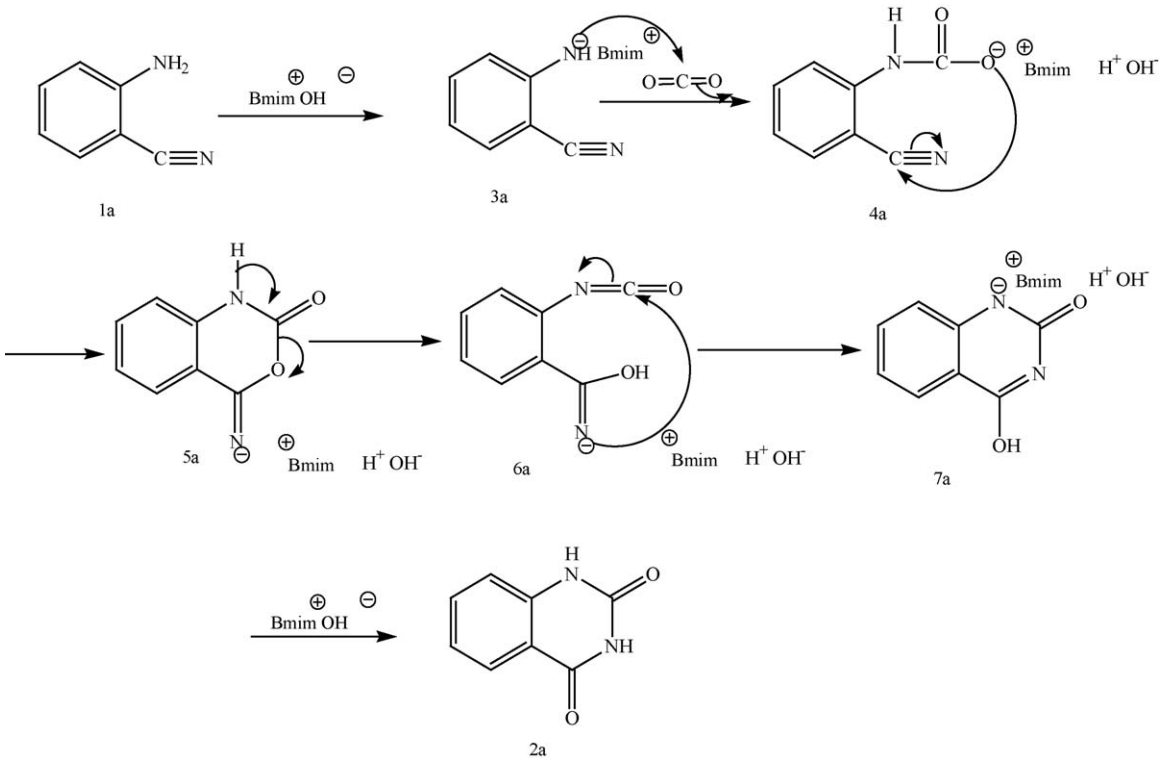



**Fig. 4.** Catalyst recyclibility on the synthesis of quinazoline-2,4(1*H*,3*H*)-diones. Reaction conditions: 2-aminobenzonitrile (20 mmol), ([Bmim]OH) (5 mmol), solvent-free, $CO_2$ (3 MPa), temperature (120 °C), time (18 h). Isolated yield.

**Table 3**
Synthesis of quinazoline-2,4(1*H*,3*H*)diones **2a**–**2h** carbonyl compounds[a].

| Entry | Reactant | Product | Yield[b] (%) |
|---|---|---|---|
| 1 |  1a |  2a | 90 |
| 2 |  1b |  2b | 85 |
| 3 |  1c |  2c | 82 |
| 4 |  1d |  2d | 76 |
| 5 |  1e |  2e | 52 |
| 6 |  1f |  2f | 80 |
| 7 |  1g |  2g | 35 |
| 8 |  1h |  2h | 48 |

[a] Reaction condition: reactant (20 mmol), [Bmim]OH (5 mmol), solvent-free, $CO_2$ (3 MPa), 18 h at 120 °C.
[b] Isolated yield.




