Urea-hydrogen peroxide-mediated C(sp2)-H bond selenylation of imidazoheteroarenes and simple activated arenes

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INTRODUCTION

In recent decades there has been uprising interest in the medicinal properties of organoselenides.[1] These ubiquitous structural have their wide applications in material sciences,[2] in catalysis and modern organic transformations.[3] Research studies have led to important discoveries regarding selective C–Se bond formation and in this context a notable approach is direct selenylation. In this regard, nitrogen- or oxygen-containing arenes with organoselenides have appeared as a very important class of molecules, with diverse applications in the biological sciences.[5] Therefore, their synthesis via sustainable routes have attracted considerable attention.

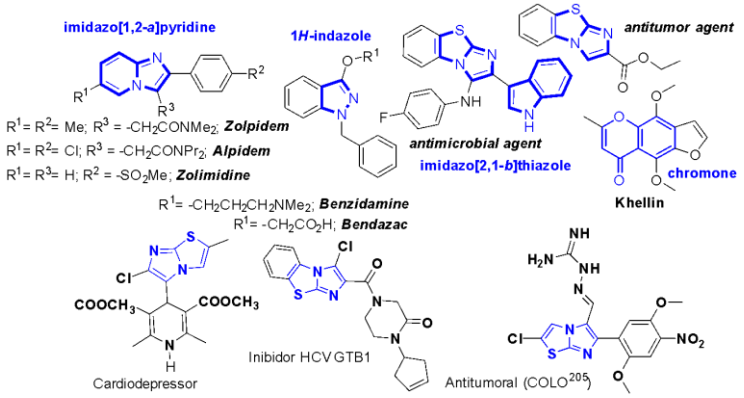
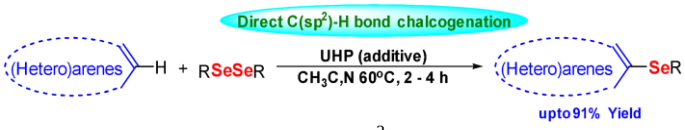


Figure 1. Biologically relevant and pharmaceuticals with Heteroarenes.

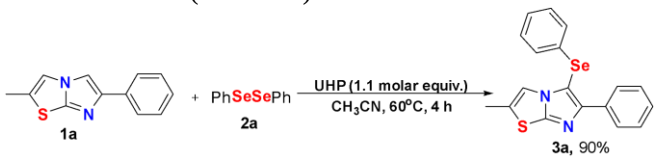
As part of our wider research program aimed at designing and developing eco-friendly processes, [6] herein we report, urea-hydrogen peroxide (UHP)-mediated direct C(sp^2)-H bond selenylation of imidazoheteroarenes and simple activated arenes. Under optimized reaction conditions, one equiv. of (hetero)arene, 0.55 equiv. of various diorganyl diselenides, 1.1 equiv. of UHP in CH_3CN as solvent, resulted the desired selenylated products in good to excellent yields (Scheme 1). Besides, the reaction was successfully applied to other biologically relevant structures.



Scheme 1. UHP-mediated C(sp^2)-H bond selenylation of (hetero)arenes.

RESULTS AND DISCUSSION

For the optimization of the reaction, **1a** and **2a** were selected as model substrates. Ideal condition was achieved by using one equiv. of **1a** and UHP, half molar equiv. of **2a** and in CH_3CN as solvent, with a reaction time of 4min at 40 °C. (Scheme 2).



Scheme 2. Optimized reaction conditions.

With the best result in hand, we explored the generality & scope of this methodology & the reaction demonstrated wide substrate scope in terms of the diorganyl diselenides, and imidazo[2,1-*b*] thiazole (IT) under the optimized conditions (Figure 2-3).

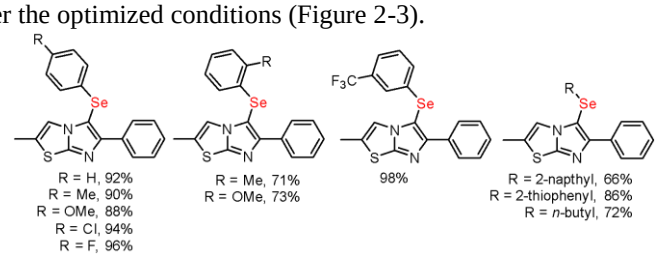


Figure 2. Scope and generality of the reaction using different diselenides **2**.

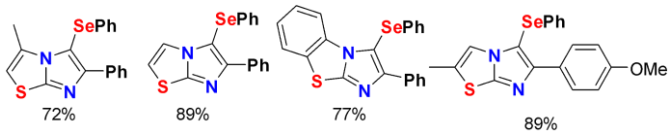


Figure 3. Scope and generality of the reaction using different TI **1**.

Motivated with the results of Chalcogenation of IP, we further extended this methodology to other and imidazo[1,2-a] pyridines (IP), imidazo[1,2-a] pyrimidine, indazoles, chromone, anilines, anisole, phenols, and their naphthalene analogues (Figure 3).

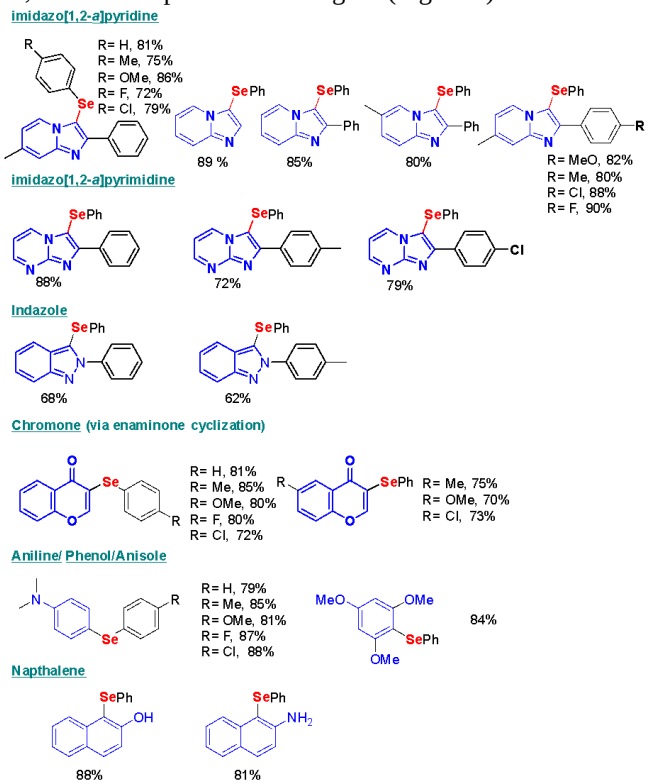


Figure 4. Scope and generality of Chalcogenation of Heteroarenes.

Further studies to expend the scope and to propose a tentative mechanism, are in progress in our lab.

CONCLUSION

In summary, a new, urea-hydrogen peroxide (UHP)-mediated, eco-friendly methodology for the direct C(sp^2)-H bond selenylation of imidazoheteroarenes and simple activated arenes. A diverse range of heteroarenes were successfully tested, e.g., imidazo[2,1-*b*] thiazole (IT), imidazo[2,1-*b*] thiazole (IT), indazoles, chromones, anilines, anisole, phenols, and their naphthalene analogues. Under optimized conditions, the reaction worked efficiently in the presence of 1.1 equiv. of UHP, half equiv. of diorganyl diselenides, react with (hetero)arenes, affording a wide range of regioselective products in good to excellent yields.

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