International Journal of Biochemistry, Bioinformatics and Biotechnology Studies
Vol.3, No.1, pp.1-5, March 2017
Published by European Centre for Research Training and Development UK (www.eajournals.org)

LACTIC ACID FERMENTATION IN STARFRUIT (AVERRHOA CARAMBOLA) JUICE BY LACTOBACILLUS PLANTARUM

Anggi M. S. Siregar

Postgraduate School, Universitas Airlangga

ABSTRACT: *Starfruit (Averrhoa carambola) is one of fruit that grow in Indonesia widely. People consume starfruit only by eat it directly and there is no other way to consume it despite eat it directly. It has many antioxidant that can be useful for human health. Probiotics are live microbial feed supplement that affects host by improve the balance of intestinal. Most of probiotics are lactic acid bacteria such as Lactobacillus plantarum. Probiotics can provide some health benefits such cholesterol reduction, enhanced function of gastrointestinal, lower the risk of colon cancer, and improved immune system.In this study, we successfully fermented a starfruit juice with lactic acid concentration 59025 ppm as yield 87,5%.*

KEYWORDS: Fermentation, Lactic Acid, Starfruit

INTRODUCTION

Averrhoa carambola or starfruit is an attractive, tropical, exotic, and shrub-like ornamental tree from Oxalidaceae family. The ripe fruits can freshly consumed or sometimes used to produce jelly and juice. The fruit widely used as traditional medicine for treatment some of ailments. The innovation of starfruit consumption technique is needed to enhance people to consume this fruit. It has many active compounds that help us in our health needs.

Fermentation is one of process that can improve the organoleptic qualities of food. Not only that, it also can enhance the use of the food. The microbial cell that include in the product also can help in gastrointestinal to against the pathogen. One of the fermentation is lactic acid fermentation.

The aim of this study is want to try an innovation in presenting starfruit juice with fermentation of *Lactobacillus plantarum*.

LITERATURE REVIEW

Fermentation

Fermentation is one of the oldest process that used to preserve food. Fermented food consumes in many country. Microorganism such as bacteria, yeast, and molds play a prominent role in the fermentation process. The products are depending on the biochemical reaction of the agent. Fermentation process enhances nutritional value of the food by that biochemical reaction in synthesis amino acids, mineral, or vitamins. It also can change the digestibility, detoxification, and destruction. These can change the flavor, aroma, and texture that can affect organoleptic qualities (Aktac *et al*. 2015).

Print ISSN: 2397-7728, Online ISSN: 2397-7736

Lactic acid bacteria enhance immune system that support the production of gamma interferon and immunoglobulin A, which leads antitumor activity. The mechanism is the bacteria enter the digestive tract with the fermented food leads to decrease the activity of some enzymes such as b-glucoronidase, nitroreductase, and azotoreductase in the intestinal (Turantas, 1998).

Lactic Acid Fermentation

Lactic acid bacteria already used widely in a food industry. Many fruits and vegetables successfully used to be fermented by lactic acid bacteria. Application of lactic acid bacteria in fermentation on fruits and vegetables is cheap and can be sustain to prevent the decaying process which can extend the food consumability in a safe conditions. *Lactobacillus plantarum* is known widely as one of bacteria which mostly used in fruits and vegetables. *L. plantarum* easily found in fermentation and also gastrointestinal tract of animals and humans. It is naturally contaminating and applying due to its adaptable in a broad condition. It can ferment vary carbohydrate and other polimer source. It also can catabolize polyphenol compounds and also synthesize antimicrobial compounds (Filannino *et al*., 2014).

