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# SURAT TUGAS

Nomor : 00209/A.1.5/ST.FTP/11/2020

Dekan Fakultas Teknologi Pertanian Universitas Katolik Soegijapranata, Semarang dengan ini memberikan tugas kepada:

| | | |
|---|---|---|
| Nama | : | **Dr. Laksmi Hartayanie, MP.** |
| Status | : | Dosen Fakultas Teknologi Pertanian Universitas Katolik Soegijapranata, Semarang. |
| Tugas | : | Sebagai Presenter (Poster Presentation) ICSAF 2020 **"Lactic Acid Fermentation For Improving Rice Flour Properties"** dalam kegiatan 4th International Conference on Sustainable Global Agriculture and Food (ICSAF) in Taiwan via online conference. |
| Tempat | : | Online. |
| Hari/Tanggal | : | Jumat, 06 November 2020 |
| Lain-lain | : | Harap melaksanakan tugas dengan sebaik-baiknya dan penuh tanggung jawab, serta memberikan laporan setelah selesai melaksanakan tugas. |

Semarang, 06 November 2020
**Dekan,**

**Dr. R. Probo Y. Nugrahedi, M. Sc.**
NPP. : 0581 2001 244

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# SURAT KETERANGAN

**No. 00412/A.1.5/FTP/02/2021**

Nama-nama dosen Fakultas Teknologi Pertanian Universitas Katolik Soegijapranata, Semarang berikut ini :

1. Dr. R. Probo Y. Nugrahedi STP, Msc.
2. Meiliana, S.Gz., MS.
3. Mellia Harumi, S.Si., M.Sc
4. Dr. Ir. Christiana Retnaningsih, MP.
5. Dea Nathania Hendryanti, S.TP., M.S
6. Dr. Alberta Rika Pratiwi, MSi.
7. Dr. Ir. Bernadeta Soedarini, MP.
8. Dr. Victoria Kristina Ananingsih, MSc.
9. Inneke Hantoro, STP, MSc.
10. Prof. Dr. Ir. Budi Widianarko, MSc.
11. Dr. Ir. Lindayani, MP.
12. Dr. Laksmi Hartayanie, MP.

Adalah benar-benar telah mengikuti the 4th International Conference on Sustainable Global Agriculture and Food pada 06 November 2020 sebagai Presenter oral maupun Poster yang diselenggarakan oleh Fu Jen Catholic University Taiwan secara daring.

Demikian surat keterangan ini dibuat sebagai pengganti sementara sertifikat yang belum diterbitkan oleh panitia.

Semarang, 09 Februari 2021

**Dekan,**

**Dr. R. Probo Y. Nugrahedi, M. Sc.**
NPP. : 0581 2001 244

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| Taiwan FJCU | | | | |
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| ICSAF-P001 [FM] | 40 | F-P-FM1-Liao | LIAO | CHIA-WEI |
| ICSAF-P002 [FM] | 109 | F-P-FM2-Hung | HUNG | MAN-CHIA |
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| ICSAF-P008 [FC] | 156 | F-P-FC8-Lee | LEE | YUNG-YUAN |
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| ICSAF-P004 [FM] | 211 (L | I-P-FM4-Hartajanie | Hartajanie | Laksmi |
| ICSAF-P005 [FM] | 211 (L | I-P-FM5-Hartajanie | Hartajanie | Laksmi |
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| ICSAF-P005 [FP] | 125 | I-P-FP5-Retnaningsih | Retnaningsih | Christiana / Ch |
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| ICSAF-P006 [RF] | 101 | I-P-RF6-Meiliana | | Meiliana |


# ***Acceptance Letter***

November 01, 2020

Dear Dr. Laksmi Hartajanie,

We are very pleased to confirm that your submission entitled below has been accepted for the 4th ICSAF in New Taipei City, Taiwan, November 6-7, 2020.

**Lactic Acid Fermentation for improving rice flour properties**

Paper ID: ICSAF-P004 [FM]
Presentation Type: Poster
Authors: Laksmi Hartajanie, Lindayani, Vivi Dwiyanti Yuwono, Yovita Hartono
Affiliation: Soegijapranata Catholic University
Session/Topic: Food microbiology and safety

Please check the conference information given on the ICSAF 2020 in Taiwan website (https://icsaf.org/) for the details of registration and paper upload process. The presentation guideline and format was shown in the conference website. You can check the session you will be presenting from the conference program to be announced on the website soon.

We look forward to your presentation and participation in ICSAF 2020. Please do not hesitate to contact us should you require further information and/or guidance.

