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2ND INTERNATIONAL SCIENCE,
ENGINEERING AND TECHNOLOGY
COLLOQUIUM



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PREFACE

Welcome to the 2nd International Science, Engineering and Technology Colloquium 2025 (ISETC 2025)!

It is with great pleasure that we present this year's colloquium, a distinguished gathering of scholars, researchers, and professionals dedicated to the advancement of applied sciences. Held virtually on 9th July 2025, ISETC 2025 serves as a platform to highlight cutting-edge research, foster meaningful networking, encourage collaborations, and explore innovative solutions to global challenges.

This year's theme, "The Power of Scientific Innovation: Intelligent Solutions for a Sustainable World" highlights our shared goal to solve global challenges through applied science. It celebrates innovation as a key to building a more sustainable and resilient future. We're proud to feature keynote speakers and presenters who bring fresh insights, bold ideas, and breakthroughs shaping tomorrow's world.

We would like to extend our heartfelt appreciation to the Faculty of Applied Sciences, Universiti Teknologi MARA, Perak Branch, Tapah Campus, for their outstanding support and assistance throughout the planning and execution of the event. Their dedication has been instrumental to the success of this colloquium. We would like to sincerely thank all participants and researchers for their valuable contributions. We also appreciate the reviewers for their careful evaluations and helpful feedback. Your hard work and support mean a lot to us.

As editors, we are proud to present this collection of proceedings. It is an honour to bring together the interesting and meaningful work of our speakers and authors. We hope the ideas shared will lead to new discoveries, encourage more research, and help solve global challenges through science and innovation.

Warm regards,

Dr. Emi Norzehan Mohamad Mahbob

Dr. Saiyidah Nafisah Hashim

Ms. Lili Widarti Zainuddin

Ms. Nurul Nazwa Mohammad

Ms. Rozaina Saleh

ISETC 2025 Proceedings Editors

HYDROGEN PEROXIDE RADICAL SCAVENGING ACTIVITY OF SYNTHESIZED ACYLPYRAZOLONE DERIVATIVES: EVALUATION OF ANTIOXIDANT POTENTIAL

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Abstract: This study investigates the antioxidant activity of two synthesized acylpyrazolone derivatives, HPMBP and HPMoFBP, using a hydrogen peroxide (H₂O₂) scavenging assay. The derivatives were reacted with H₂O₂ in phosphate buffer (pH 7.4) and assessed spectrophotometrically at 230 nm. Both compounds demonstrated high scavenging activity: HPMBP at 96.56% and HPMoFBP at 94.55%, outperforming ascorbic acid (78.36%). These findings suggest that acylpyrazolone derivatives exhibit significant antioxidant properties and may serve as promising candidates for therapeutic agents combating oxidative stress. Further biological evaluations in vitro and in vivo are warranted.

Keywords: *Antioxidant activity, acylpyrazolone, hydrogen peroxide scavenging, HPMBP, HPMoFBP*

INTRODUCTION

Reactive oxygen species (ROS), including hydrogen peroxide (H₂O₂), superoxide anions, and hydroxyl radicals, are naturally produced in the human body as byproducts of normal cellular metabolism. While these molecules serve beneficial roles in cell signaling and homeostasis, an overproduction of ROS can lead to oxidative stress, an imbalance between ROS and the body's ability to detoxify them using antioxidants (Halliwell & Gutteridge, 2015). Oxidative stress has been strongly implicated in the pathogenesis of various chronic diseases, such as cardiovascular disorders, neurodegenerative diseases, diabetes, and cancer (Valko et al., 2007).

Antioxidants are substances that delay or inhibit oxidative damage to target molecules by neutralizing ROS. While synthetic antioxidants like butylated hydroxytoluene (BHT) and butylated hydroxyanisole (BHA) are commonly used in food and pharmaceutical industries, their application is increasingly restricted due to associated health risks including toxicity and carcinogenic potential (Pham-Huy et al., 2008). Therefore, the demand for safer and more effective antioxidant compounds especially those derived from or inspired by biologically active frameworks has intensified.

In this context, acylpyrazolone derivatives have garnered attention due to their versatile pharmacological properties, including antimicrobial, anticancer, anti-inflammatory, and antioxidant effects (Barad et al., 2023). These heterocyclic compounds are characterized by a pyrazolone ring substituted with acyl groups, which can be structurally modified to enhance biological activity (Asif et al., 2021). However, limited studies have specifically explored the antioxidant activity of acylpyrazolones, particularly their ability to scavenge hydrogen peroxide radicals.

