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MICROWAVE-ASSISTED SYNTHESIS OF A NOVEL IMIDAZOLE-TRIAZOLE DERIVATIVE FOR ANTIBACTERIAL EVALUATION

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INTRODUCTION

Nitrogen-containing heterocycles, particularly imidazole and 1,2,3-triazole derivatives, represent an important class of bioactive compounds with a broad range of pharmacological activities, including antibacterial, antifungal, antiviral, and anticancer effects. Combining these two heterocyclic scaffolds within a single molecular framework represents a promising strategy for the development of novel biologically active compounds[1]. Green chemistry approaches aim to improve the efficiency and sustainability of chemical synthesis by reducing energy consumption, reaction time, waste generation, and the use of hazardous reagents and solvents[2]. Microwave-assisted synthesis has emerged as an effective tool in this context, enabling rapid and efficient transformations under controlled reaction conditions. In particular, microwave irradiation can significantly shorten reaction times compared with conventional heating[3].

TARGET COMPOUND

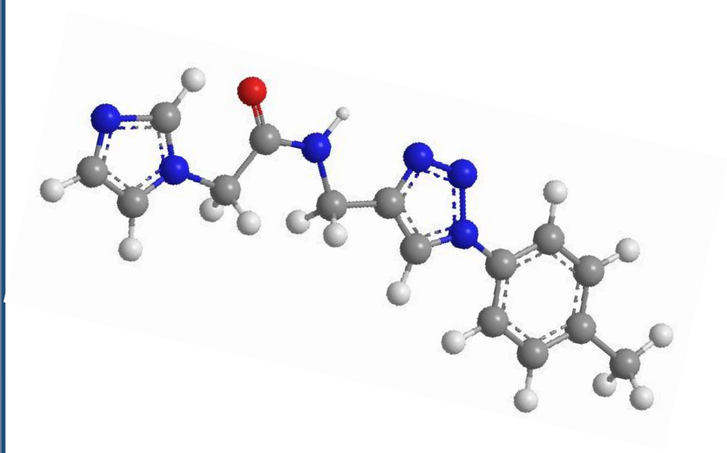
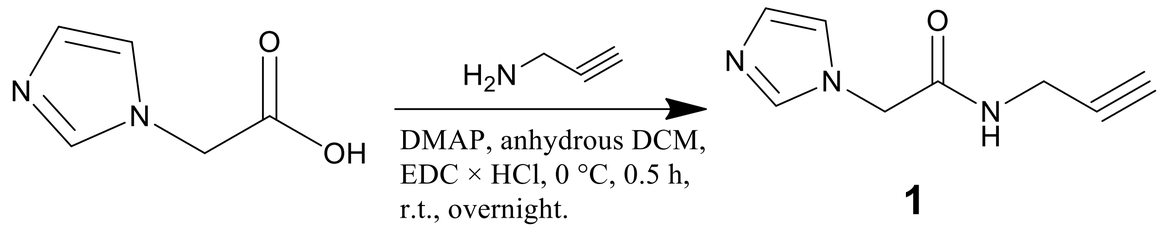


Figure 1. target imidazole–1,2,3-triazole derivative (**3**)

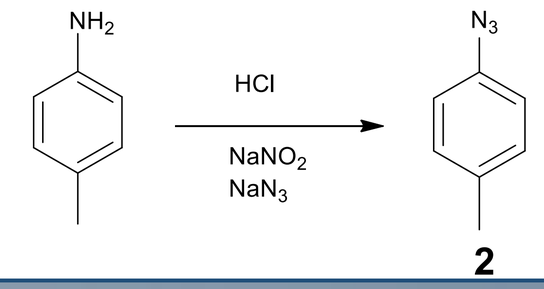
SYNTHETIC APPROACH

Step 1 – The propargyl intermediate, 2-(1H-imidazol-1-yl)-*N*-(prop-2-yn-1-yl)acetamide (**1**), was prepared via the Steglich esterification method.