Yours Sincerely,

Prof. Bing-Huei Chen
Chairman of the Organizing Committee

# Lactic acid fermentation for improving rice flour properties

Laksmi Hartajanie[12], Lindayani [1], Vivi Dwiyanti Yuwono[1], Yovita Hartono[1]
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**ABSTRACT**

Original rice flour has a low digestibility, so it is modified by fermentation using lactic acid bacteria (LAB) to improve the chemical and physical characteristics. Lactic acid bacteria used in the study were *Lactobacillus pentosus* LLA18 and *Lactobacillus fermentum* LLB3 that were isolated from a pickled bamboo shoot. The purpose of this study was to determine the effect of fermentation time and types of LAB on the making of fermented rice flour. Rice was fermented for 24, 48, 72, 96, and 120 hours. Fermented rice flour is chemically and physically analyses; and Scanning Electronic Microscope (SEM) was performed to see the fermented starch granules. The fermentation treatment showed better chemical and physical characteristics compared to rice flour without fermentation. The best rice flour was obtained with a fermentation time of 120 hours using the *Lactobacillus fermentum* LLB3. Based on Scanning Electronic Microscope (SEM), fermented rice flour has separating, not clustering, and irregular starch granules.

Keywords: lactic acid bacteria, rice flour, fermentation

In general, one-half of the world population, including East and Southeast Asia, is wholly dependent upon rice as a staple food. Almost 95 percent of the world's rice crop is eaten by humans. Rice is cooked by boiling, or it can be ground into a flour. It is eaten alone and in a great variety of soups, side dishes, and main dishes in Asian, Middle Eastern, and many other cuisines.

Red rice (*Oryza nivara*) is generally a broken rice skin that is only separated from the husk, so that the epidermis is still attached to the endosperm. Red rice contains genes that produce anthocyanins that can be seen in the physical condition of rice.

To improve the digestibility of carbohydrates is through fermentation by microbes such as lactic acid bacteria. The modification of flour carried out in this study is expected to form the desired characteristics of the final product, such as changes in the chemical characteristics of flour and Scanning Electronic Microscope (SEM) analyses. Flour fermentation has better characteristics than flour that is not fermented (Copeland et al., 2009).

