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Reaction of 1-Nitroso-2-naphthols with α-Functionalized Ketones and Related Compounds: The Unexpected Formation of Decarbonylated 2-Substituted Naphtho[1,2-*d*][1,3]oxazoles

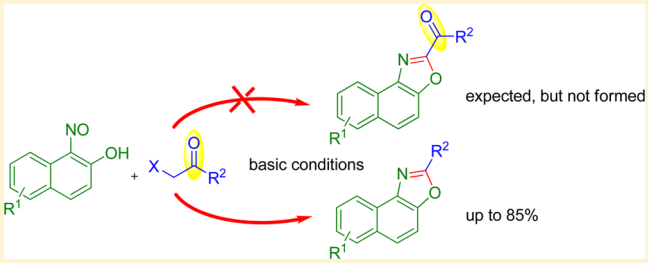
Nayyef Aljaar,[†] Chandi C. Malakar,[†] Jürgen Conrad,[†] Wolfgang Frey,[‡] and Uwe Beifuss[†,*]

[†]Bioorganische Chemie, Institut für Chemie, Universität Hohenheim, Garbenstraße 30, D-70599 Stuttgart, Germany

[‡]Institut für Organische Chemie, Universität Stuttgart, Pfaffenwaldring 55, D-70569 Stuttgart, Germany

Supporting Information

ABSTRACT: Reactions between 1-nitroso-2-naphthols and α-functionalized ketones such as α-bromo-, α-chloro-, α-mesyloxy-, α-tosyloxy-, and α-hydroxy ketones under basic conditions delivered 2-substituted naphtho[1,2-*d*][1,3]oxazoles in a single synthetic operation. The product formation was accompanied by the unexpected loss of the C═O group from the α-functionalized ketones. With aryl bromides, allyl bromides, α-bromo diketones, α-bromo cyanides, α-bromoesters, and α-bromo ketoesters as substrates the formation of naphtho[1,2-*d*][1,3]oxazoles was also observed. The transformations were performed in 1,2-dichloroethane or acetonitrile under reflux and gave the corresponding naphthoxazoles with yields ranging between 52% and 85%.



INTRODUCTION

A number of natural products containing benzoxazole or naphthoxazole moieties are known,[1] including the antimycobacterial pseudopteroxazole from the West Indian gorgonian coral *Pseudopterogorgia elisabethae*,[2] UK-1 from *Streptomyces* sp. 517-02,[3] AJI9561 from *Streptomyces* sp. AJ9561,[4] salviamine B and isosalviamine E from *Salvia yunnanensis*,[5a] as well as salvianen and neosalvianen from *Salvia mitiorrhiza*[5b] (Figure 1).

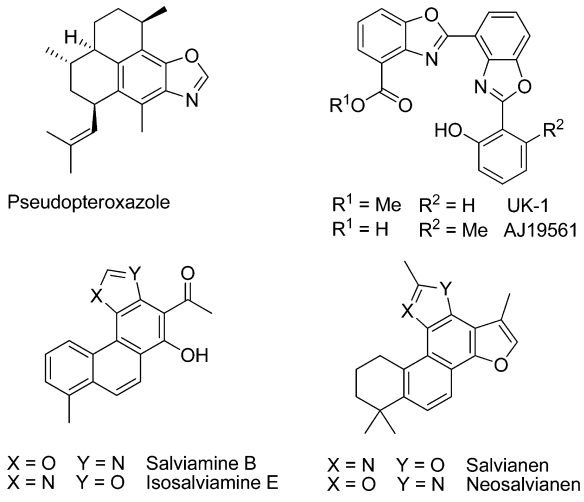


Figure 1. Natural products with annulated oxazole moieties.

Benzoxazoles and naphthoxazoles exhibit a wide range of pharmacologically important biological activities. They have been shown to act as cathepsin inhibitors,[6] topoisomerase II inhibitors,[7] PTP-1B inhibitors,[8] lysophosphatidic acid acyltransferase-β inhibitors,[9] 5-HT$_3$ receptor partial agonists,[10] estrogen receptor-β agonists,[11] and melatonin receptor agonists.[12] In addition, annulated oxazoles are increasingly gaining importance in materials science, especially in the field of fluorescent materials.[13]

Consequently, the development of synthetic methods for the preparation of functionalized annulated oxazoles has received considerable attention.[14] To date, various methods have been reported for the synthesis of 2-alkylated and 2-arylated benzoxazoles, as well as related heterocycles. Among the more traditional approaches are reactions between 2-aminophenols and carboxylic acid derivatives, such as carboxylic acids,[15a,c,d,g−i] carboxylic acid chlorides,[15b,d,e] carboxylic acid anhydrides,[15f] and carboxylic amides;[15h,i] reactions between 2-aminophenols and aldehydes followed by oxidation;[16] intramolecular cyclizations of *N*-(2-haloaryl)carboxamides under strong basic conditions;[17] and the ring contraction of 1,4-benzoxazinones.[18] More recently, a number of Cu-catalyzed approaches to the benzoxazole ring system have been discovered, including the intramolecular cyclization of *N*-(2-haloaryl)carboxamides,[19] the intramolecular oxidative C−O coupling of *N*-(2-aryl)carboxamides,[20] the reaction between 1,2-dihaloarenes and carboxamides,[21] as well as the reaction between 2-bromoanilines and acyl chlorides.[21a] There is also a couple of methods that are based on the functionalization of the 2-position of the benzoxazole ring. They include a number of Pd-catalyzed cross-coupling reactions[22] as well as the

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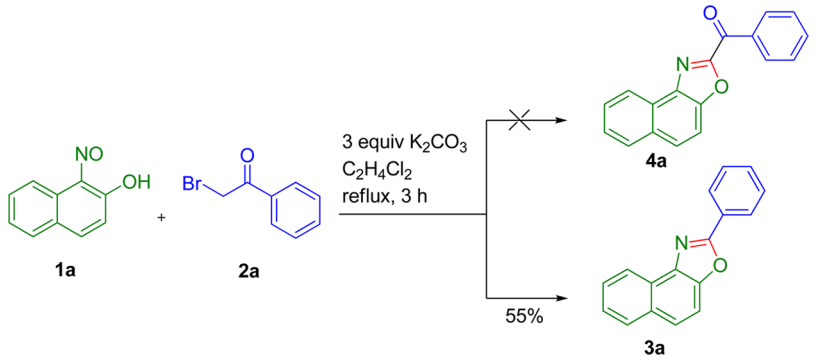
Scheme 1. Unexpected Formation of 2-Phenylnaphtho[1,2-*d*][1,3]oxazole (3a)



transition-metal-catalyzed direct arylation of benzoxazoles with activated aryls.[23] Another approach to 2-alkylated and 2-arylated annulated oxazoles is based on the reaction of *o*-hydroxy nitroso aryls with alkyl halides and benzyl halides.[24] However, it seems that scope and limitations of this method have not been explored in depth. Apart from the synthesis of 2-alkylated and 2-arylated derivatives, the preparation of annulated oxazoles carrying a functional group such as a carbonyl, an ester, or a nitrile group at C-2 is also of great interest.[14,25]

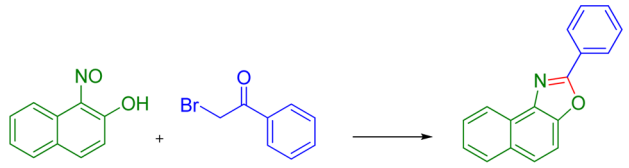
Here, we report the preparation of 2-arylated as well as 2-functionalized naphthoxazoles from the reaction of 1-nitroso-2-naphthols with α-functionalized ketones, α-bromo diketones, aryl bromides, allyl bromides, α-bromo cyanides, α-bromoesters, and α-bromo ketoesters.

RESULTS AND DISCUSSION

Inspired by earlier results showing that benzyl bromides can undergo reaction with 1-nitroso-2-naphthols to produce 2-aryl-substituted naphtho[1,2-*d*][1,3]oxazoles,[24] we envisioned that 2-aroyl naphtho[1,2-*d*][1,3]oxazoles could be obtained in a similar fashion if the benzyl bromides were replaced with α-functionalized acetophenones. To synthesize the 2-benzoyl-substituted naphtho[1,2-*d*][1,3]oxazole **4a**, the reaction between 1 equiv of 1-nitroso-2-naphthol (**1a**) and 2 equiv of α-bromo acetophenone (**2a**) was performed. It was found that after 3 h at reflux in 1,2-dichloroethane under basic conditions the nitrosonaphthol was fully consumed. However, it came as a surprise when, instead of the expected 2-benzoylnaphtho[1,2-*d*][1,3]oxazole (**4a**), the corresponding 2-phenylated compound **3a** was isolated as the sole product in 55% (Scheme 1).

This unexpected result implies that the reaction between **1a** and **2a** is accompanied by a decarbonylation. As most of the few decarbonylations of ketones need to be performed in the presence of transition metals[26] or under photochemical conditions,[27] it was decided to study the reaction between 2-nitroso-1-naphthols **1** and α-functionalized acetophenones **2** in greater detail. First, the model reaction between **1a** and **2a** was optimized with regard to solvent, base, the amount of base, and the ratio of the starting materials (Table 1). It was found that the transformation can be performed not only in 1,2-dichloroethane but also in a number of other solvents including tetrahydrofuran, acetone, acetonitrile, *N*,*N*-dimethylformamide, and *o*-dichlorobenzene (Table 1, entries 1−6). However, in no case did the yield exceed that obtained in 1,2-dichloroethane (Table 1, entry 2). It was also possible to replace K_2CO_3 by other bases, such as K_3PO_4, Cs_2CO_3, C_2H_5ONa, and NaOH (Table 1, entries 7−10). Again, the yields were always lower

Table 1. Optimization of the Reaction between 1-Nitroso-2-naphthol (1a) and α-Bromo Acetophenone (2a)



1a 2a 3a

entry	molar ratio **1a**:**2a**	base (equiv)	solvent	*T* (°C)	*t* (h)	yield of **3a** (%)
1	1:2	K_2CO_3 (3)	THF	reflux	6.5	40
2	1:2	K_2CO_3 (3)	$C_2H_4Cl_2$	reflux	3	55
3	1:2	K_2CO_3 (3)	CH_3COCH_3	reflux	3	32
4	1:2	K_2CO_3 (3)	CH_3CN	reflux	3	43
5	1:2	K_2CO_3 (3)	DMF	85	3	42
6	1:2	K_2CO_3 (3)	*o*-$C_6H_4Cl_2$	85	3	41
7	1:2	K_3PO_4 (3)	$C_2H_4Cl_2$	reflux	4	53
8	1:2	Cs_2CO_3 (3)	$C_2H_4Cl_2$	reflux	4.5	49
9	1:2	C_2H_5ONa (3)	$C_2H_4Cl_2$	reflux	3	24
10	1:2	NaOH (3)	$C_2H_4Cl_2$	reflux	3	37
11	1:1	K_2CO_3 (3)	$C_2H_4Cl_2$	reflux	3	70
12	2:1	K_2CO_3 (3)	$C_2H_4Cl_2$	reflux	3	80
13	2:1	K_2CO_3 (2)	$C_2H_4Cl_2$	reflux	3	72
14	2:1	K_2CO_3 (1)	$C_2H_4Cl_2$	reflux	3	58

than that observed with K_2CO_3 (Table 1, entry 2). Then, the influence of the ratio of **1a** and **2a** on the outcome of the reaction was studied (Table 2, entries 1, 11, and 12). Interestingly, the yield of **3a** could be increased to 70% and 80%, respectively, when the ratio of **1a** and **2a** was changed from 1:2 to 1:1 and 2:1, respectively. Best results were observed when a 2:1 mixture of **1a** and **2a** was employed (Table 1, entry 12). Under these conditions, **3a** could be isolated in 80% yield. Reduction of the amount of K_2CO_3 to 2 and 1 equiv, respectively, was associated with a drop of the yield (Table 1, entries 13 and 14). Remarkably enough, under all reaction conditions the decarbonylated product **3a** was formed exclusively. Not even a trace of ketone **4a** was formed.

