Poster Presentation

The 7th TSME International Conference on Mechanical Engineering
13-16 December 2016

POS0015

THE INCREASE OF GAMMA-AMINOBUTYRIC ACID (GABA) BY USING ATMOS PHERIC PLASMA

P. Wongpanom[1]*, T. Traikool[2], N. Poolyarat[2], D. Athinuwat[3] and T. Onjun[1]

[1]School of Manufacturing Systems and Mechanical Engineering,
Sirindhorn International Institute of Technology, Thammasat University, Pathum Thani, 12120, Thailand
[2]Department of Physics, Faculty of Science and Technology, Thammasat University, Pathum Thani, 12120, Thailand
[3] Department of organic farming management, Faculty of Science and Technology, Thammasat University,
Pathum Thani, 12120, Thailand
Corresponding Author: E-mail patcharee.wpn@gmail.com, Telephone Number 080-0918815

Abstract

This work aims to increase the quantity of gamma-aminobutyric acid (GABA) in Thai Sung-yod rice by using atmospheric plasma generated by dielectric barrier discharge (DBD). After Thai sung-yod rice seeds are treated with atmospheric plasma, they were soaked in water at 40˚C for 4 hr in the oven. Then, they were soaked again in water for 24 hr they were exposed by atmospheric plasma. GABA content was determined by spectrophotometry at a wavelength of 630 nm and analyzed by ANOVA software. It is found that atmospheric plasma treatment can increase the GABA content in rice seeds up to 47%.

Keywords: Gamma-aminobutyric acid (GABA), Atmospheric plasma, Plasma

1. Introduction

Nowadays, the current trends of consumers want a healthy food with more nutritional value. As a result, many people are interested in germinated brown rice because germinated brown rice has high nutrients. Germinated brown rice caused by soaked in water can increases nutrients, especially gamma aminobutyric acid or GABA.

Fig.1 Germinated brown rice

GABA is a substance formed by natural processes occurring while the rice is germinated the white root nodule of rice. GABA is an amino acid from the decarboxylation process of Glutamic acid. GABA has functions as a neurotransmitter in the central nervous system, which acts as a inhibitor to maintain a balance in the brain activities. That can prevent diseases such as cancer, diabetes, Alzheimer disease and also reduce blood pressure. Moreover, GABA helps to stimulate the anterior pituitary, which is responsible for producing hormones that help in the human growth hormone (HGH), which causing the tissue that make the muscle firmness and substance lipotropic which is prevent the accumulation of fat in the body that can lose weight for those who want to diet**.**

2. Materials and Methods

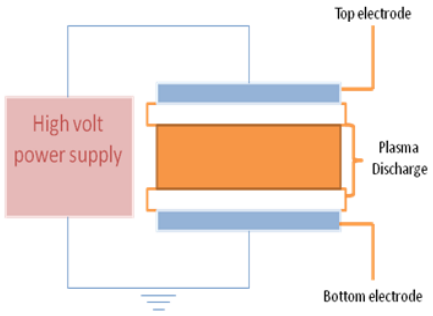
2.1 Sample

In this work, brown rice of Thai Sung-Yod rice cultivar from Phatthalung province was used.

2.2 Dielectric Barrier Discharge (DBD)

Brown rice of Thai Sung-Yod rice was placed on petri dish with gas gaps 3 mm which was applied by a high frequency electric field over a parallel copper plate at 16 kV with frequency 5.5 kHz for 30 s.

(A) Experiment setup



(B) Diagram of Dielectric Barrier Discharge (DBD)

Fig. 2 (A) Experiment setup and (B) Diagram of Dielectric Barrier Discharge (DBD)

2.3 Process of GABA

After treated with plasma, rice seeds samples were soaked in water at 40˚C for 4 hr and soaked it again at room temperature. After the seeds was soaked for 24 hr at room temperature. Then, the rice seeds samples start to germinate. After germinated rice seeds samples were threshed and dissolved with 80% ethanol shaken it thoroughly, then filtered with the filter paper(no.1). Evaporate the ethanol in the filtered solution by boiled for 10 min. Added 3 ml distilled water, 0.2 ml of 0.2 M borate buffer and 1.0 ml of 6% phenol, then mixed it thoroughly and cooled for 5 min. Next added 0.4 ml of 10–15% NaOCl, after that shaken it. Finally, boiled the solution for 10 min, and allowed to cool.

