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Sekian, terima kasih.

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# DEVELOPMENT OF FERMENTED WATER KEFIR AMARANTH DRINK

**by**


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A dissertation submitted in partial fulfillment of the requirement for the degree of
Bachelor of Technology (B. Tech) in the field of Food Technology
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## DECLARATION BY AUTHOR

This dissertation is composed of my original work, and contains no material previously published or written by another person except where due reference has been made in the text. The content of my dissertation is the result of work I have carried out since the commencement of my research project and does not include a substantial part of work that has been submitted to qualify for the award of any other degree or diploma in any university or other tertiary institution.

CHIN WEN YI

JULY 2020

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## LIST OF ABBREVIATIONS

| Abbreviation | Caption |
|---|---|
| ºC | Degree Celsius |
| α | alpha |
| β | beta |
| µm | micrometer |
| µL | microliter |
| AOAC | Association of Official Analytical Chemists |
| ANOVA | Analysis of Variance |
| BGLB | Brilliant Green Bile Agar |
| CaEDTA | Calcium disodium edetate |
| CFU | Colony Forming Unit |
| CFU/mL | Colony Forming Units per milliliter |
| EC | *Escherichia coli* Broth |
| EMB | Eosin Methylene Blue Agar |
| g | gram |
| GC5 | Fermented green amaranth without water kefir grains with 5% brown sugar |
| GC7 | Fermented green amaranth without water kefir grains with 7% brown sugar |
| GK5 | Fermented green amaranth with water kefir grains with 5% brown sugar |
| GK7 | Fermented green amaranth with water kefir grains with 7% brown sugar |
| HPLC | High-performance liquid chromatography |

| | |
|---|---|
| hr | hour |
| L | liter |
| LST | Lauryl Tryptose Broth |
| M | molarity |
| min | minute |
| mg | milligram |
| mg GAE/100g | milligram of gallic acid equivalents per 100 g |
| mL | milliliter |
| mL/min | milliliter per minute |
| mm | millimeter |
| mmHg | millimeter of mercury |
| MPN | Most probable number |
| MRS | De man, Rogosa, Sharpe Agar |
| $Na_2CO_3$ | sodium carbonate |
| NaOH | sodium hydroxide |
| PCA | Plate Count Agar |
| PDA | Potato Dextrose Agar |
| RC5 | Fermented red amaranth without water kefir grains with 5% brown sugar |
| RC7 | Fermented red amaranth without water kefir grains with 7% brown sugar |
| RK5 | Fermented red amaranth with water kefir grains with 5% brown sugar |
| RK7 | Fermented red amaranth with water kefir grains with 7% brown sugar |

| | |
|---|---|
| UV-Vis | Ultraviolet-visible |
| w/v | mass/volume |

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**PENGHASILAN MINUMAN KEFIR AIR BAYAM**

## ABSTRAK

Tujuan kajian ini adalah untuk menghasilkan minuman kefir air dari jus bayam sebagai alternatif untuk vegetarian dan pengguna yang mempunyai intoleransi laktosa bagi menggantikan minuman berasas susu haiwan. Pelbagai analisis telah dijalankan ke atas minuman kefir air bayam merah (*Amaranthus tricolor*) dan bayam hijau (*Amaranthus blitum*) yang difermentasi dengan tahap gula (5% dan 7%) yang terpilih. Kedua-dua minuman kefir air bayam merah dan hijau mencapai penurunan signifikan ($p<0.05$) dalam nilai pH, jumlah pepejal larut dan tahap sukrosa menunjukkan proses fermentasi yang berkesan. Minuman kefir air bayam merah yang difermentasi menggunakan 5% tahap gula menunjukkan peningkatan signifikan ($p<0.05$) dalam aktiviti antioksidan dan kandungan jumlah fenolik telah mengenal pastikan kandungan nutritisi yang tinggi. Kedua-dua minuman kefir air bayam merah dan hijau dapat klaim properti probiotik disebabkan pencapaian minima $10^6$ CFU/mL lactobacilli lepas 2 minggu penyimpanan. Keputusan dari analisis mikrobiologi telah menunjukkan lactobacilli ($13.39 \times 10^6$ CFU/mL) dan yis dan kulat ($25.23 \times 10^6$ CFU/mL) dalam minuman kefir air bayam merah yang difermentasi menggunakan 7% tahap gula jauh lebih tinggi berbanding bayam hijau. Kedua- dua sampel mempunyai kandungan coliform yang dalam julat selamat dan ketiadaan coliform fecal telah menunjukkan kualiti mikrobiologi yang stabil. Namun begitu, jus bayam merah dan hijau tidak sepenuhnya sesuai sebagai substrat minuman kefir air disebabkan keasidan tertitrat dan kiraan sel boleh hidup yang rendah. Kesimpulannya, minuman kefir air bayam merah dan bayam hijua telah berjaya dihasilkan.

**DEVELOPMENT OF FERMENTED WATER KEFIR AMARANTH DRINK**

## ABSTRACT

The aim of this study is to develop fermented water kefir drink from vegetable amaranth juice as an alternative for vegetarians and lactose intolerants to replace dairy beverages. Various analyses were conducted on fermented water kefir red amaranth (*Amaranthus tricolor*) and green amaranth (*Amaranthus blitum*) drinks fermented with selected sugar levels (5% and 7%). Both fermented red and green amaranth samples with 7% sugar achieved significant ($p<0.05$) decrement in pH value, total soluble solids, and sucrose concentration which represented efficient water kefir fermentation. Fermented red amaranth sample showed significant ($p>0.05$) increment in antioxidants activity and total phenolic content after fermentation represented higher nutritional value. Both fermented red and green amaranth samples were able to claim probiotic properties due to the achievement of minimum $10^6$ CFU/mL of lactobacillus after 2 weeks of storage. Results from microbiological analyses showed a significantly ($p<0.05$) higher lactobacilli count ($13.39 \times 10^6$ CFU/mL) and yeast and mold count ($25.23 \times 10^6$ CFU/mL) in fermented red amaranth drink with 7% sugar level compared to green amaranth. Both samples had acceptable range of coliform count and absence of fecal coliforms represented the stable microbial quality. However, red and green amaranth vegetable juice were not fully suitable to use as water kefir substrate due to low titratable acidity and total viable cell count. As an overall, fermented red and green amaranth water kefir drinks were successfully produced.