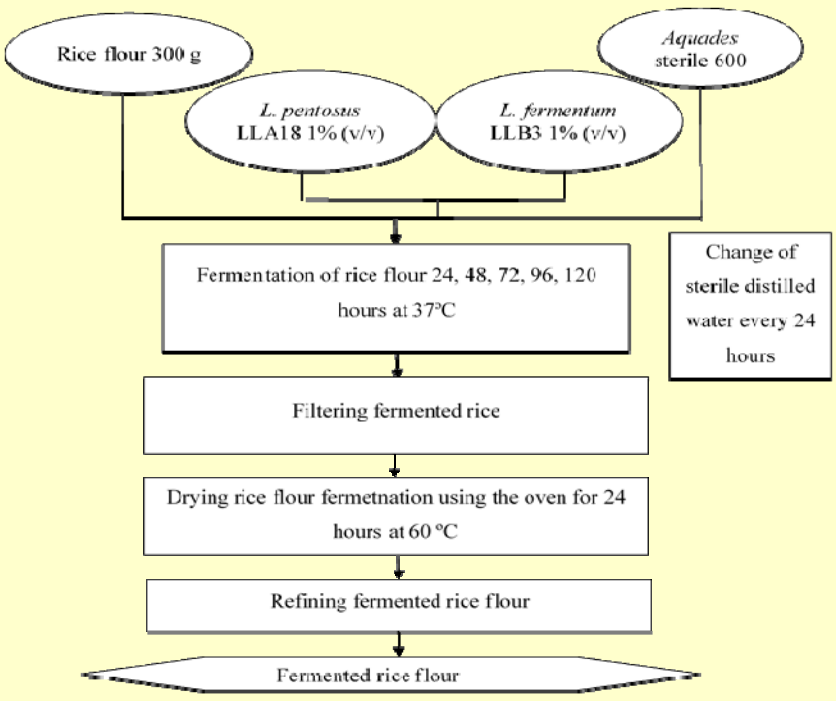


Figure 1. Flow chart of rice flour fermentation

Table 1. Chemical analyses of rice flour during fermentation

| Culture \ Chemical analyses | Duration of fermentation (hours) 0 | 24 | 48 | 72 | 96 | 120 |
|---|---|---|---|---|---|---|
| | | | Water content (%) | | | |
| *L. pentosus* LLA18 | 6.82 ± 0.07* | 7.28 ± 0.14$^{ab}$ | 7.52 ± 0.43$^{abc}$ | 7.20 ± 0.25$^{abc}$ | 7.28 ± 0.30$^{c}$ | 6.96 ± 0.22$^{a}$ |
| *L. fermentum* LLB3 | | 7.22 ± 0.41$^{abc}$ | 7.26 ± 0.35$^{bc}$ | 7.25 ± 0.35$^{abc}$ | 7.32 ± 0.48$^{c}$ | 7.12 ± 0.60$^{bc}$ |
| | | | Fat content (%)** | | | |
| *L. pentosus* LLA18 | 1.77 ± 0.49* | 1.42 ± 0.33$^{d}$ | 1.35 ± 0.28$^{bcd}$ | 1.75 ± 0.15$^{e}$ | 1.37 ± 0.14$^{cd}$ | 1.24 ± 0.28$^{abcd}$ |
| *L. fermentum* LLB3 | | 1.02 ± 0.26$^{a}$ | 0.95 ± 0.22$^{a}$ | 1.23 ± 0.19$^{abcd}$ | 1.08 ± 0.21$^{abc}$ | 1.05 ± 0.22$^{ab}$ |
| | | | Protein content (%)** | | | |
| *L. pentosus* LLA18 | 8.05±1.05* | 7.53±0.19$^{a}$ | 9.28±0.66$^{b}$ | 10.10±0.41$^{c}$ | 11.03±0.48$^{d}$ | 11.91±0.31$^{e}$ |
| *L. fermentum* LLB3 | | 12.37±0.18$^{ef}$ | 12.96±0.91$^{f}$ | 14.18±0.58$^{g}$ | 15.58±0.58$^{h}$ | 17.22±0.60$^{i}$ |
| | | | Ash content (%) | | | |
| *L. pentosus* LLA18 | 0.50 ± 0.10* | 0.25 ± 0.03$^{f}$ | 0.23 ± 0.02$^{e}$ | 0.19 ± 0.01$^{c}$ | 0.16 ± 0.01$^{b}$ | 0.11 ± 0.01$^{a}$ |
| *L. fermentum* LLB3 | | 0.28 ± 0.01$^{g}$ | 0.22 ± 0.01$^{de}$ | 0.20 ± 0.01$^{cd}$ | 0.16 ± 0.02$^{b}$ | 0.11 ± 0.01$^{a}$ |
| | | | Reducing sugar content (%)** | | | |
| *L. pentosus* LLA18 | 0.20 ± 0.01* | 0.14 ± 0.01$^{a}$ | 0.22 ± 0.02$^{c}$ | 0.25 ± 0.01$^{d}$ | 0.28 ± 0.01$^{e}$ | 0.31 ± 0.01$^{f}$ |
| *L. fermentum* LLB3 | | 0.17 ± 0.03$^{b}$ | 0.22 ± 0.03$^{c}$ | 0.29 ± 0.01$^{e}$ | 0.32 ± 0.02$^{f}$ | 0.39 ± 0.01$^{g}$ |
| | | | Amylose content (%) | | | |
| *L. pentosus* LLA18 | 21.27 ± 0.97* | 19.92±1.67$^{de}$ | 19.61±0.77$^{cde}$ | 18.54±1.74$^{abcd}$ | 17.86±1.01$^{abc}$ | 17.50±2.12$^{ab}$ |
| *L. fermentum* LLB3 | | 20.98±0.67$^{e}$ | 19.02±0.87$^{bcd}$ | 18.72±2.18$^{bcd}$ | 18.49±0.95$^{abcd}$ | 16.74±1.77$^{a}$ |
| | | | pH** | | | |
| *L. pentosus* LLA18 | 6.36 ± 0.02* | 4.35 ± 0.05$^{h}$ | 4.19 ± 0.11$^{g}$ | 4.08 ± 0.09$^{fg}$ | 3.94 ± 0.07$^{de}$ | 3.79 ± 0.09$^{c}$ |
| *L. fermentum* LLB3 | | 4.19 ± 0.07$^{g}$ | 4.02 ± 0.11$^{ef}$ | 3.83 ± 0.16$^{cd}$ | 3.65 ± 0.14$^{b}$ | 3.45 ± 0.10$^{a}$ |

Keys:
- All values are mean ± standard deviation, * no statistical testing is performed.
- Parameters with the symbol ** do not show significant differences ($p < 0.05$) between 2 types of bacteria based on the Independent T-Test.
- Values with different superscript symbols show significantly different relationships in each treatment ($p < 0.05$) based on the One-Way ANOVA test. The significance test between treatments used the Duncan test.