Hydrogen peroxide, despite being less reactive than other ROS, is biologically significant because it can diffuse through membranes and give rise to more reactive species such as hydroxyl radicals through Fenton-type reactions (Kastanek et al., 2023). Assessing a compound's H₂O₂ scavenging ability is thus a crucial parameter in evaluating its antioxidant potential. Therefore, this study aims to synthesize and evaluate two acylpyrazolone derivatives, 1-phenyl-3-methyl-4-benzoyl-5-pyrazolone (HPMBP) and 1-phenyl-3-methyl-4-(2-fluorobenzoyl)-5-pyrazolone (HPMoFBP) for their hydrogen peroxide scavenging activity. By correlating structural features with observed activity, the study seeks to highlight the potential of acylpyrazolone derivatives as novel therapeutic antioxidant agents.

LITERATURE REVIEW

Reactive oxygen species such as H₂O₂, superoxide anions, and hydroxyl radicals can cause oxidative damage to lipids, proteins, and DNA (Halliwell & Gutteridge, 2015). Oxidative stress plays a central role in the pathophysiology of chronic conditions (Valko et al., 2007). Natural and synthetic antioxidants are employed to mitigate ROS effects, but the safety and efficiency of synthetic options are increasingly questioned (Pham-Huy et al., 2008).

Acylpyrazolone derivatives possess antimicrobial, anticancer, anti-inflammatory, and antioxidant properties (Barad et al., 2023). Structural modifications, such as introducing halogens, may enhance their biological activity by increasing electron-withdrawing effects, thus improving radical stabilization (Martins et al., 2009). Nonetheless, studies directly evaluating their H₂O₂ scavenging ability remain scarce.

MATERIALS AND METHODS

Materials

1-phenyl-3-methyl-4-benzoyl-5-pyrazolone (HPMBP), 1-phenyl-3-methyl-4-(2-fluorobenzoyl)-5-pyrazolone (HPMoFBP), ascorbic acid, hydrogen peroxide (40 mM), and phosphate buffer (pH 7.4). Unless otherwise indicated, all reagents were of analytical grade and used without any further purification.

Synthesis of Acylpyrazolone Derivatives

The derivatives were synthesized via condensation reactions involving 1-phenyl-3-methyl-5-pyrazolone with benzoyl chloride or 2-fluorobenzoyl chloride (Mahbob et al., 2023; Mahbob et al., 2024). Structural confirmation was achieved through standard techniques.

Hydrogen Peroxide Scavenging Assay

The assay was adapted from Manjusha and Merugu (2017). A 40 mM hydrogen peroxide solution was prepared in phosphate buffer (pH 7.4). The absorbance spectrum was recorded using a UV-Visible spectrophotometer, with phosphate buffer used as the blank. A total of 0.4 mL of the test compound or ascorbic acid (standard) was added to 0.6 mL of the hydrogen peroxide solution. Phosphate buffer was then added to bring the final volume to 2.0 mL. After incubation for 10 minutes, the absorbance of the reaction mixture was measured at 230 nm against a blank solution containing phosphate buffer without hydrogen peroxide. The hydrogen peroxide scavenging activity of the test compounds and ascorbic acid was calculated (Equation 1) and compared.

$$\text{H}_2\text{O}_2 \text{ scavenging activity (\%)} = \frac{A_c - A_s}{A_c} \times 100 \quad (1)$$

where A_c is the absorbance of the control and A_s is the absorbance of the sample/standard.

RESULTS AND DISCUSSION

Both HPMBP and HPMoFBP showed high H₂O₂ scavenging activity, with values of 96.56% and 94.55%, respectively, outperforming ascorbic acid (78.36%) (Table 1).

Table 1. Hydrogen Peroxide Scavenging Activity of Compounds

Compound	Scavenging Activity (%)
HPMBP	96.56
HPMoFBP	94.55
Ascorbic Acid	78.36

The superior antioxidant activity may be attributed to structural features. The fluorine substituent in HPMoFBP and the benzoyl moiety in HPMBP likely enhance radical stabilization. These findings corroborate previous literature emphasizing the importance of chemical structure in antioxidant efficacy (Martins et al., 2009; Rana et al., 2023).

