ISETC2025

UNIVERSITI TEKNOLOGI MARA

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2 ND INTERNATIONAL SCIENCE, ENGINEERING AND TECHNOLOGY COLLOQUIUM



THE POWER OF SCIENTIFIC INNOVATION

INTELLIGENT SOLUTIONS FOR A SUSTAINABLE WORLD

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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

PROFILING AND IDENTIFICATION OF ORGANIC COMPOUNDS IN DIVERSE ALCOHOLIC BEVERAGES USING GC-MS

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Abstract: Alcoholic beverages contain complex mixtures of volatile and semi-volatile organic compounds that reflect differences in their manufacturing process. Despite their commercial and forensic significance, comprehensive chemical profiling of these beverages, particularly in the Malaysian context, remains limited. This study aimed to develop and optimise a Gas Chromatography-Mass Spectrometry (GC-MS) method for the identification and characterization of organic compounds in selected alcoholic beverages. Samples from Tiger and Carlsberg beers, Sauvignon Blanc and Chardonnay wines, and Grey Goose and Absolut vodkas were subjected to liquid-liquid extraction using dichloromethane. GC-MS analysis was conducted using an HP-5MS non-polar column, with compound identification based on NIST library matching. The results revealed a wide range of compound classes, including alcohols, esters, phenols, siloxanes, fatty acids, hydrocarbons, and terpenes. Phenylethyl alcohol and siloxane derivatives were consistently detected across all samples, while compounds such as benzene derivatives and steroids appeared unique to specific beverage types. The developed method successfully differentiated the chemical profiles of each beverage, offering potential applications in quality control, authenticity verification, and forensic investigations.

***Keywords*:** *Alcoholic beverages, GC-MS, organic compounds*

INTRODUCTION

Alcoholic beverages such as beer, wine, and distilled spirits have been consumed for centuries and contain a complex mix of organic compounds that influence their flavour, aroma, and potential health impacts. The composition of these compounds varies depending on the ingredients used, fermentation conditions, and distillation steps. Despite their widespread use and cultural relevance, particularly in regions like Sabah and Sarawak, detailed chemical profiling of these beverages in Malaysia remains limited. Accurate analysis is crucial for ensuring product quality, detecting harmful substances, and addressing counterfeit products. Therefore, this study aims to optimise a GC-MS method for the identification and characterisation of organic compounds present in different alcoholic beverages, specifically beer, wine, and vodka.

MATERIALS AND METHODS

Six alcoholic beverage samples were analysed: two beers (Tiger and Carlsberg), two wines (Sauvignon Blanc and Chardonnay), and two vodkas (Grey Goose and Absolut). Each sample was first filtered, then 5 mL of beverage was placed in a centrifuge tube and mixed with 4 mL of dichloromethane for liquid–liquid extraction (LLE). After shaking and phase separation, the organic layer was dried using anhydrous sodium sulphate, filtered, and transferred to vials for GC-MS analysis. Analysis was performed using a non-polar HP-5MS column with an oven temperature programme from 70 °C to 280 °C and nitrogen as the carrier gas. Compounds were identified by comparing spectra to the NIST library.

RESULTS AND DISCUSSION

The GC-MS method identified a range of organic compounds across all beverage types, including alcohols, esters, siloxanes, phenols, fatty acids, and hydrocarbons. Phenylethyl alcohol and siloxanes were consistently present, while each beverage type showed unique compounds: for example, stigmasta-3,5-diene was found only in Sauvignon Blanc, and benzene derivatives were prominent in vodkas. Beers showed more fermentation-derived compounds such as phenylethyl alcohol and unique terpenes. Wines exhibited higher levels of esters and phenolic compounds, adding to their fruity and floral profile. Vodkas contained fewer by-products due to repeated distillation, with more hydrocarbons and benzene derivatives. Siloxanes detected were attributed to instrument artefacts. Overall, the developed method successfully distinguished beverage types and demonstrated the potential of chemical profiling for authenticity and safety monitoring.

Table 1. Identified organic compounds in alcoholic beverages by GC-MS

Sample Type	Major Compounds Identified (based on Area%)
Beer (Tiger)	Phenylethyl Alcohol, Precocene I
Beer (Carlsberg)	Phenylethyl Alcohol, 2,2'-Ethylidenebis(5-methylfuran), Cholest-5-en-3-ol acetate
Wine (Sauvignon Blanc)	Phenylethyl Alcohol, Stigmasta-3,5-diene, Ethyl 9-hexadecenoate
Wine (Chardonnay)	Phenylethyl Alcohol, Butanedioic acid diethyl ester, 2,4-Di-tert-butylphenol
Vodka (Grey Goose)	Benzene derivatives (e.g., Benzenepropanal), 2,4-Di-tert-butylphenol, Octacosane
Vodka (Absolut)	Benzene derivatives, 2,4-Di-tert-butylphenol, Pentadecane

CONCLUSIONS

This study successfully optimized a GC-MS method for the profiling and identification of organic compounds in various alcoholic beverages. The method demonstrated sufficient sensitivity in detecting both volatile and semi-volatile compounds, revealing shared and unique chemical profiles across beer, wine, and vodka. These findings contribute to a deeper understanding of alcoholic beverage composition, support product authentication efforts, and provide a reliable foundation for future applications in food safety, quality control, and forensic analysis.

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