Although the mechanism of the transformation is not known in detail (vide infra), it is clear that $Br^{\ominus}$ acts as a leaving group. This is why we studied whether the Br atom in **2a** can be replaced by other typical leaving groups. As expected, α-chloro acetophenone (**2b**) can also be employed as a substrate (Table 2, entry 1). However, the yield of **3a** dropped to 60%. The Br atom can also be replaced by a mesyloxy as well as a tosyloxy group. The yield of **3a** amounted to 76% and 85%, respectively

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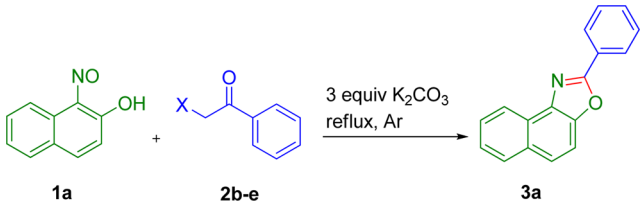
Table 2. Synthesis of 3a Using Different α-Functionalized Acetophenones[a]



1a 2b-e 3a

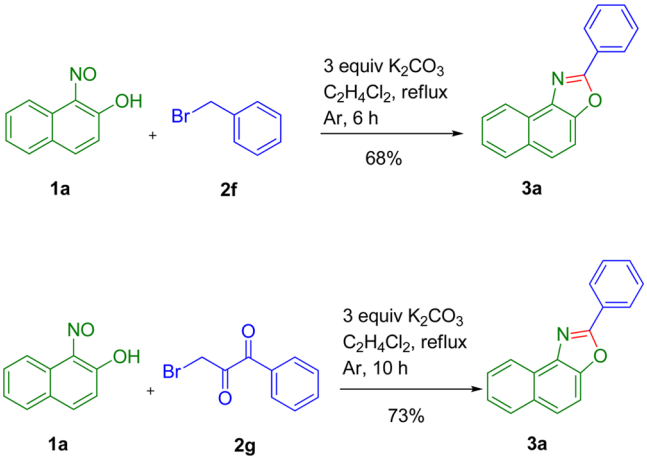
entry	2	X	t (h)	yield of 3a (%)
1	b	Cl	5	60[b]
2	c	OMs	6.5	76[c]
3	d	OTs	9	85[c]
4	e	OH	4	73[c]

[a]2 mmol of **1a** was reacted with 1 mmol of **2**. [b]The reaction was performed in 1,2-dichloroethane. [c]The reaction was performed in acetonitrile.

(Table 2, entries 2 and 3). Remarkably, α-hydroxy acetophenone **2e** could also be used as starting material (Table 2, entry 4). Despite the finding that with the α-tosyloxy ketone **2d** the yield of **3a** was slightly better than with the α-bromo ketone **2a** as the substrate, all further reactions were performed with α-bromo-functionalized compounds.

With optimized reaction conditions available, two control reactions were performed. First, **1a** was reacted with benzyl bromide (**2f**) as the substrate to yield **3a** as the only product in 68% (Scheme 2). This result is in good agreement with the

Scheme 2. Two Control Experiments



results of Yao and Hung.[24a] Next, **1a** was reacted with bromomethyl phenyl diketone (**2g**). It came as a big surprise to us when again **3a** was the only product formed, this time in 73% yield. This finding implies that the transformation with the diketone proceeds with the formal loss of two C=O groups. As far as we know such loss of two C=O groups has not been reported before.

To evaluate the scope of the new transformation, the reaction of **1** with several bromomethyl aryl ketones was conducted. First, bromomethyl phenyl ketones **2h–p** carrying different substituents on the phenyl ring were studied. It was found that a number of substituents, including methyl-, methoxy-, halo-, cyano-, and methoxycarbonyl substituents, were tolerated (Table 3, entries 1–9). The yields of **3b–j** were in the range of 65–78%. It seems that the electronic effects of the substituent(s) on the phenyl group of **2** can be disregarded as both electron-donating and electron-withdrawing groups gave similar results. Furthermore, it was established that the oxazole formation can also be performed with bromomethyl 2-naphthyl ketone (**2q**) and bromomethyl 1-pyrenyl ketone (**2r**) as the substrates (Table 3, entries 10 and 11). The reaction also tolerates the use of substituted nitrosonaphthols such as 6-methoxy-1-nitroso-2-naphthol (**1b**) (Table 3, entry 12).

In another set of experiments it was studied whether the bromomethyl aryl ketones can be replaced with other functional groups (Table 4). The reactions of **1a** with 1-bromo-3-methyl-2-butene (**2s**) and 1-bromo-4-methyl-3-pentene-2-one (**2t**) clearly demonstrated that allyl bromides as well as bromomethyl vinyl ketones can be employed as substrates. With both starting materials, the 2-vinylated naphthoxazole **3n** was isolated (Table 4, entries 1 and 2). The transformation with bromo acetonitrile (**2u**) produces **3o** in 75% and therefore is an interesting alternative for the synthesis of 2-cyano oxazole moieties (Table 4, entry 3). Finally, the transformations with the α-bromoester **2v** and the α-bromo ketoester **2w** were studied. It turned out that with both substrates the same product, namely, the naphtho[1,2-*d*][1,3]oxazole-2-carboxylic acid ethyl ester (**3p**), was formed exclusively (Table 4, entries 4 and 5).

With respect to the reaction mechanism, it is assumed that the transformation starts with the reaction of **1a** (in the form of its *o*-quinone oxime tautomer) with the α-bromoketone **2a** to give the oxime ether **5**. This is followed by rearrangement of **5** to the corresponding nitrone **6**, which after deprotonation to **7** undergoes ring closure to the 3-benzoylated oxaziridine **8** (Scheme 3). Intramolecular nucleophilic 1,2-attack of the phenolate on the C=O double bond of **8** triggers the opening of the oxaziridine ring to yield **9**, which in turn results in the formation of the 1,3-oxazetidine **11**. The cleavage of formic acid is the final step of the sequence (**11** → **3a**) and delivers the 2-phenylated naphthoxazole **3a**.[28]

So far, there is no proof for the reaction mechanism presented. However, it is supported by a number of experiments. First of all it seems that no radicals are involved as the reaction of **1a** with **2a** in the presence of 1 equiv of the radical scavenger 6-hydroxy-2,5,7,8-tetramethylchromane-2-carboxylic acid under standard conditions resulted in the formation of **3a** in 78%. Then, it was excluded that the α-functionalized ketones **2** undergo decarbonylation under reaction conditions. For this purpose, α-bromo acetophenone (**2a**) was treated with 3 equiv of K_2CO_3 in $C_2H_4Cl_2$ in the absence of **1a**. After 3 h under reflux 92% of the starting material was recovered. This result clearly demonstrates that **2a** is stable under reaction conditions. A similar observation was made with bromomethyl phenyl diketone (**2g**): after treatment with 3 equiv of K_2CO_3 in refluxing $C_2H_4Cl_2$ for 3 h, **2g** was reisolated with 95%.

To prove that the quinone oxime ether **5** can act as an intermediate for the oxazole formation, we set out to synthesize the compound. For this purpose, **1a** and **2a** were reacted in the presence of 2.3 equiv of triethyl amine in dry methanol at room temperature for 3 h (Scheme 4). Under these conditions, the oxime ether **5** was formed with 76% yield. The structure of **5** was confirmed by X-ray crystal structure analysis.[29] The exclusive formation of a quinone oxime ether is rather unusual as the reaction between an *o*-quinone oxime and an alkylating or benzylating agent is expected to produce the corresponding nitrone as the main product.[24c,30] When **5** was reacted under the conditions of the oxazole formation, i.e., 3 equiv of K_2CO_3, $C_2H_4Cl_2$, reflux, 3 h, the oxazole **3a** was formed with 75% yield (Scheme 4). This experiment proves (a) that **5** can act as an

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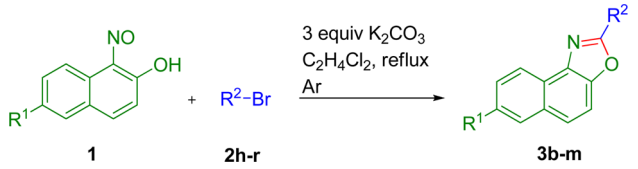
intermediate for the oxazole formation and (b) that the decarbonylation takes place after the formation of **5**.

To study the loss of the C═O group in more detail, it was decided to synthesize 2-benzoylnaphtho[1,2-*d*][1,3]oxazole (**4a**) and to react it under standard conditions. For this purpose, 2-phenacylpyridinium bromide **12**[31] was reacted with 1-nitroso-2-naphthol (**1a**) according to the procedure of Lown and Moser to give the desired material (Scheme 5).[32] 2-Benzoyl

Table 3. Reaction of 1a,b with 2h−r for the Synthesis of 2-Aryl-Substituted Naphtho[1,2-*d*][1,3]oxazoles 3b−m[a]



1 **2h-r** **3b-m**

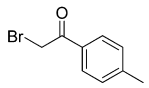
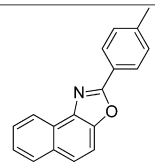
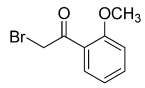
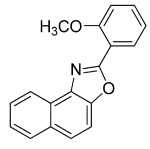
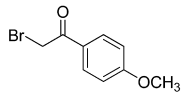
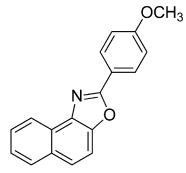
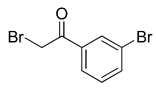
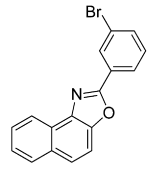
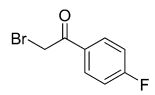
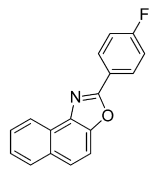
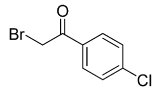
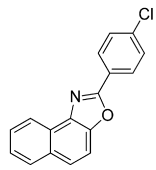
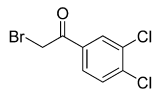
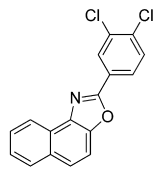
entry	**1**	R^1	**2**	time (h)	**3**	yield of **3** (%)
1	**a**	H	 **h**	4	 **b**	74
2	**a**	H	 **i**	4.5	 **c**	76
3	**a**	H	 **j**	4.5	 **d**	78
4	**a**	H	 **k**	4.5	 **e**	66
5	**a**	H	 **l**	4.5	 **f**	68
6	**a**	H	 **m**	5	 **g**	69
7	**a**	H	 **n**	5	 **h**	65