Table 2. Physical analyses of rice flour during fermentation

| Culture \ Physical analyses | Duration of fermentation (hours) 0 | 24 | 48 | 72 | 96 | 120 |
|---|---|---|---|---|---|---|
| | | | White degree (%)** | | | |
| *L. pentosus* LLA18 | 96.41±0.16* | 95.37±0.52$^{c}$ | 94.67±0.63$^{b}$ | 94.52±0.80$^{b}$ | 94.26±0.59$^{ab}$ | 93.66±0.29$^{a}$ |
| *L. fermentum* LLB3 | | 96.20±0.19$^{d}$ | 95.69±0.47$^{cd}$ | 95.49±0.82$^{c}$ | 93.97±0.61$^{ab}$ | 94.34±0.46$^{ab}$ |
| | | | Kamba density (g/ml) | | | |
| *L. pentosus* LLA18 | 0.68 ± 0.03* | 0.65 ± 0.02$^{f}$ | 0.55 ± 0.03$^{d}$ | 0.51 ± 0.03$^{c}$ | 0.46 ± 0.02$^{b}$ | 0.42 ± 0.02$^{a}$ |
| *L. fermentum* LLB3 | | 0.57 ± 0.01$^{e}$ | 0.57 ± 0.03$^{e}$ | 0.50 ± 0.01$^{c}$ | 0.49 ± 0.03$^{c}$ | 0.47 ± 0.01$^{b}$ |
| | | | solubility (%)** | | | |
| *L. pentosus* LLA18 | 3.64±0.55* | 4.47±1.21$^{a}$ | 7.45±1.52$^{c}$ | 8.13±1.17$^{cd}$ | 9.12±1.13$^{d}$ | 10.93±0.63$^{e}$ |
| *L. fermentum* LLB3 | | 5.96±0.87$^{b}$ | 8.78±1.49$^{cd}$ | 11.13±0.73$^{ef}$ | 12.29±1.18$^{f}$ | 15.11±0.68$^{h}$ |
| | | | *Swelling Volume* (%)** | | | |
| *L. pentosus* LLA18 | 8.23±0.77* | 8.58±0.58$^{a}$ | 9.95±0.15$^{c}$ | 9.95±0.15$^{c}$ | 10.90±0.53$^{de}$ | 12.04±0.45$^{f}$ |
| *L. fermentum* LLB3 | | 9.42±0.49$^{b}$ | 10.56±0.47$^{d}$ | 10.56±0.47$^{d}$ | 12.34±0.36$^{fg}$ | 12.66±0.82$^{g}$ |
| | | | *water absorption capacity* (%) | | | |
| *L. pentosus* LLA18 | 0.64 ± 0.37* | 0.88 ± 0.24$^{ab}$ | 1.00 ± 0.09$^{b}$ | 1.00 ± 0.09$^{b}$ | 0.88 ± 0.05$^{ab}$ | 0.69 ± 0.03$^{a}$ |
| *L. fermentum* LLB3 | | 0.85 ± 0.25$^{ab}$ | 1.02 ± 0.07$^{b}$ | 1.02 ± 0.07$^{b}$ | 0.95 ± 0.14$^{b}$ | 0.89 ± 0.24$^{ab}$ |

Keys:
- All values are mean ± standard deviation. * no statistical testing is performed.
- Parameters with the symbol ** do not show significant differences ($p < 0.05$) between 2 types of bacteria based on the Independent T-Test.
- Values with different superscript symbols show significantly different relationships in each treatment ($p < 0.05$) based on the One-Way ANOVA test. The significance test between treatments used the Duncan test.

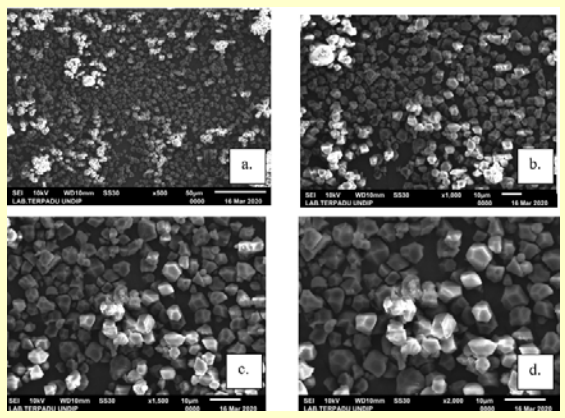


Figure 2. Morphology of Fermented Rice Starch Granules for 120 hours fermentation with *Lactobacillus fermentum* LLB3 with magnifications of 500x (a), 1000x (b), 1500x (c), and 2000x (d)

**Conclusion**

The best rice flour was obtained with a fermentation time of 120 hours using the *Lactobacillus fermentum* LLB3. Based on Scanning Electronic Microscope (SEM), fermented rice flour has separating, not clustering, and irregular starch granules.

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