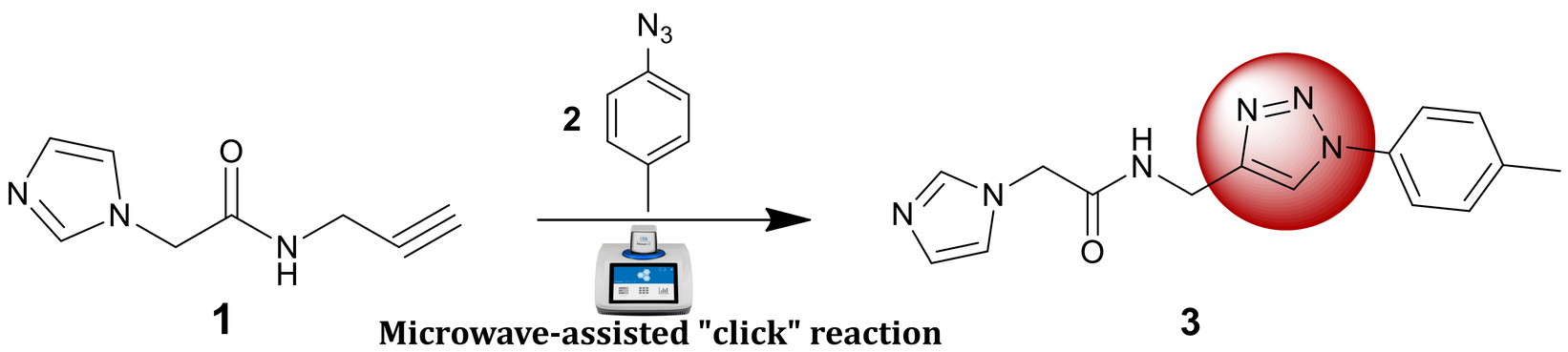
STEP 1



STEP 2



STEP 3



Step 2 – The corresponding aryl azide (**2**) was prepared from the appropriate aniline derivative through diazotization followed by azidation.

Step 3 – The propargyl intermediate (**1**) and aryl azide (**2**) were subjected to a copper-catalyzed azide–alkyne cycloaddition (CuAAC) reaction to afford the target imidazole–1,2,3-triazole derivative 2-(1H-imidazol-1-yl)-N-((1-(p-tolyl)-1H-1,2,3-triazol-4-yl)methyl)acetamide (**3**).

RESULTS

On the **Figure 2** ^{1}H NMR spectra of propargyl derivative (**2**) and target triazole derivative (**3**) are presented. In both spectra, signals in the δ 6.87–8.75 ppm region were observed, corresponding to the protons of the imidazole ring. The formation of the target triazole derivative was confirmed by ^{1}H NMR spectroscopy by comparison with the spectrum of the corresponding propargyl precursor. A clear indication of the successful cycloaddition was the disappearance of the characteristic propargyl signals observed in the precursor at δ 3.16 ppm, corresponding to the terminal alkyne proton (≡CH), and at δ 3.91 ppm, assigned to the propargylic CH_2 group. Their absence in the spectrum of the final product, together with the appearance of new signals at δ 4.43 and 4.78 ppm, corresponding to the two methylene groups (one from imidazole and one from triazole part of the molecule), supports the formation of the triazole ring.

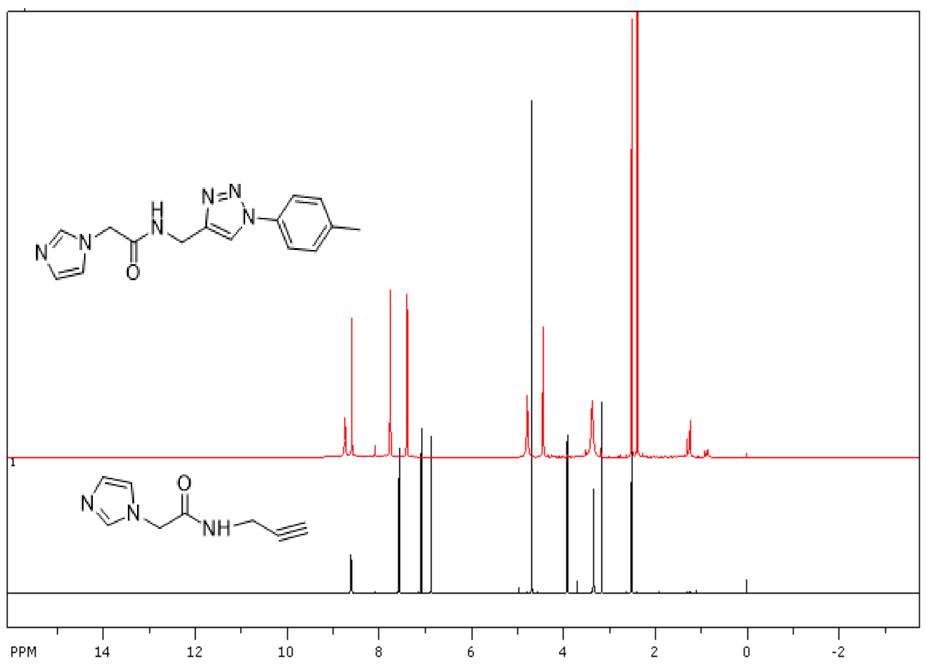


Figure 2. ^{1}H NMR spectra of propargyl derivative (**2**) and target triazole derivative (**3**)

CONCLUSIONS

A new imidazole–1,2,3-triazole derivative (**3**) was successfully synthesized through a three-step synthetic route. The key CuAAC "click" reaction was performed using microwave irradiation, providing a rapid and energy-efficient approach that represents a more environmentally friendly alternative to conventional heating. Structural characterization by ^{1}H NMR, ^{13}C NMR, and MS confirmed the successful formation of the target compound. As a next step, the synthesized compound will be evaluated for antibacterial activity against selected bacterial strains to assess its potential as a novel antimicrobial agent.

REFERENCES:

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3. S. Swami, N. Sharma, G. Sharma, R. Shrivastava. *RSC Adv.* **15** (2025) 2361–2415.

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