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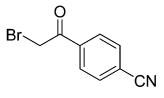
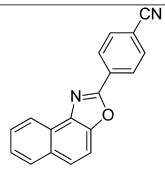
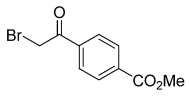
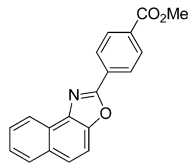
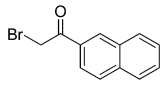
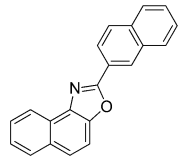
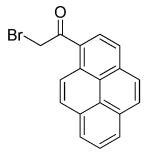
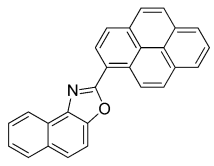
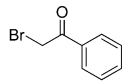
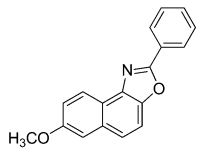
Table 3. continued

entry	1	R^1	2	time (h)	3	yield of 3 (%)
8	a	H	 **o**	5.5	 **i**	71
9	a	H	 **p**	5.5	 **j**	71
10	a	H	 **q**	5	 **k**	70
11	a	H	 **r**	10	 **l**	71
12	b	OCH_3	 **a**	4	 **m**	78

[a]2 mmol of **1** was reacted with 1 mmol of **2**.

naphtho[1,2-*d*][1,3]oxazole (**4a**) was then treated with 3 equiv of K_2CO_3 in $C_2H_4Cl_2$. After reflux for 3 h, the starting material **4a** was recovered in 95%. This experiment clearly demonstrates that **4a** cannot be considered as an intermediate in the formation of 2-phenylnaphtho[1,2-*d*][1,3]oxazole (**3a**) from **1a** and **2a**. Even if the reaction mechanism for the unexpected formation of decarbonylated 2-substituted naphtho[1,2-*d*][1,3]oxazoles from the reaction of 1-nitroso-2-naphthols with α-functionalized ketones and related compounds could not be elucidated in detail, a number of experiments support the mechanism presented in Scheme 3.

To find out whether the new transformation is restricted to 1-nitroso-2-naphthols **1**, the regioisomer 2-nitroso-1-naphthol (**13**) was also employed as a substrate (Scheme 6). Not unexpected, the decarbonylated product, namely, 2-phenylnaphtho[2,1-*d*]-[1,3]oxazole (**14**), was isolated in 45% yield.

The structures of all naphtho[1,2-*d*][1,3]oxazoles were unambiguously elucidated by NMR spectroscopy and mass spectrometry. Full assignment of the ^1H and ^{13}C chemical shifts was achieved by evaluating their gCOSY, gHSQC, and gHMBC spectra. For example, **3a** has three scalar coupled aromatic ^1H spin systems: 6H, 7H, 8H, and 9H (ring A), 4H and 5H (ring B), and 2′H−6′H (ring D). To assign the structure we used gHMBC to fix the positions of the five quaternary carbon C-2, C-3a, C-5a, C-9a, and C-9b, which link the three aromatic rings (A, B, and D). It was shown by the gHMBC spectrum that ring D is attached to ring C at carbon C-2 at δ = 162.3, which showed strong $^3J_{CH}$ correlations to protons 2′-H and 6′-H. Ring B is linked to ring C at C-5a and C-9a, which can be confirmed by the strong $^3J_{CH}$ correlations from C-5a to protons 4-H, 7-H, and 9-H, as well as from C-9a to protons 6-H and 8-H. Ring B is connected with ring C via C-3a and C-9b, as shown by $^3J_{CH}$correlations from C-3a to the proton 5-H, whereas C-9b correlates to protons 4-H and 9-H (Figure 2).

CONCLUSIONS

In summary, we have developed an efficient method for the synthesis of 2-substituted naphtho[1,2-*d*][1,3]oxazoles by reaction between 1-nitroso-2-naphthols and α-functionalized ketones, such as α-bromo-, α-chloro-, α-mesyloxy-, α-tosyloxy-, and α-hydroxy ketones, under basic conditions in a single synthetic operation. The formation of naphtho[1,2-*d*][1,3]oxazoles also took place

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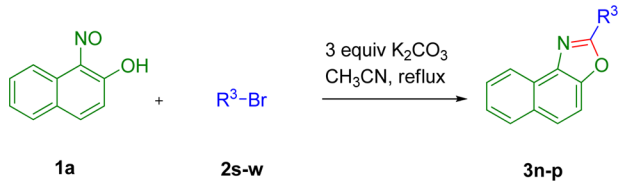
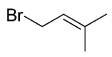
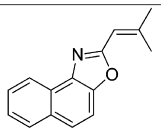
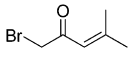
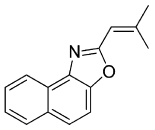
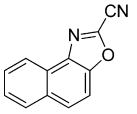
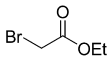
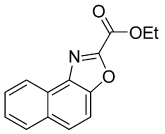
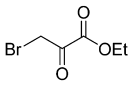
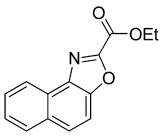
Table 4. Synthesis of Various 2-Substituted Naphtho[1,2-*d*][1,3]oxazoles[a]



1a 2s-w 3n-p

entry	2	time (h)	3	Yield of 3 (%)
1	 s	4	 n	63
2	 t	8	 n	62
3	 u	3	 o	75
4	 v	6	 p	56
5	 w	12	 p	52

[a]2 mmol of **1a** was reacted with 1 mmol of **2**.

with aryl bromides, allyl bromides, α-bromo diketones, α-bromo cyanides, α-bromoesters, and α-bromo ketoesters as substrates. The product formation was accompanied by the unexpected loss of the C═O group when α-functionalized ketones, α-functionalized diketones, and α-bromo ketoesters were used as starting materials. The method not only provides an efficient and reliable access to numerous 2-substituted annulated oxazoles but also is one of the few examples of a metal -free decarbonylation of ketones.

EXPERIMENTAL SECTION

General Remarks. All commercially available reagents were used without further purification. Glassware was dried for 4 h at 140 °C. Solvents used in reactions were distilled over appropriate drying agents prior to use. Solvents used for extraction and purification were distilled prior to use. Reaction temperatures are reported as bath temperatures. Thin-layer chromatography (TLC) was performed on TLC silica gel 60 F254. Compounds were visualized with UV light (λ = 254 nm) and/or by immersion in an ethanolic vanillin solution or by immersion in $KMnO_4$ solution followed by heating. Products were purified by flash chromatography on silica gel, 0.04−0.063 mm. Melting points were obtained on a melting point apparatus with open capillary tubes and are uncorrected. IR spectra were measured on a FT-IR spectrometer. UV spectra were recorded with a spectrophotometer. ^{1}H (^{13}C) NMR spectra were recorded at 300 (75) and 500 (125) MHz using $CDCl_3$ as the solvent. The ^{1}H and ^{13}C chemical shifts were referenced to residual solvent signals at δ H/C 7.26/77.00 ($CDCl_3$) relative to TMS as internal standard. HSQC, HMBC, NOESY, ROESY, HSQMBC, and COSY spectra were recorded on a NMR spectrometer at 500 or 300 MHz. Coupling constants J [Hz] were directly taken from the spectra and are not averaged. Splitting patterns are designated as s (singlet), d (doublet), t (triplet), q (quartet), quin (quintet), m (multiplet), and br (broad). 1D and 2D homonuclear NMR spectra were measured with standard pulse sequences. Low-resolution electron impact mass spectra (MS) and exact mass electron impact mass spectra (HRMS) were obtained at 70 eV using a double-focusing sector field mass spectrometer. Intensities are reported as percentages relative to the base peak (I = 100%).

General Procedure I for the Preparation of Compounds 3a−m. A mixture of the 1-nitroso-2-naphthol **1** (2 mmol), the bromomethyl

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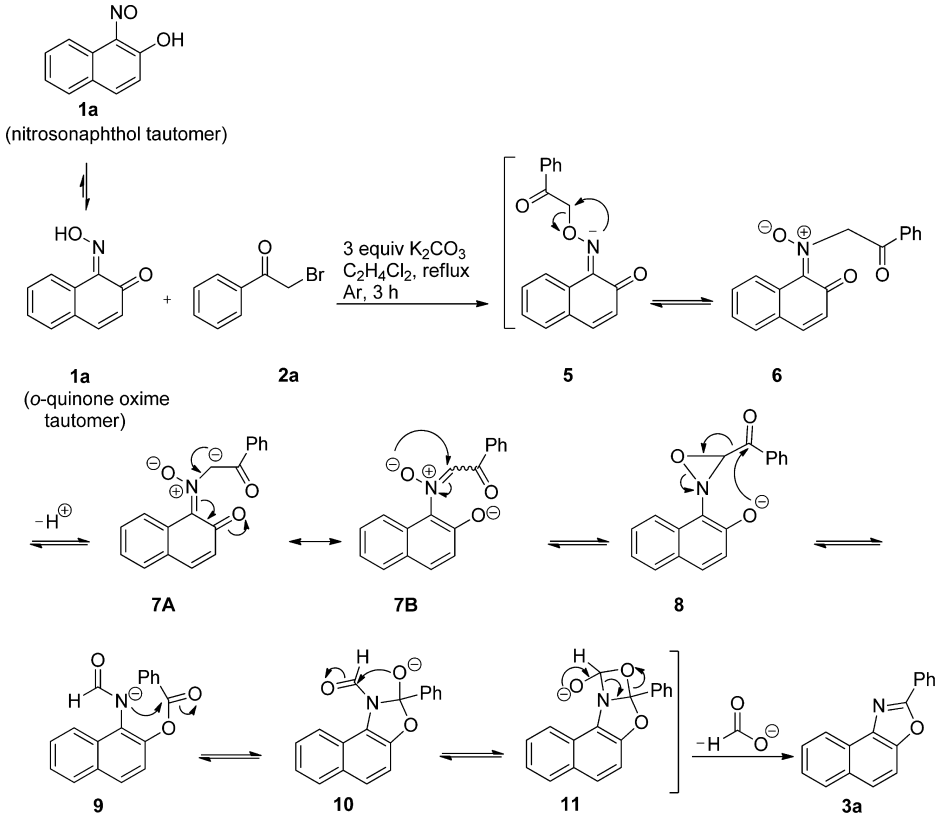
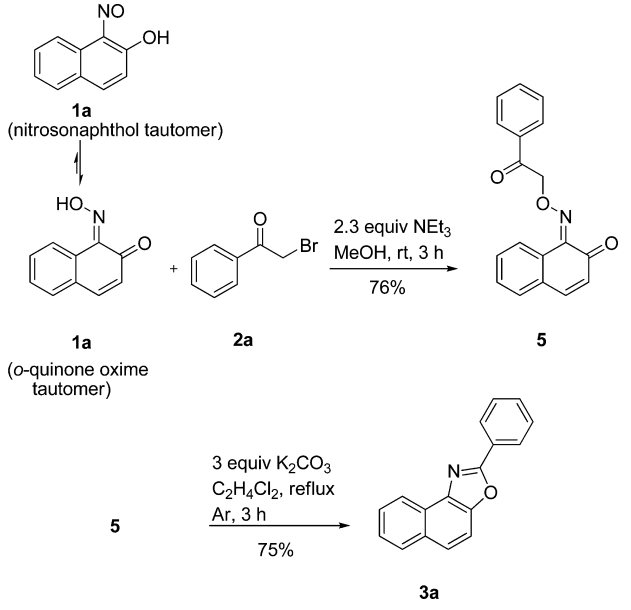
Scheme 3. Proposed Reaction Mechanism for the Formation of 2-Substituted Naphtho[1,2-*d*][1,3]oxazoles