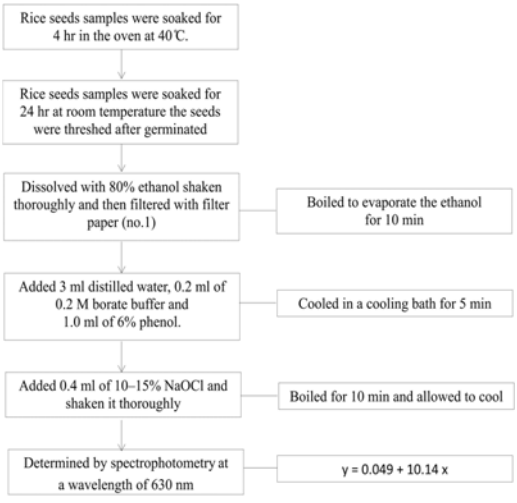


Fig 3 Process of GABA

The solutions were determined by spectrophotometer at the wavelength by 630 nm with ethanol as a blank.

Fig. 4 The spectrophotometer

GABA content was determined by comparing the optical density reading with the standard GABA content curve analyzed by Eq. (1)

$$y = 0.049 + 10.14\ x \qquad (1)$$

3. Result and discussion

The results show that the germination of Sung-Yod rice with plasma treatment is higher than without plasma treatment. This is similar to the report that the germination rate can be increased up to 75.4% with plasma treatment compared with 56.4% of the germination rate of without plasma treatment [3]. Brown rice started to change at the first day both of with plasma treatment and without plasma treatment after cultivation. From Fig 5 and Fig 6, it can be found that with plasma treatment has grown better, by has longer roots than without plasma treatment.

POS0015

Fig. 5 The comparison of the germinated between (A) Sung-yod rice without plasma treatment and (B) Sung-yod rice with plasma treatment cultivated after 3 days.

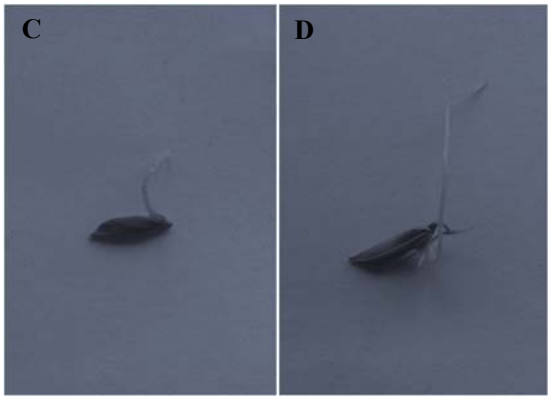


Fig. 6 The comparison of the length between (C) Sung-yod rice without plasma treatment and (D) Sung-yod rice with plasma treatment cultivated after 3 days.

The GABA content of rice seeds can be increased after treated with plasma treatment compared with without plasma treatment significantly at 1st, 2nd, 3rd and 5th days. Although the GABA content at 4th, 6th and 7th day of with plasma treatment and without plasma treatment was found no difference significantly that shown in Fig 7.

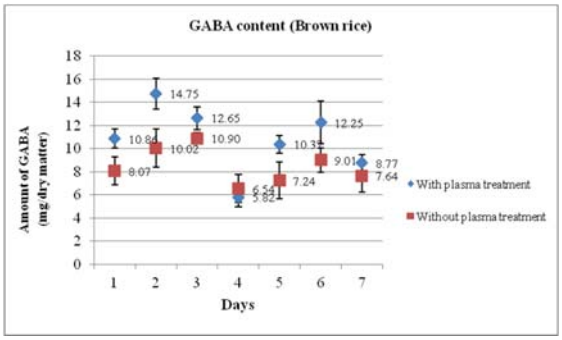


Fig. 7 GABA content

From Fig.7 the GABA content decline after 2nd days because of the amount of GABA are transported into the Krebs cycle for generate energy to growth the seedlings.

4. Conclusion

Base on the ANOVA analyze at 95% confidential level, it is found that the GABA content of brown rice of Thai Sung-Yod rice with plasma treatment increases when the seeds are treated with atmospheric plasma. The GABA content with plasma treatment increases higher than without plasma treatment (at the 1st, 2nd, 3rd and 5th days after cultivar) (by 37.5724%, 47.2055%, 16.0550% and 12.3711%, respectively) significantly.

5. Acknowledgement

The authors gratefully acknowledge the financial support provided by Thammasat University, Thailand under the TU Research Scholar, Contract No. 1/2559.

6. References

[1] Karladee, D. S. Suriyong, S. (2012). γ–Aminobutyric acid (GABA) content in different varieties of brown rice during germination, *Applied ScienceAsia*, 38(2012), Feb 2012, pp. 13-17

[2] Noriko, K. Kikuichi, T.Hidechika T. Tadanao, S. Naoto, S. Toshinori, K.(2007). Effect of soaking and gaseous treatment on GABA content in germinated brown rice, *Applied Food Engineering,* 78(2007), December 2005, pp. 556-560

[3] Tipwimol, T. (2014). Development of dielectric barrier discharge for plasma production to improve Pathum Thani 80(RD31) rice seed germination, Thammasat University,Phahum Thani

[4] Vcharkarn.com.(2009). Germinated brown rice, URL:http://www.vcharkarn.com/varticle/39050, accessed on 14/07/2016