FTIR Analysis and Its Correlation to Radical Scavenging

The FTIR spectra of HPMBP and HPMoFBP (Figure 1) further support the successful synthesis and potential antioxidant mechanisms of the compounds. Characteristic absorption bands corresponding to carbonyl (C=O), aromatic C=C, and pyrazolone ring structures were observed. Notably, the strong absorption near 1600–1650 cm^{-1} indicates the presence of conjugated carbonyl groups, which are known to contribute to radical scavenging by stabilizing unpaired electrons.

For HPMoFBP, an additional band around 1100–1200 cm^{-1} suggests the presence of a C–F bond, consistent with fluorinated substituents. This fluorine atom is thought to exert an inductive electron-withdrawing effect, further stabilizing the radical intermediate. The hydroxyl (–OH) group stretching around 3200–3500 cm^{-1} also implies potential hydrogen-donating capabilities, enhancing antioxidant activity.

These structural features, supported by FTIR, align well with the observed high scavenging efficiencies and offer insight into the radical stabilization mechanisms of the tested compounds.

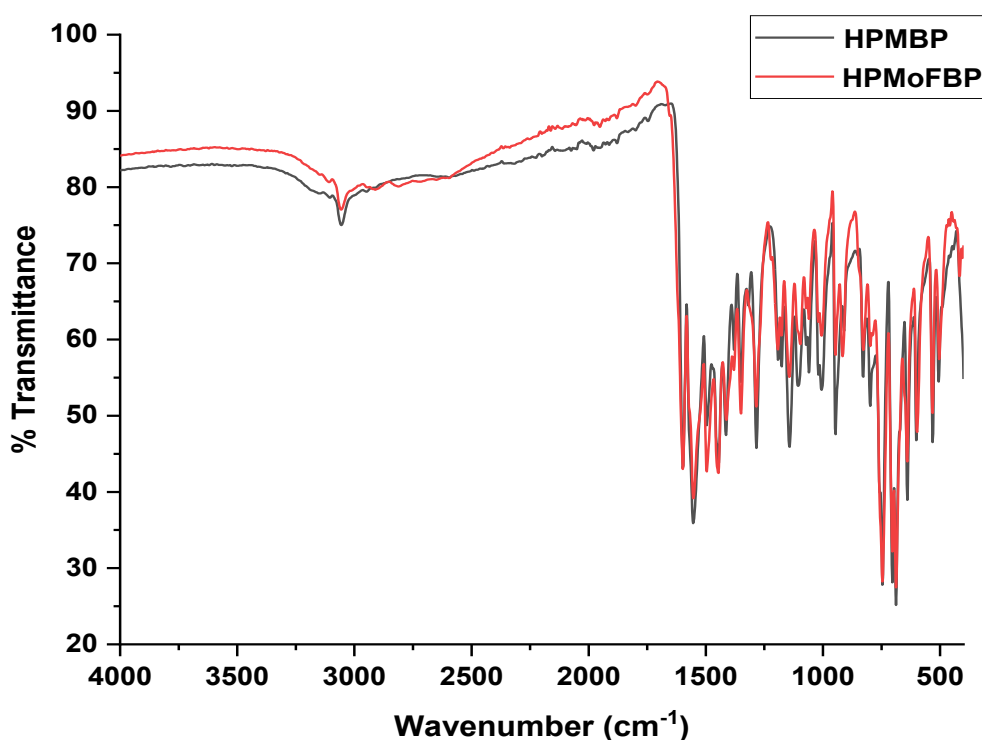


Figure 1. FTIR spectra of HPMBP and HPMoFBP

CONCLUSIONS

This study demonstrated the antioxidant potential of two acylpyrazolone derivatives through their ability to scavenge hydrogen peroxide radicals. HPMBP and HPMoFBP surpassed the activity of ascorbic acid, validating their promise as therapeutic antioxidant agents. Structural modifications played a pivotal role in enhancing activity. FTIR analysis further confirmed the presence of functional groups contributing to radical scavenging mechanisms. Future research should explore biological activity in cellular models and evaluate pharmacokinetics and safety profiles.

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Sekian, terima kasih.

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Saya yang menjalankan amanah,

Setuju.

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