Scheme 4. Synthesis of the Proposed Intermediate 5 and Its Cyclization to 3a

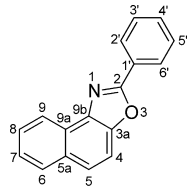


aryl ketone **2** (1 mmol), and K_2CO_3 (417 mg, 3 mmol) in dry 1,2-dichloroethane (5 mL) was refluxed under argon until the starting material **2** was consumed (TLC). After cooling to room temperature, the reaction mixture was poured into water and extracted with ether (3 × 30 mL). The combined organic extracts were washed with brine (30 mL). After drying over anhydrous $MgSO_4$ and concentration in vacuo the resulting residue was purified by flash chromatography over silica gel to afford the desired product.

General Procedure II for the Preparation of Compounds 3n–p. A mixture of 1-nitroso-2-naphthol (**1a**) (346 mg, 2 mmol), substrate **2** (1 mmol), and K_2CO_3 (417 mg, 3 mmol) in dry CH_3CN (5 mL) was refluxed under argon until the starting material **2** was consumed (TLC). After cooling to room temperature, the reaction mixture was poured into water and extracted with ether (3 × 30 mL). The combined organic extracts were washed with brine (30 mL). After drying over anhydrous $MgSO_4$ and concentration in vacuo the resulting residue was purified by flash chromatography over silica gel to afford the desired product.

Synthesis of Starting Materials. α-Tosyloxy acetophenone,[33] α-mesyloxy acetophenone,[34] bromomethyl phenyl diketone,[35] 1-bromo-4-methyl-3-pentene-2-one,[36] 6-methoxy-1-nitroso-2-naphthol,[37] methyl 4-(2-bromoacetyl)benzoate,[38] and bromomethyl 1-pyrenyl ketone[39] were prepared according to the literature.

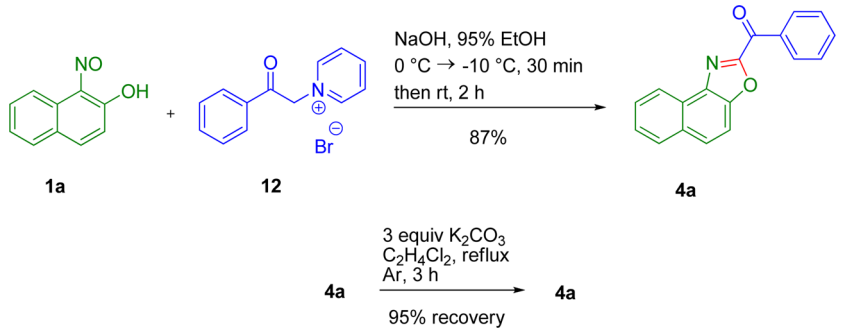
Synthesis of 2-Substituted Naphtho[1,2-*d*][1,3]oxazoles 3. *Synthesis of 2-Phenylnaphtho[1,2-d][1,3]oxazole (**3a**).*[16b]



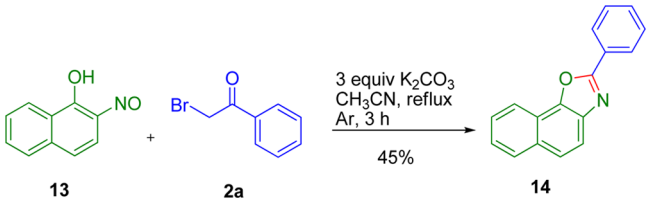
According to the general procedure I, a mixture of 1-nitroso-2-naphthol (**1a**) (346 mg, 2 mmol), 2-bromo acetophenone (**2a**) (199 mg, 1 mmol), and K_2CO_3 (417 mg, 3 mmol) in dry 1,2-dichloroethane (5 mL) was refluxed under argon for 3 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 20:1) gave **3a** as a yellow solid in 80% yield (196 mg, 0.80 mmol): mp 135—136 °C (lit.[16b] mp 133—135 °C); R_f = 0.56 (cyclohexane/EtOAc = 3:1); UV (MeCN) λ_{max} (log ε) 343 (4.25), 330 (4.29), 302 (4.20), 291 (4.21) nm; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.54 (partially overlapped, 3H, 3′-H, 4′-H and 5′-H), 7.56 (partially overlapped, 1H, 7-H), 7.69 (ddd, ^4J (6-H, 8-H) = 1.2 Hz, ^3J (7-H, 8-H) = 7.0 Hz, ^3J (8-H, 9-H) = 8.0 Hz, 1H, 8-H), 7.74 (d, ^3J (4-H, 5-H) = 8.9 Hz, 1H, 4-H), 7.81 (brd, ^3J (4-H, 5-H) = 8.9 Hz, 1H, 5-H), 7.98

dx.doi.org/10.1021/jo3022956 | J. Org. Chem. 2013, 78, 154–166

Scheme 5. Synthesis of 2-Benzoylnaphtho[1,2-*d*][1,3]oxazole (4a) and Its Behavior under Standard Conditions



Scheme 6. Synthesis of 2-Phenylnaphtho[2,1-*d*][1,3]oxazole (13)



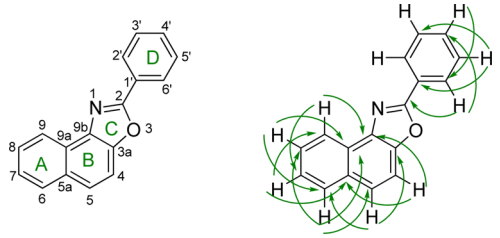
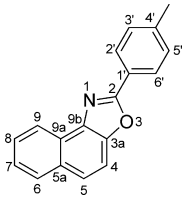


Figure 2. Important gHMBC correlations (H→C) of **3a** (green arrow: ^3J gHMBC).

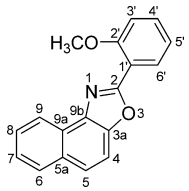
(brd, ^3J (6-H, 7-H) = 7.9 Hz, 1H, 6-H), 8.31—8.38 (m, 2H, 2′-H and 6′-H), 8.61 (brd, ^3J (8-H, 9-H) = 8.4 Hz, 1H, 9-H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 110.8 (C-4), 122.3 (C-9), 125.4 (C-7), 126.0 (C-5), 126.6 (C-9a), 126.9 (C-8), 127.3 (C-2′), 127.5 (C-1′), 128.6 (C-6), 128.9 (C-3′), 131.0 (C-4′), 131.2 (C-5a), 137.6 (C-9b), 148.0 (C-3a), 162.3 (C-2).

*Synthesis of 2-(4-Methylphenyl)naphtho[1,2-d][1,3]oxazole (**3b**).*[16b]



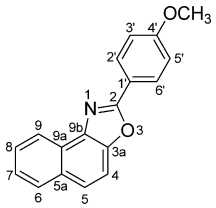
According to the general procedure I, a mixture of 1-nitroso-2-naphthol (**1a**) (346 mg, 2 mmol), 2-bromo-4′-methylacetophenone (**2h**) (213 mg, 1 mmol), and K_2CO_3 (417 mg, 3 mmol) in dry 1,2-dichloroethane (5 mL) was refluxed under argon for 4 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 20:1) gave **3b** as a yellow solid in 74% yield (192 mg, 0.74 mmol): mp 167—169 °C (lit.[16b] mp 168—170 °C); R_f = 0.58 (cyclohexane/EtOAc = 3:1); ^{1}H NMR (300 MHz, $CDCl_3$) δ 2.46 (s, 3H), 7.35 (d, ^3J = 8.1 Hz, 2H), 7.55 (ddd, ^4J = 1.0 Hz, ^3J = 7.0 Hz, ^3J = 8.1 Hz, 1H), 7.67 (ddd, ^4J = 0.9 Hz, ^3J = 7.3 Hz, ^3J = 8.2 Hz, 1H), 7.73 (d, ^3J = 8.9 Hz, 1H), 7.80 (d, ^3J = 8.9 Hz, 1H), 7.97 (d, ^3J = 8.1 Hz, 1H), 8.23 (d, ^3J = 8.2 Hz, 2H), 8.59 (d, ^3J = 8.2 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 21.6, 110.8, 122.3, 124.8, 125.3, 125.7, 126.5, 126.9, 127.3, 128.5, 129.6, 131.2, 137.7, 141.5, 147.9, 162.6.

*Synthesis of 2-(2-Methoxyphenyl)naphtho[1,2-d][1,3]oxazole (**3c**).*[16b]



According to the general procedure I, a mixture of 1-nitroso-2-naphthol (**1a**) (346 mg, 2 mmol), 2-bromo-2′-methoxyacetophenone (**2i**) (230 mg, 1 mmol), and K_2CO_3 (417 mg, 3 mmol) in dry 1,2-dichloroethane (5 mL) was refluxed under argon for 4.5 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 10:1) gave **3c** as a yellow solid in 76% yield (210 mg, 0.76 mmol): mp 103—104 °C (lit.[16b] mp 102 °C); R_f = 0.26 (cyclohexane/EtOAc = 3:1); ^{1}H NMR (300 MHz, $CDCl_3$) δ 4.05 (s, 3H), 7.08—7.16 (m, 2H), 7.47—7.57 (m, 2H), 7.67 (ddd, ^4J = 0.9 Hz, ^3J = 7.2 Hz, ^3J = 7.8 Hz, 1H), 7.76 (d, ^3J = 8.9 Hz, 1H), 7.81 (d, ^3J = 8.9 Hz, 1H), 7.97 (d, ^3J = 8.2 Hz, 1H), 8.22 (dd, ^4J = 1.6 Hz, ^3J = 7.8 Hz, 1H), 8.63 (d, ^3J = 8.2 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 56.2, 110.9, 112.1, 116.7, 120.8, 122.4, 125.2, 125.8, 126.6, 126.8, 128.5, 131.1, 131.3, 132.4, 137.4, 147.9, 158.2, 161.1.