**Scheme 2.** The possible reaction path.

investigated. It was observed that 2-amino-5-chlorobenzonitrile **1c** smoothly reacts with $CO_2$ providing excellent yield up to 82% of the 6-chloro-1H-quinazoline-2,4-dione **2c** (entry 3). Whereas, 2-amino-4-chlorobenzonitrile **1d** providing only 76% yield of 7-chloroquinazoline-2,4(1*H*,3*H*)-dione **2d** under the present experimental conditions (entry 4). Mizuno and co-worker reports that DBU reagent was unable to convert 2-amino-5-nitrobenzonitrile **1e** to expected 6-nitroquinazoline-2,4(1*H*,3*H*)-dione **2e**. They also report that due to its low basicity, 2-amino-5-nitrobenzonitrile **1e** gave a complex mixture instead of the expected product [17]. However, the present catalytic system works well for the synthesis of 2-amino-5-nitrobenzonitrile **1e** providing 52% yield of the 6-nitroquinazoline-2,4(1*H*,3*H*)-dione **2e** (entry 5). The group like methoxy is found to seize the reaction in positive direction to give the higher yield of the desired product because of its electron-donating tendency which increases the basicity of the reactant. However, electron-withdrawing group such as $NO_2$ is found to decrease the basicity of the reactant leads to decrease in yield. Apart from the 2-amino-4-chlorobenzonitrile/2-amino-5-chlorobenzonitrile, reaction of 2-amino-5-fluorobenzonitrile **1f** was also found to proceed smoothly providing 80% yield of the 6-fluroquinazoline-2,4(1*H*,3*H*)-dione **2f**. In order to explore the generality of the protocol, we turned our attention towards the six member *N*-heterocyclic carbonitrile and results were summarized in the (Table 3). The reaction of the 4-amino-5-pyrimidinecarbonitrile **1g** with $CO_2$ provided 35% yield of 1H-pyrimido[4,5-d]pyrimidine-2,4-dione **2g** under present reaction conditions (entry 7). Encouraged by these results, the catalyst was then subjected for the reaction of five member *N*-heterocyclic carbonitrile. It was observed that 3-aminopyrazole-4-carbonitrile **1h** smoothly reacts with $CO_2$ providing 48% yield of the 2,7-dihydropyrazolo[3,4-d]pyrimidine-4,6-dione **2h** (entry 8). Thus, the protocol proved to be general for the $CO_2$ fixation reaction of various structurally and electronically different aminobenzonitriles and five/six membered *N*-heterocyclic carbonitriles providing good to excellent yield of the desired quinazoline-2,4(1*H*,3*H*)-dione. It indicates a broad field of application of the present methodology and its wider functional group compatibility.

The probable reaction pathway for [Bmim]OH catalyzed synthesis of quinazoline-2,4(1*H*,3*H*)-diones **2a** using 2-aminobenzonitrile **1a** and $CO_2$ is shown in Scheme 2.

The amide **3a** which is generated in situ, can be formed by the reaction of 2-aminobenzonitrile **1a** with [Bmim]OH in solvent-free condition [28]. The amide **3a** rapidly reacts with $CO_2$, giving rise to carbamate ester **4a**. As the temperature increase, the ion exchange reaction takes place between the carbamic acid and [Bmim]OH. As a result, the carbamate anion is activated by the 1-butyl-3-methyl imidazolium ion $[Bmim]^+$ [25]. Then nucleophilic cyclization of **4a** in to **5a**, followed by the rearrangement of **5a** by way of the isocyanate intermediate **6a**, which gives **7a**. Finally, stabilization of **7a** gives the final product **2a**. The formation of isocyanate intermediate **6a** assisted by the *o*-cyano group appears to be importance [17]. At the same time, [Bmim]OH is regenerated to complete the catalytic reaction cycle.

## 4. Conclusion

We have developed an efficient protocol for the synthesis of quinazoline-2,4(1*H*,3*H*)-diones from 2-aminobenzonitrile and $CO_2$ using relatively cheap, and well defined [Bmim]OH as a efficient catalyst. As per our knowledge this is the first homogeneous reusable catalyst for the title reaction. The reaction was optimized with respect to various electron-rich, electron-deficient aminobenzonitriles and five/six member *N*-heterocyclic carbonitriles providing good to excellent yield of the desired quinazoline-2,4(1*H*,3*H*)-dione. This method offers marked improvements with regard to operational simplicity, high isolated yields of products, greenness of the procedure, avoiding hazardous organic solvents and toxic catalyst. Considering the economical value of the quinazoline-2,4(1*H*,3*H*)-diones derivatives we developed a new

methodology which minimizes the number of unit operations and waste streams.

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