

PROCEEDINGS

Electrochemical Synthesis and Activity Study of Nitrogen/Oxygen Heterocyclic Functional Molecules

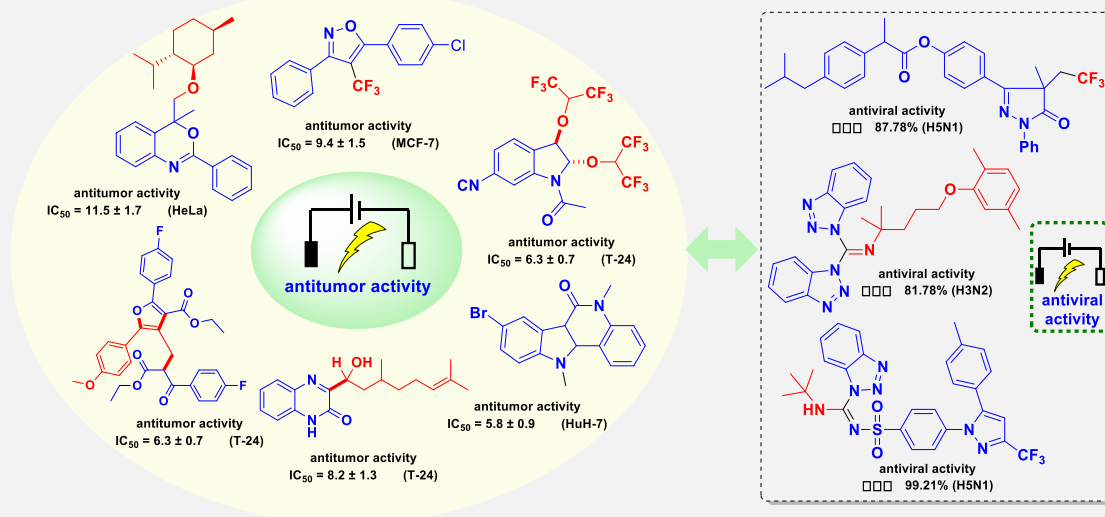
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ABSTRACT

Heterocyclic compounds account for over 75% of clinically used drugs and provide molecular skeletons for over 90% of new drugs, making them a research focus in the fields of chemistry and medicine. Among them, nitrogen/oxygen heterocycles serve as the core skeleton for innovative drug development, including anticancer drugs, antiviral drugs, and antibiotics, and the development of green and efficient novel synthetic strategies for them has attracted significant attention. Traditional synthetic methods for nitrogen/oxygen-containing heterocyclic compounds rely on chemical oxidants or noble metal catalysts, which suffer from limitations such as poor selectivity, low atom economy, and poor functional group compatibility, severely restricting the precise construction and drug-likeness optimization of structurally diverse drug molecules. This study explores new strategies for the green synthesis and modification of nitrogen/oxygen-containing heterocyclic compounds by replacing chemical reagents with electric current, efficiently synthesizing compounds such as phenanthrene, indoline, benzoxazine, sulfonylguanidine, pyrazolone, and tetrasubstituted furans. These synthetic strategies do not require exogenous redox agents, significantly reducing waste emissions. Furthermore, in vitro screening for antitumor and antiviral activities revealed that most of the synthesized compounds exhibited good inhibitory effects on tumor cells, and sulfonylguanidine and pyrazolone derivatives showed good antiviral activity.



KEYWORDS

Electrochemical synthesis; nitrogen/oxygen heterocycles; antitumor activity; antiviral activity



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References

1. Wu, Y. -M., Ma, X. -L., Li, F. -Y., Huang, C. -C., Gao, L. et al. (2024). Dearomative cyclization/spirocyclization via electrochemical reductive hydroarylation of nonactivated arenes. *Organic Letters*, 26(42), 8993–8998.
2. Wei, W. -J., Zhan, L., Jiang, C. -N., Tang, H. -T., Pan, Y. -M. et al. (2023). Electrochemical oxidative cascade cyclization of olefinic amides and alcohols leading to the synthesis of alkoxylated 4H-3,1-benzoxazines and indolines. *Green Chemistry*, 25(3), 928–933.
3. Mo, Z. -Y., Zhang, Y., Tang, X. -Y., Gao, L., Pan, Y. -M. et al. (2026). An electrocatalytic three-component cyclization reaction: synthesis of selenium-containing cyclopentenones via intermolecular selective [3 + 2] annulation of terminal alkynes, unsaturated propionates, and diselenides. *Green Chemistry*, 28(1), 159–165.