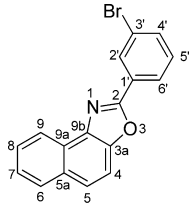
*Synthesis of 2-(4-Methoxyphenyl)naphtho[1,2-d][1,3]oxazole (**3d**).*[16b]



According to the general procedure I, a mixture of 1-nitroso-2-naphthol (**1a**) (346 mg, 2 mmol), 2-bromo-4′-methoxyacetophenone (**2j**) (230 mg, 1 mmol), and K_2CO_3 (417 mg, 3 mmol) in dry 1,2-dichloroethane (5 mL) was refluxed under argon for 4.5 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 20:1) gave **3d** as a yellow solid in 78% yield (215 mg, 0.78 mmol): mp 116—117 °C (lit.[16b] mp 116—118 °C); R_f = 0.36 (cyclohexane/EtOAc = 3:1); ^{1}H NMR (300 MHz, $CDCl_3$) δ 3.89 (s, 3H), 7.03—7.06 (m, 2H), 7.54 (ddd, ^4J = 0.9 Hz, ^3J = 7.0 Hz, ^3J = 7.9 Hz, 1H), 7.64—7.68 (m, 1H), 7.71 (d, ^3J = 8.8 Hz, 1H), 7.78 (d, ^3J = 8.7 Hz, 1H), 7.96 (d, ^3J = 8.2 Hz, 1H), 8.25—8.28 (m, 2H), 8.58 (d, ^3J = 8.2 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 55.4, 110.7, 114.3, 120.1, 122.2, 125.2, 125.4, 126.4, 126.8, 128.5, 129.0, 131.2, 137.7, 147.8, 162.0, 162.5.

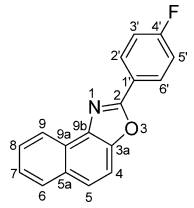
dx.doi.org/10.1021/jo3022956 | J. Org. Chem. 2013, 78, 154−166

*Synthesis of 2-(3-Bromophenyl)naphtho[1,2-d][1,3]oxazole (**3e**).*[16b]



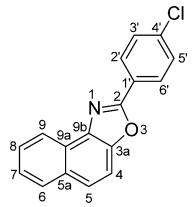
According to the general procedure I, a mixture of 1-nitroso-2-naphthol (**1a**) (346 mg, 2 mmol), 2-bromo-3′-bromoacetophenone (**2k**) (278 mg, 1 mmol), and K_2CO_3 (417 mg, 3 mmol) in dry 1,2-dichloroethane (5 mL) was refluxed under argon for 4.5 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 20:1) gave **3e** as a yellow solid in 66% yield (214 mg, 0.66 mmol): mp 199—200 °C (lit.[16b] mp 199 °C); R_f = 0.49 (cyclohexane/EtOAc = 3:1); ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.41 (dt, ^3J = 7.9 Hz, 1H), 7.57 (ddd, ^4J = 0.9 Hz, ^3J = 7.0 Hz, ^3J = 7.9 Hz, 1H), 7.65 (d, ^3J = 8.2 Hz, 1 H), 7.70 (d, ^3J = 7.6 Hz, 1H), 7.73 (d, ^3J = 8.9 Hz, 1H), 7.83 (d, ^3J = 8.9 Hz, 1H), 7.98 (d, ^3J = 8.2 Hz, 2H), 8.26 (d, ^3J = 7.8 Hz, 1H), 8.49 (brs, 1H), 8.58 (d, ^3J = 8.2 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 110.8, 122.2, 123.0, 125.5, 125.8, 126.5, 126.6, 127.2, 128.6, 129.4, 130.2, 130.4, 131.3, 133.9, 137.5, 148.2, 160.7.

*Synthesis of 2-(4-Fluorophenyl)naphtho[1,2-d][1,3]oxazole (**3f**).*[40]



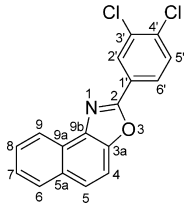
According to the general procedure I, a mixture of 1-nitroso-2-naphthol (**1a**) (346 mg, 2 mmol), 2-bromo-4′-fluoroacetophenone (**2l**) (217 mg, 1 mmol), and K_2CO_3 (417 mg, 3 mmol) in dry 1,2-dichloroethane (5 mL) was refluxed under argon for 4.5 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 20:1) gave **3f** as a yellow solid in 68% yield (178 mg, 0.68 mmol): mp 168—169 °C (lit.[40] mp 170—171.5 °C); R_f = 0.65 (cyclohexane/EtOAc = 3:1); IR (ATR) $\tilde{\nu}$ 1465 (C═N), 1227 (C—O), 1151, 1007, 1060, 799, 732, 715 cm^{-1}; UV (MeCN) λ_{max} (log ε) 343 (4.30), 329 (4.33), 302 (4.26), 291 (4.25) nm; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.20—7.26 (m, 2H, 2′-H and 6′-H), 7.55 (ddd, ^4J (7-H, 9-H) = 0.8 Hz, ^3J (7-H, 8-H) = 7.0 Hz, ^3J (6-H, 7-H) = 8.1 Hz, 1H, 7-H), 7.67 (brd, ^3J (7-H, 8-H) = 7.3 Hz, 1H, 8-H), 7.72 (brd ^3J (4-H, 5-H) = 8.9 Hz, 1H, 4-H), 7.80 (brd, ^3J (4-H, 5-H) = 8.9 Hz, 1H, 5-H), 7.97 (d, ^3J (6-H, 7-H) = 8.2 Hz, 1H, 6-H), 8.30—8.35 (m, 2H, 3′-H and 5′-H), 8.57 (brd, ^3J (8-H, 9-H) = 8.2 Hz, 1H, 9-H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 110.7 (C-4), 116.1 (d, ^2J (^{19}F, ^{13}C) = 22.0 Hz, C-3′), 122.2 (C-9), 123.7 (d, ^4J (^{19}F, ^{13}C) = 3.3 Hz, C-1′), 125.4 (C-7), 126.0 (C-5), 126.5 (C-9a), 127.0 (C-8), 128.6 (C-6), 129.5 (d, ^3J (^{19}F, ^{13}C) = 8.9 Hz, C-2′), 131.2 (C-5a), 137.6 (C-9b), 148.0 (C-3a), 161.4 (C-2), 164.5 (d, ^1J (^{19}F, ^{13}C) = 251 Hz, C-4′); MS (EI, 70 eV) m/z 263 (100) [M$^+$], 235 (4); HRMS (EI, M$^+$) calcd for $C_{17}H_{10}FNO$ (263.0746), found 263.0744.

*Synthesis of 2-(4-Chlorophenyl)naphtho[1,2-d][1,3]oxazole (**3g**).*[41]



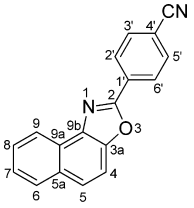
According to the general procedure I, a mixture of 1-nitroso-2-naphthol (**1a**) (346 mg, 2 mmol), 2-bromo-4′-chloroacetophenone (**2m**) (233 mg, 1 mmol), and K_2CO_3 (417 mg, 3 mmol) in dry 1,2-dichloroethane (5 mL) was refluxed under argon for 5 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 20:1) gave **3g** as a yellow solid in 69% yield (193 mg, 0.69 mmol): mp 189—190 °C (lit.[41] mp 188—189 °C); R_f = 0.50 (cyclohexane/EtOAc = 3:1); ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.50—7.58 (m, 3H), 7.68 (d, ^3J = 7.4 Hz, 1H), 7.72 (d, ^3J = 8.9 Hz, 1H), 7.82 (d, ^3J = 8.9 Hz, 1H), 7.98 (d, ^3J = 8.1 Hz, 1H), 8.26 (d, ^3J = 8.6 Hz, 2H), 8.57 (d, ^3J = 8.1 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 110.7, 122.2, 125.5, 126.0, 126.3, 126.5, 127.1, 128.55, 128.59, 129.2, 131.2, 137.2, 137.6, 148.1, 161.3.

*Synthesis of 2-(3,4-Dichlorophenyl)naphtho[1,2-d][1,3]oxazole (**3h**).*



According to the general procedure I, a mixture of 1-nitroso-2-naphthol (**1a**) (346 mg, 2 mmol), 2-bromo-3′,4′-dichloroacetophenone (**2n**) (268 mg, 1 mmol), and K_2CO_3 (417 mg, 3 mmol) in dry 1,2-dichloroethane (5 mL) was refluxed under argon for 5 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 20:1) gave **3h** as a yellow solid in 65% yield (205 mg, 0.65 mmol): mp 167—168 °C; R_f = 0.56 (cyclohexane/EtOAc = 3:1); IR (ATR) $\tilde{\nu}$ 1465 (C═N), 1377, 1232 (C—O), 1137, 1091, 1060, 1028, 879, 812, 798, 760, 741, 722 cm^{-1}; UV (MeCN) λ_{max} (log ε) 337 (4.41), 306 (4.22), 295 (1.50), 291 (4.19) nm; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.57 (ddd, ^4J (7-H, 9-H) = 1.3 Hz, ^3J (7-H, 8-H) = 7.0 Hz, ^3J (6-H, 7-H) = 8.3 Hz, 1H, 7-H), 7.62 (d, ^3J (5′-H, 6′-H) = 8.5 Hz, 1H, 5′-H), 7.69 (ddd, ^4J (6-H, 8-H) = 1.2 Hz, ^3J (7-H, 8-H) = 6.9 Hz, ^3J (8-H, 9-H) = 8.2 Hz, 1H, 8-H), 7.72 (d, ^3J (4-H, 5-H) = 8.9 Hz, 1H, 4-H), 7.84 (brd, ^3J (4-H,5-H) = 8.9 Hz, 1H, 5-H), 7.98 (brd, ^3J (6-H, 7-H) = 8.3 Hz, 1H, 6-H), 8.15 (dd, ^4J (2′-H, 6′-H) = 2.1 Hz, ^3J (5′-H, 6′-H) = 8.5 Hz, 1H, 6′-H), 8.42 (d, ^4J (2′-H, 6′-H) = 2.0 Hz, 1H, 2′-H), 8.56 (brd, ^3J (8-H, 9-H) = 8.2 Hz, 1H, 9-H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 110.7 (C-4), 122.2 (C-9), 125.7 (C-7), 126.3 (C-6′), 126.5 (C-9a), 126.7 (C-5), 127.3 (C-8), 127.4 (C-1′), 128.6 (C-6), 129.0 (C-2′), 131.0 (C-5′), 131.3 (C-5a), 133.5 (C-3′), 135.3 (C-9b), 137.5 (C-4′), 148.2 (C-3a), 160.1 (C-2); MS (EI, 70 eV) m/z 313 (16) [M$^+$], 278 (6) [M — Cl]$^+$ 250 (4), 214 (3), 156 (5), 114 (23), 88 (4); HRMS (EI, M$^+$) calcd for $C_{17}H_9Cl_2NO$ (313.0061), found 313.0044.

