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SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in our opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Master of Science.

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I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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STUDY ON THE MICROBIAL GROWTH INHIBITION BY USING PINEAPPLE LEAVES JUICE

AMIRAH BINTI YA'ACOB

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ABSTRAK

Oleh kerana daun nanas adalah salah satu sisa organik yang kaya dengan sebatian fenolik, adalah wajar untuk memperoleh pengetahuan yang lebih mendalam mengenai potensi daun nanas sebagai perencat pertumbuhan mikrob (MGI). Kajian ini bertujuan untuk mencirikan sebatian fenolik dalam jus daun nanas (PLJ), menyaring dan mengoptimumkan keadaan yang mempengaruhi perencatan pertumbuhan mikrob dengan memanfaatkan PLJ. Penting untuk mengenal pasti sebatian fenolik individu dalam jus daun nanas (PLJ) menggunakan kaedah "UPLC- QTOF-MS" untuk mengesan sebatian fenolik. Kaedah ini menghasilkan kecekapan yang lebih baik dengan analisis yang lebih pantas. Dalam penyelidikan ini, PLJ diekstrak menggunakan mesin tebu elektrik. Kaedah "TLFD" digunakan untuk menganalisis faktor-faktor yang mempengaruhi proses perencatan pertumbuhan mikrob dengan menggunakan PLJ. "TLFD"menggunakan semua kombinasi tahap faktor berganda untuk menganggar pengaruh faktor dengan berkesan dan mengesan interaksi. Proses analisis memakan masa dan mahal kerana faktor-faktor ini mempengaruhi proses tersebut. Oleh itu, perlu menggunakan kaedah "CCD" di bawah "RSM" untuk menentukan keadaan optimum proses perencatan pertumbuhan mikrob melalui pengoptimuman. Reka bentuk eksperimen perencatan pertumbuhan mikrob dibina menggunakan perisian "Design Expert" (versi 7.1.6) untuk menganalisis keadaan yang diperlukan untuk proses tersebut. Perencatan pertumbuhan mikrob diukur menggunakan kaedah penghitungan unit pembentuk koloni "(CFU"). Faktor-faktor yang mempengaruhi perencatan pertumbuhan mikrob dinyatakan dalam unit CFU/mL. Kajian ini mempertimbangkan empat faktor yang akan dianalisis oleh TLFD: masa perencatan mikrob (0.5–5 jam), kepekatan kandungan fenolik total (TPC) dalam PLJ (0.2563 dan 0.5127 mg GAE/mL), suhu (26–37 °C) dan nisbah PLJ ke mikrob (PLJ/M) (v/v) (1:1 dan 1:3). Keadaan terbaik yang diperoleh untuk perencatan pertumbuhan mikrob ialah masa perencatan mikrob 0.5 jam, 0.5127 mg GAE/mL TPC dalam PLJ, 1:1 PLJ/M dan suhu 37 °C. Analisis varians (ANOVA) menunjukkan bahawa suhu (Faktor C) mempunyai sumbangan terbesar (1.56%) untuk menghalang pertumbuhan mikrob, disertai dengan kepekatan TPC dalam PLJ (Faktor B) dengan 1.27%, masa perencatan mikrob (Faktor A) dengan 1.07% dan PLJ / M (Faktor D) 0.29%. CFU minimum dijumpai pada 2.81×10^5 CFU/mL, yang menunjukkan perencatan maksimum pertumbuhan mikrob dengan 21.74%. Reka bentuk komposit pusat (CCD) digunakan untuk menentukan suhu optimum (35–39 °C) dan masa perencatan mikrob (10–50 min) yang mempengaruhi proses perencatan pertumbuhan mikrob. Kajian pengoptimuman menunjukkan bahawa perencatan pertumbuhan mikrob maksimum 94.73% dengan nilai minimum 9.12×10^4 CFU/mL dicapai pada suhu optimum 37 °C dengan masa perencatan 34.25 min. Penyelidikan ini menunjukkan bahawa PLJ dapat digunakan sebagai produk semula jadi yang mempunyai nilai yang tinggi untuk diaplikasikan kepada sektor pertanian.

ABSTRACT

Since pineapple leaves are one of the organic wastes rich in phenolic compounds, it is desirable to gain deeper knowledge on the potential of pineapple leaves as a microbial growth inhibitor (MGI). This study aimed to characterize the phenolic compounds in pineapple leaves juice (PLJ), screen and optimize the conditions affecting microbial growth inhibition by exploiting PLJ. It is important to identify the individual phenolic compounds in pineapple leaves juice (PLJ) using ultra-high- performance liquid chromatography-quadrupole time of flight-mass spectroscopy (UPLC-QTOF-MS) to detect phenolic compounds. This method resulted in better efficiency with speedy analysis. In this research, PLJ were extracted using an electrical sugarcane press machine. It was decided to use two-level factorial design (TLFD), a screening experiment to analyze the factors affecting the microbial growth inhibition process by using PLJ. TLFD uses all combinations of multiple factor levels to effectively estimate the influence of factors and detect interactions. The analysis process is time-consuming and costly because these factors affected the process. Therefore, it is necessary to use a central composite design (CCD) under RSM to determine the optimum conditions of the microbial growth inhibition process through optimization. The microbial growth inhibition experimental design was built using Design Expert software (version 7.1.6) to analyze the conditions required for the process. Microbial growth inhibition was measured using the colony- forming unit (CFU) count method. The factors influencing the inhibition of microbial growth were expressed in units of CFU/mL. The study considered four factors that were analyzed by TLFD: microbial inhibition time (0.5–5 h), total phenolic content (TPC) concentration in PLJ (0.2563 and 0.5127 mg GAE/mL), temperature (26–37 °C) and ratio of PLJ to microbe (PLJ/M) (v/v) (1:1 and 1:3). The best conditions obtained for microbial growth inhibition were a microbial inhibition time of 0.5 h, 0.5127 mg GAE/mL TPC in PLJ, 1:1 PLJ/M and a temperature of 37 °C. The analysis of variance (ANOVA) showed that temperature (Factor C) has the greatest contribution (1.56%) to inhibit microbial growth, accompanied by TPC concentration in PLJ (Factor B) with 1.27%, microbial inhibition time (Factor A) with 1.07% and PLJ/M (Factor D) with 0.29%. The minimum CFU was found at 2.81×10^5 CFU/mL, which showed the maximum inhibition of microbial growth at 21.74%. Central composite design (CCD) determined the optimum temperature (35– 39 °C) and microbial inhibition time (10–50 min) that influences the microbial growth inhibition process. Optimization studies show that a maximum microbial growth inhibition of 94.73% with a minimum value of 9.12×10^4 CFU/mL was achieved at an optimum temperature of 37 °C with an inhibition time of 34.25 min. This research suggests that PLJ can be utilized as a value-added natural product for application in the agricultural sector.

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