*Synthesis of 2-(4-Cyanophenyl)naphtho[1,2-d][1,3]oxazole (**3i**).*



According to the general procedure I, a mixture of 1-nitroso-2-naphthol (**1a**) (346 mg, 2 mmol), 4′-(2-bromoacetyl)benzonitrile (**2o**) (224 mg, 1 mmol), and K_2CO_3 (417 mg, 3 mmol) in dry 1,2-dichloroethane (5 mL) was refluxed under argon for 5.5 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 10:1) gave **3i** as a yellow solid in 71% yield (193 mg, 0.71 mmol): mp 221—222 °C; R_f = 0.35 (cyclohexane/EtOAc = 3:1); IR (ATR) $\tilde{\nu}$ 2232 (C≡N), 1492 (C═N), 1372, 1237 (C—O), 1090, 1053, 1008, 878, 848, 817, 749, 736 cm^{-1}; UV (MeCN) λ_{max} (log ε) 347 (4.29), 309 (3.99), 299 (4.00) nm; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.59 (ddd, ^4J (7-H, 9-H) = 1.2 Hz, ^3J (7-H, 8-H) = 6.9 Hz, ^3J (6-H, 7-H) = 8.2 Hz, 1H, 7-H), 7.71 (ddd, ^4J (6-H, 8-H) = 1.2 Hz, ^3J (7-H, 8-H) = 7.0 Hz, ^3J (8-H, 9-H) = 8.2 Hz, 1H, 8-H), 7.74 (d, ^3J (4-H, 5-H) = 9.0 Hz, 1H, 4-H), 7.82 (d-like, ^3J (2′-H, 3′-H) = 8.5 Hz, 2H, 3′-H and 5′-H), 7.86 (brd, ^3J (4-H, 5-H) = 9.1 Hz, 1H, 5-H), 7.99 (brd, ^3J (6-H, 7-H) = 8.2 Hz, 1H, 6-H), 8.41 (d-like, ^3J (2′-H, 3′-H) = 8.5, 2H, 2′-H and 6′-H), 8.57 (brd, ^3J (8-H, 9-H) = 8.3 Hz, 1H, 9-H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 110.8 (C-4), 114.2 (C-4′), 118.3 (CN), 122.2 (C-9), 125.8 (C-7),

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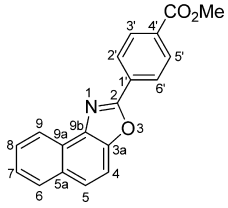
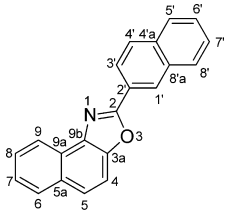
126.6 (C-9a), 127.3 (C-5), 127.4 (C-8), 127.6 (C-2′), 128.7 (C-6), 131.34 (C-5a), 131.38 (C-1′), 132.7 (C-3′), 137.6 (C-9b), 148.4 (C-3a), 160.1 (C-2); MS (EI, 70 eV) *m*/*z* 270 (100) [M^+], 242 (3) [M — CO]$^+$, 121 (4), 114 (17); HRMS (EI; M^+) calcd for $C_{18}H_{10}N_2O$ (270.0793), found 270.0803.

*Synthesis of 4-Naphtho[1,2-d][1,3]oxazol-2-yl-benzoic Acid Methyl Ester (**3j**).*[24a]



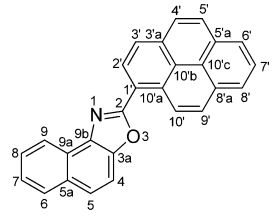
According to the general procedure I, a mixture of 1-nitroso-2-naphthol (**1a**) (346 mg, 2 mmol), methyl 4′-(2-bromoacetyl)benzoate (**2p**) (258 mg, 1 mmol), and K_2CO_3 (417 mg, 3 mmol) in dry 1,2-dichloroethane (5 mL) was refluxed under argon for 5.5 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 10:1) gave **3j** as a yellow solid in 71% yield (215 mg, 0.71 mmol): mp 202—203 °C; R_f = 0.36 (cyclohexane/EtOAc = 3:1); ^{1}H NMR (300 MHz, $CDCl_3$) δ 3.97 (s, 3H), 7.57 (ddd, ^4J = 1.3 Hz, ^3J = 7.0 Hz, ^3J = 7.9 Hz, 1H), 7.68 (d, ^3J = 7.3 Hz, 1H), 7.74 (d, ^3J = 9.1 Hz, 1H), 7.84 (d, ^3J = 8.9 Hz, 1H), 7.98 (d, ^3J = 8.1 Hz, 1H), 8.20 (d, ^3J = 8.4 Hz, 2H), 8.39 (d, ^3J = 8.4 Hz, 2H), 8.60 (d, ^3J = 8.1 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 52.4, 110.8, 122.2, 125.6, 126.6, 126.8, 127.1, 127.2, 128.6, 130.1, 131.28, 131.34, 132.0, 137.7, 148.3, 161.2, 166.4.

*Synthesis of 2-(Naphth-2-yl)naphtho[1,2-d][1,3]oxazole (**3k**).*[42]



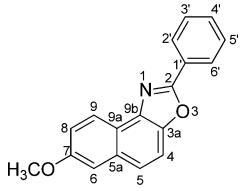
According to the general procedure I, a mixture of 1-nitroso-2-naphthol (**1a**) (346 mg, 2 mmol), bromomethyl 2-naphthyl ketone (**2q**) (249 mg, 1 mmol), and K_2CO_3 (417 mg, 3 mmol) in dry 1,2-dichloroethane (5 mL) was refluxed under argon for 5 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 20:1) gave **3k** as a yellow solid in 70% yield (207 mg, 0.70 mmol): mp 153—154 °C (lit.[42] mp 154 °C); R_f = 0.54 (cyclohexane/EtOAc = 3:1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.54—7.59 (m, 3H, 6′-H, 7′-H and 7-H), 7.70 (ddd, ^4J (6-H, 8-H) = 1.3 Hz, ^3J (7-H, 8-H) = 6.9 Hz, ^3J (8-H, 9-H) = 8.1 Hz, 1H, 8-H), 7.78 (d, ^3J (4-H, 5-H) = 8.9 Hz, 1H, 4-H), 7.84 (d, ^3J (4-H, 5-H) = 8.9 Hz, 1H, 5-H), 7.87—7.91 (m, 1H, 5′-H), 7.97 (d, ^3J (6-H, 7-H) = 8.2 Hz, 1H, 6-H), 7.98 (d, ^3J (3′-H, 4′-H) = 8.7 Hz, 1H, 4′-H), 7.99—8.02 (m, 1H, 8′-H), 8.40 (dd, ^4J (1′-H, 3′-H) = 1.7 Hz, ^3J (3′-H, 4′-H) = 8.5 Hz, 1H, 3′-H), 8.65 (brd, ^3J (8-H, 9-H) = 8.1 Hz, 1H, 9-H), 8.84 (brs, 1H, 1′-H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 110.7 (C-4), 122.3 (C-9), 123.9 (C-3′), 124.7 (C-2′), 125.3 (C-7), 126.0 (C-5), 126.5 (C-9a), 126.8 (C-7′), 126.9 (C-8), 127.48 (C-1′), 127.49 (C-6′), 127.9 (C-5′), 128.6 (C-6), 128.7 (C-4′), 128.8 (C-8′), 131.2 (C-5a), 133.0 (C-8′a), 134.5 (C-4′a), 137.7 (C-9b), 148.1 (C-3a), 162.4 (C-2).

*Synthesis of 2-(Pyren-1-yl)naphtho[1,2-d][1,3]oxazole (**3l**).*



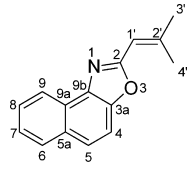
According to the general procedure I, a mixture of 1-nitroso-2-naphthol (**1a**) (346 mg, 2 mmol), bromomethyl 1-prenyl ketone (**2r**) (324 mg, 1 mmol), and K_2CO_3 (209 mg, 1.5 mmol) in dry 1,2-dichloroethane (5 mL) was refluxed under argon for 10 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 20:1) gave **3l** as a blue solid in 71% yield (261 mg, 0.71 mmol): mp 149—150 °C; R_f = 0.45 (cyclohexane/EtOAc = 3:1); IR (ATR) $\tilde{\nu}$ 1524 (C═N), 1226 (C—O), 1109, 1073, 1008, 832, 792, 704 cm^{-1}; UV (MeCN) λ_{max} (log ε) 573 (2.97), 413 (4.25), 393 (4.41), 289 (4.38), 238 (4.53) nm; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.59 (ddd, ^4J (7-H, 9-H) = 1.1 Hz, ^3J (7-H, 8-H) = 6.8 Hz, ^3J (6-H, 7-H) = 8.3 Hz, 1H, 7-H), 7.74 (brdd, ^3J (8-H, 9-H) = 6.0 Hz, ^3J (7-H, 8-H) = 7.1 Hz, 1H, 8-H), 7.80 (d, ^3J (4-H, 5-H) = 8.6 Hz, 1H, 4-H), 7.83 (d, ^3J (4-H, 5-H) = 8.6 Hz, 1H, 5-H), 8.01 (brd, ^3J (6-H, 7-H) = 8.6 Hz, 1H, 6-H), 8.04 (dd, ^3J (6′-H, 7′-H) = 6.8 Hz, ^3J (7′-H, 8′-H) = 8.3 Hz 1H, 7′-H), 8.07 (d, ^3J (4′-H, 5′-H) = 8.5 Hz, 1H, 4′-H), 8.14 (d, ^3J (4′-H, 5′-H) = 8.5 Hz, 1H, 5′-H), 8.22 (d, ^3J (6′-H, 7′-H) = 8.8 Hz, 1H, 6′-H), 8.23 (d, ^3J (2′-H, 3′-H) = 7.6 Hz, 1H, 3′-H), 8.27 (d, ^3J (7′-H, 8′-H) = 9.2 Hz, 1H, 8′-H), 8.31 (d, ^3J (9′-H, 10′-H) = 9.7 Hz, 1H, 9′-H), 8.76 (d, ^3J (8-H, 9-H) = 7.9 Hz, 1H, 9-H), 8.89 (d, ^3J (2′-H, 3′-H) = 8.5 Hz, 1H, 2′-H), 9.93 (d, ^3J (9′-H, 10′-H) = 9.2 Hz, 1H, 10′-H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 110.8 (C-4), 120.5 (C-1′), 122.5 (C-9), 124.4 (C-10′c), 124.7 (C-3′), 125.1 (C-10′b), 125.4 (C-7), 125.5 (C-10′), 125.9 (C-8′), 126.1 (C-6′), 126.3 (C-7′), 126.7 (C-9a), 127.0 (C-8), 127.2 (C-4′), 127.3 (C-2′), 128.6 (C-6), 129.1 (C-5′), 129.4 (C-9′), 129.6 (C-10′a), 130.7 (C-8′a), 131.20 (C-5′a), 131.23 (C-5a), 133.2 (C-3′a), 138.0 (C-9b), 147.7 (C-3a), 162.7 (C-2); MS (EI, 70 eV) *m*/*z* 369 (100) [M^+], 313 (3), 227 (12), 200 (4), 154 (6), 114 (8); HRMS (EI; M^+) calcd for $C_{27}H_{15}NO$ (369.1154), found 369.1159.

*Synthesis of 7-Methoxy-2-phenylnaphtho[1,2-d][1,3]oxazole (**3m**).*



According to the general procedure I, a mixture of 6-methoxy-1-nitroso-2-naphthol (**1b**) (408 mg, 2 mmol), 2-bromo acetophenone (**2a**) (199 mg, 1 mmol), and K_2CO_3 (417 mg, 3 mmol) in dry 1,2-dichloroethane (5 mL) was refluxed under argon for 4 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 20:1) gave **3m** as a yellow solid in 78% yield (216 mg, 0.78 mmol): mp 138—139 °C; R_f = 0.45 (cyclohexane/EtOAc = 3:1); IR (ATR) $\tilde{\nu}$ 1595, 1530 (C═N), 1467, 1447, 1367 (C—O), 1272, 1232 (C—O), 1155, 1056, 1045, 1006, 937, 818, 776, 705 cm^{-1}; UV (MeCN) λ_{max} (log ε) 356 (4.19), 342 (4.13), 307 (4.19), 297 (4.26) nm; ^{1}H NMR (300 MHz, $CDCl_3$) δ 3.96 (s, 3H, CH_3), 7.30 (brd, ^3J (6-H, 8-H) = 2.3 Hz, 1H, 6-H), 7.34 (dd, ^4J (6-H, 8-H) = 2.5 Hz, ^3J (8-H, 9-H) = 8.8 Hz, 1H, 8-H), 7.42—7.53 (m, 1H, 4′-H), 7.53—7.60 (m, 2H, 3′-H and 5′-H), 7.70 (s, 2H, 4-H and 5-H), 8.29—8.36 (m, 2H, 2′-H and 6′-H), 8.50 (d, ^3J (8-H, 9-H) = 8.9 Hz, 1H, 9-H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 55.4 (CH_3), 107.3 (C-6), 111.2 (C-4), 119.1 (C-8), 121.6 (C-9a), 123.8 (C-9), 124.7 (C-5), 127.3 (C-2′), 127.6 (C-1′), 128.9 (C-3′), 131.0 (C-4′), 132.5 (C-5a), 137.9 (C-9b), 146.9 (C-3a), 157.4 (C-7), 162.3 (C-2); MS (EI, 70 eV) *m*/*z* 275 (100) [M^+], 260 (8) [M — CH_3]$^+$, 232 (43), 138 (6), 101 (4); HRMS (EI; M^+) calcd for $C_{18}H_{13}NO_2$ (275.0946), found 275.0949.

*Synthesis of 2-Prenylnaphtho[1,2-d][1,3]oxazole (**3n**).*



According to the general procedure II, a mixture of 1-nitroso-2-naphthol (**1a**) (346 mg, 2 mmol), prenyl bromide (**2s**) (149 mg, 1 mmol), and K_2CO_3 (417 mg, 3 mmol) in dry CH_3CN (5 mL) was refluxed under argon for 4 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 20:1) gave **3n** as a colorless oil in 63% yield

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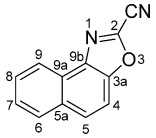
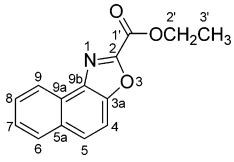
(138 mg, 0.63 mmol): R_f = 0.35 (cyclohexane/EtOAc = 3:1); IR (ATR) $\tilde{\nu}$ 3050 (alkene C−H), 2973, 1659 (alkene C═C), 1514 (C═N), 1434, 1374, 1335, 1314 (C−O), 1271, 1234 (C−O), 1202 (C−O), 1182, 1084, 1057, 1006, 931, 847, 795, 785, 744, 716 cm^{-1}; UV (MeCN) λ_{max} (log ε) 341 (4.35), 326 (4.29), 300 (4.18), 289 (4.28) nm; ^{1}H NMR (300 MHz, $CDCl_3$) δ 2.07 (s, 3H, 3′-H), 2.43 (s, 3H, 4′-H), 6.38 (s, 1H, 1′-H), 7.52 (ddd, ^4J (6-H, 8-H) = 1.1 Hz, ^3J (7-H, 8-H) = 7.1 Hz, ^3J (8-H, 9-H) = 7.9 Hz, 1H, 8-H), 7.61 (partially overlapped, 1H, 7-H), 7.65 (d, ^3J (4-H, 5-H) = 8.6 Hz, 1H, 4-H), 7.75 (brd, ^3J (4-H, 5-H) = 8.9 Hz, 1H, 5-H), 7.95 (brd, ^3J (6-H, 7-H) = 8.2 Hz, 1H, 6-H), 8.51 (brd, ^3J (8-H, 9-H) = 8.2 Hz, 1H, 9-H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 21.0 (C-4′), 27.6 (C-3′), 110.7 (C-4), 112.0 (C-1′), 122.2 (C-9), 125.1 (C-8), 125.3 (C-5), 126.4 (C-9a), 126.7 (C-7), 128.5 (C-6), 131.1 (C-5a), 137.2 (C-9b), 146.9 (C-3a), 149.2 (C-2′), 162.3 (C-2); MS (EI, 70 eV) m/z 223 (100) [M^+], 208 (28) [M — CH_3]$^+$, 152 (6), 114 (12); HRMS (EI; M^+) calcd for $C_{15}H_{13}NO$ (223.0997), found 223.0996.

*Synthesis of 2-Cyanonaphtho[1,2-d][1,3]oxazole (**3o**).*



According to the general procedure II, a mixture of 1-nitroso-2-naphthol (**1a**) (246 mg, 1 mmol), bromoacetonitrile (**2u**) (119 mg, 1 mmol), and K_2CO_3 (417 mg, 3 mmol) in dry CH_3CN (5 mL) was refluxed under argon for 3 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 8:1) gave **3o** as a colorless solid in 75% yield (145 mg, 0.75 mmol): mp 163—164 °C; R_f = 0.45 (cyclohexane/EtOAc = 3:1); IR (ATR) $\tilde{\nu}$ 2241 (C≡N), 1579, 1518 (C═N), 1287 (C−O), 1273, 1084, 1051, 1005, 959, 804, 786, 754, 697 cm^{-1}; UV (MeCN) λ_{max} (log ε) 336 (4.10), 324 (4.08), 299 (4.01) nm; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.66 (ddd, ^4J (7-H, 9-H) = 1.3 Hz, ^3J (7-H, 8-H) = 7.1 Hz, ^3J (6-H, 7-H) = 7.9 Hz, 1H, 7-H), 7.72 (d, ^3J (4-H, 5-H) = 8.9 Hz, 1H, 4-H), 7.77 (ddd, ^4J (6-H, 8-H) = 1.2 Hz, ^3J (7-H, 8-H) = 6.9 Hz, ^3J (8-H, 9-H) = 8.0 Hz, 1H, 8-H), 8.01 (brd, ^3J (6-H, 7-H) = 7.6 Hz, 1H, 6-H), 8.02 (brd, ^3J (4-H, 5-H) = 8.9 Hz, 1H, 5-H), 8.52 (brd, ^3J (8-H, 9-H) = 8.2 Hz, 1H, 9-H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 109.4 (CN), 110.6 (C-4), 122.2 (C-9), 126.3 (C-9a), 126.9 (C-7), 128.5 (C-8), 128.8 (C-6), 130.7 (C-5), 131.7 (C-5a), 135.7 (C-9b), 136.1 (C-2), 148.7 (C-3a); MS (EI, 70 eV) m/z 194 (100) [M^+], 166 (6) [M — CO]$^+$, 139 (4), 88 (4); HRMS (EI; M^+) calcd for $C_{12}H_6N_2O$ (194.0480), found 194.0472.

*Synthesis of 4-Naphtho[1,2-d][1,3]oxazol-2-carboxylic Acid Ethyl Ester (**3p**).*



According to the general procedure II, a mixture of 1-nitroso-2-naphthol (**1a**) (346 mg, 1 mmol), ethyl bromoacetate (**2v**) (172 mg, 1 mmol), and K_2CO_3 (417 mg, 3 mmol) in dry CH_3CN (5 mL) was refluxed under argon for 6 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 8:1) gave **3p** as a white solid in 56% yield (134 mg, 0.56 mmol): mp 107—108 °C; R_f = 0.36 (cyclohexane/EtOAC = 3:1); IR (ATR) $\tilde{\nu}$ 1736 (C═O), 1537 (C═N), 1444 (alkane C−H), 1330, 1275 (ester C−O), 1240 (C−O), 1190, 1172 (C−O), 1150, 1087, 1023, 810, 779, 761, 744 cm^{-1}; UV−vis (MeCN) λ_{max} (log ε) 335 (4.26), 325 (4.25), 298 (3.90) nm; ^{1}H NMR (300 MHz, $CDCl_3$) δ 1.52 (t, ^3J = 7.1 Hz, 3H, 3′-H), 4.61 (q, ^3J = 7.1 Hz, 2H, 2′-H), 7.60 (ddd, ^4J (7-H, 9-H) = 1.2 Hz, ^3J (7-H, 8-H) = 7.1 Hz, ^3J (6-H, 7-H) = 8.2 Hz, 1H, 7-H), 7.71 (ddd, ^4J (6-H, 8-H) = 1.3 Hz, ^3J (7-H, 8-H) = 7.1 Hz, ^3J (8-H, 9-H) = 8.2 Hz, 1H, 8-H), 7.74 (d, ^3J (4-H, 5-H) = 9.4 Hz, 1H, 4-H), 7.95 (brd, ^3J (4-H, 5-H) = 9.4 Hz, 1H, 5-H), 7.98 (d, ^3J (6-H, 7-H) = 8.4 Hz, 1H, 6-H), 8.64 (brd, ^3J (8-H, 9-H) = 8.4 Hz, 1H, 9-H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 14.2 (C-3′), 63.2 (C-2′), 111.1 (C-4), 122.4 (C-9), 126.3 (C-7), 126.9 (C-9a), 127.9 (C-8), 128.7 (C-6), 129.7 (C-5), 131.5 (C-5a), 136.5 (C-9b), 148.8 (C-3a), 151.9 (C-2), 156.5 (C-1′); MS (EI, 70 eV) m/z 241 (100) [M^+], 196 (12) [M — OCH_2CH_3]$^+$, 182 (13), 170 (12), 169 (80), 141 (18), 140 (12), 114 (11); HRMS (EI; M^+) calcd for $C_{14}H_{11}NO_3$ (241.0739), found 241.0720.

*Synthesis of 2-Phenylnaphtho[1,2-d][1,3]oxazole (**3a**) from 2-Chloro Acetophenone (**2b**).* According to the general procedure I, a mixture of 1-nitroso-2-naphthol (**1a**) (346 mg, 2 mmol), 2-chloro acetophenone (**2b**) (155 mg, 1 mmol), and K_2CO_3 (417 mg, 3 mmol) in dry 1,2-dichloroethane (5 mL) was refluxed under argon for 5 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 20:1) gave **3a** as a yellow solid in 60% yield (147 mg, 0.60 mmol).

*Synthesis of 2-Phenylnaphtho[1,2-d][1,3]oxazole (**3a**) from 2-Mesyloxy Acetophenone (**2c**).* According to the general procedure II, a mixture of 1-nitroso-2-naphthol (**1a**) (346 mg, 2 mmol), 2-mesyloxy acetophenone (**2c**) (214 mg, 1 mmol), and K_2CO_3 (417 mg, 3 mmol) in dry CH_3CN (5 mL) was refluxed under argon for 6.5 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 20:1) gave **3a** as a yellow solid in 76% yield (186 mg, 0.76 mmol).

*Synthesis of 2-Phenylnaphtho[1,2-d][1,3]oxazole (**3a**) from 2-Tosyloxy Acetophenone (**2d**).* According to the general procedure II, a mixture of 1-nitroso-2-naphthol (**1a**) (346 mg, 2 mmol), 2-tosyloxy acetophenone (**2d**) (290 mg, 1 mmol), and K_2CO_3 (417 mg, 3 mmol) in dry CH_3CN (5 mL) was refluxed under argon for 9 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 20:1) gave **3a** as a yellow solid in 85% yield (209 mg, 0.85 mmol).

*Synthesis of 2-Phenylnaphtho[1,2-d][1,3]oxazole (**3a**) from 2-Hydroxy Acetophenone (**2e**).* According to the general procedure II, a mixture of 1-nitroso-2-naphthol (**1a**) (346 mg, 2 mmol), 2-hydroxy acetophenone (**2e**) (136 mg, 1 mmol), and K_2CO_3 (417 mg, 3 mmol) in dry CH_3CN (5 mL) was refluxed under argon for 4 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 20:1) gave **3a** as a yellow solid in 73% yield (179 mg, 0.73 mmol).

*Synthesis of 2-Phenylnaphtho[1,2-d][1,3]oxazole (**3a**) from Benzyl Bromide (**2f**).* According to the general procedure I, a mixture of 1-nitroso-2-naphthol (**1a**) (346 mg, 2 mmol), benzylbromide (**2f**) (171 mg, 1 mmol), and K_2CO_3 (417 mg, 3 mmol) in dry 1,2-dichloroethane (5 mL) was refluxed under argon for 6 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 20:1) gave **3a** as a yellow solid in 68% yield (167 mg, 0.68 mmol).

*Synthesis of 2-Phenylnaphtho[1,2-d][1,3]oxazole (**3a**) from Bromomethyl Phenyl Diketone (**2g**).* According to the general procedure I, a mixture of 1-nitroso-2-naphthol (**1a**) (346 mg, 2 mmol), bromomethyl phenyl diketone (**2g**) (227 mg, 1 mmol), and K_2CO_3 (417 mg, 3 mmol) in dry 1,2-dichloroethane (5 mL) was refluxed under argon for 10 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 20:1) gave **3a** as a yellow solid in 73% yield (178 mg, 0.73 mmol).

*Synthesis of 2-Prenylnaphtho[1,2-d][1,3]oxazole (**3n**) from 1-Bromo-4-methyl-3-pentene-2-one (**2t**).* According to the general procedure II, a mixture of 1-nitroso-2-naphthol (**1a**) (346 mg, 2 mmol), 1-bromo-4-methyl-3-pentene-2-one (**2t**) (177 mg, 1 mmol), and K_2CO_3 (417 mg, 3 mmol) in dry CH_3CN (5 mL) was refluxed under argon for 8 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 20:1) gave **3n** as a colorless liquid in 62% yield (139 mg, 0.62 mmol).

*Synthesis of 4-Naphtho[1,2-d][1,3]oxazol-2-carboxylic Acid Ethyl Ester (**3p**) from Ethyl Bromopyruvate (**2w**).* According to the general procedure II, a mixture of 1-nitroso-2-naphthol (**1a**) (346 mg, 2 mmol), ethyl bromopyruvate (**2w**) (195 mg, 1.0 mmol), and K_2CO_3 (417 mg, 3.0 mmol) in dry CH_3CN (5 mL) was refluxed under argon for 12 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 8:1) gave **3p** as a white solid in 52% yield (125 mg, 0.52 mmol).

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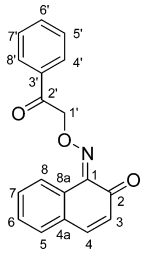
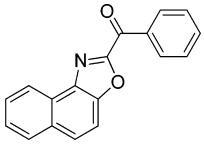
Synthesis and Reaction of [1,2]Naphthoquinone 2-(*O*-Benzoyloxime) (5). *Synthesis of [1,2]Naphthoquinone 2-(O-Benzoyloxime) (**5**).*



A solution of 1-nitroso-2-naphthol (**1a**) (177 mg, 1 mmol), 2-bromo acetophenone (**2a**) (199 mg, 1 mmol), and triethylamine (254 mg, 2.3 mmol) in dry methanol (5 mL) was stirred under argon at room temperature for 3 h. The reaction mixture was filtered on a sintered Buchner funnel, and the solid obtained was recrystallized using dichloromethane to give **5** as yellow crystals in 76% yield (220 mg, 0.76 mmol): mp 163—165 °C; R_f = 0.32 (cyclohexane/EtOAc = 2:1); IR (ATR) $\tilde{\nu}$ 1692 (C═O), 1658 (C═O), 1598, 1450, 1403, 1364, 1230, 1218, 920, 841, 751, 721, 685 cm^{-1}; UV (MeCN) λ_{max} (log ε) 342 (2.10) nm; ^{1}H NMR (300 MHz, $CDCl_3$) δ 5.85 (s, 2H, 1′-H), 6.39 (d, ^3J (3-H, 4-H) = 10.0 Hz, 1H, 3-H), 7.34—7.39 (m, 1H, 5-H), 7.39—7.45 (m, 1H, 4-H), 7.46—7.54 (m, 4H, 5′-H, 6-H, 7-H and 7′-H), 7.58—7.66 (m, 1H, 6′-H), 7.94 (dd, ^4J (4′-H, 6′-H) = 2.0 Hz, ^3J (4′-H, 5′-H) = 7.9 Hz, 2H, 4′-H and 8′-H), 8.94 (dd, ^4J (6-H, 8-H) = 2.0 Hz, ^3J (7-H, 8-H) = 8.9 Hz, 1H, 8-H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 79.0 (C-1′), 126.8 (C-8a), 127.3 (C-3), 127.7 (C-4′), 128.9 (C-5′), 129.9 (C-5), 130.5 (C-6), 131.2 (C-7), 131.3 (C-4a), 132.8 (C-8), 133.9 (C-6′), 134.3 (C-3′), 144.9 (C-4), 146.3 (C-1), 184.4 (C-2), 193.3 (C-2′); MS (EI, 70 eV) *m*/*z* 291 (24) [M^+], 273 (12) [M — H_2O]$^+$, 261 (16), 245 (68), 233 (15), 186 (12), 169 (48), 156 (44); HRMS (EI; M^+) calcd for $C_{18}H_{13}NO_3$ (291.0895), found 291.0878.

*Synthesis of 2-Phenylnaphtho[1,2-d][1,3]oxazole (**3a**) from [1,2]Naphthoquinone 2-(O-Benzoyloxime) (**5**).* According to the general procedure I, a mixture of [1,2]naphthoquinone 2-(*O*-benzoyloxime) (**5**) (146 mg, 0.5 mmol) and K_2CO_3 (208 mg, 3 mmol) in dry 1,2-dichloroethane (3 mL) was refluxed under argon for 3 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 20:1) gave **3a** as a yellow solid in 75% yield (92 mg, 0.38 mmol).

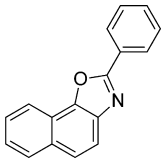
*Synthesis of 2-Benzoylnaphtho[1,2-d][1,3]oxazole (**4a**).*[32]



2-Benzoylnaphtho[1,2-*d*][1,3]oxazole (**4a**) was prepared according to the method of Lown and Moser[32] by reaction of 1-nitroso-2-naphthol (**1a**) (692 mg, 4 mmol) and phenacyl pyridinium bromide (**12**)[31] (1108 mg, 4 mmol) in 87% yield (950 mg, 3.48 mmol): mp 124—125 °C (lit.[32] mp 123 °C); R_f = 0.50 (cyclohexane/EtOAc = 3:1); IR (ATR) $\tilde{\nu}$ 1652 (C═O), 1596, 1777, 1508, 1446, 1326, 1234, 1157, 962, 911, 812, 753, 725, 685 cm^{-1}; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.57—7.67 (m, 3H), 7.68—7.73 (m, 1H), 7.74—7.78 (m, 1H), 7.81 (d, ^3J = 8.9 Hz, 1H), 7.99 (d, ^3J = 8.9 Hz, 1H), 8.02 (d, ^3J = 7.6 Hz, 1H), 8.62—8.71 (m, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 113.3, 122.3, 126.3, 127.3, 127.9, 128.6, 128.9, 130.1, 131.2, 131.6, 134.1, 135.2, 136.8, 148.6, 156.7, 179.9; MS (EI, 70 eV) *m*/*z* 273 (88) [M^+], 245 (4) [M — CO]$^+$, 214 (4).

*Treatment of 2-Benzoylnaphtho[1,2-d][1,3]oxazole (**4a**) under Reaction Condtions.* A solution of 2-benzoylnaphtho[1,2-*d*][1,3]-oxazole (**4a**) and K_2CO_3 (417 mg, 3 mmol) in dry 1,2-dichloroethane (5 mL) was refluxed under argon for 3 h. After workup 95% of **4a** were recovered.

*Synthesis of 2-Phenylnaphtho[2,1-d][1,3]oxazole (**14**).*[24b]



According to the general procedure II, a mixture of 2-nitroso-1-naphthol (**13**) (346 mg, 2 mmol), 2-bromo acetophenone (**2a**) (199 mg, 1 mmol), and K_2CO_3 (417 mg, 3 mmol) in dry acetonitrile (5 mL) was refluxed under argon for 3 h. Flash chromatography over silica gel (cyclohexane/EtOAc = 20:1) gave **14** as a yellow solid in 45% yield (100 mg, 0.18 mmol): mp 89—90 °C (lit.[24b] mp 78—88 °C); R_f = 0.45 (cyclohexane/EtOAc = 3:1); ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.52—7.60 (m, 4H), 7.62—7.69 (m, 1H), 7.80 (d, ^3J = 8.8 Hz, 1H), 7.87 (d, ^3J = 8.7 Hz, 1H), 7.99 (d, ^3J = 8.2 Hz, 1H), 8.29—8.39 (m, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 118.5, 120.2, 120.4, 125.5, 125.7, 126.9, 127.29, 127.35, 128.7, 129.0, 131.3, 131.7, 138.4, 146.4, 162.4.

■ ASSOCIATED CONTENT

Ⓢ Supporting Information

NMR spectra for all compounds. This material is available free of charge via the Internet at http://pubs.acs.org.

■ AUTHOR INFORMATION

Corresponding Author

*E-mail: ubeifuss@uni-hohenheim.de.

Notes

The authors declare no competing financial interest.

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