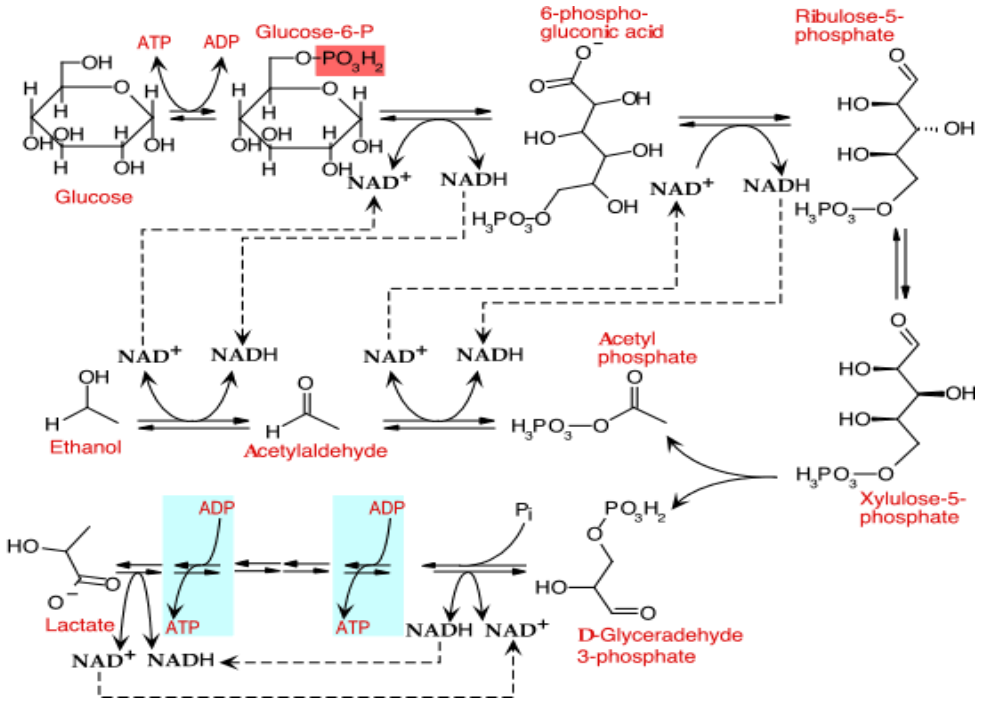

Figure 1. Biochemical Pathway that Happened in *Lactobacillus plantarum*

Starfruit (*Averrhoa carambola*)

Starfruit grow in tropic and subtropic regions of the world which popular and largerly planted in Southeast Asia. Is usually consumed fresh or juiced. Starfruit is a good sources of antioxidant such as proanthocyanidins, cathechin, and vitamin C (Shui & Leong, 2006).

Despite of antioxidant, starfruit contains active compounds amino acids, oxalic acid, tartaric acid, citric acid, carbohydrates, fats, and proteins. Starfruit has very good oxalic acid (can be as high as 1 wt% of wet mass or 74% of the total acid content depending on the level of maturity of the fruits) (Borel *et al*., 2014).

Print ISSN: 2397-7728, Online ISSN: 2397-7736

METHOD

1. Starfruits that bought from store blended and filtered and we use the supernatant. The starfruit juice sterilized by pasteurization then inoculated by *Lactobacillus plantarum* 2% (v/v) with 24 hours incobation.

2. The total sugar concentration was tested by Phenol-Sulphuric Acid method. 0,5 mL sample added with 0,5 mL phenol 1% (v/v) then shaken. After that, added 2,5 mL concentrated sulphuric acid and waited 10 minutes. The absorbance read at 488 nm.

3. The reduction sugar concentration was tested by DNS (Dinitro Salicylyc Acid) method. 1,5 mL sample added with 1,5 DNS reagent then heated with water 90^{O}C for 10 minutes. Then 1 mL of potassium sodium tartrate added to the solution. Then cooled it an the absorbance read at 575 nm.

4. The lactic acid concentration was tested by PHF method. 1 mL sample added with 6 mL sulphuric acid. Heated with water 90^{O}C for 10 minutes then cooled until ± 25^{O}C. Then added 100 µL Blue Vitriol and 200 µL PHF then shaken. Waited for 30 minutes then the absorbance read at 570 nm.

FINDING AND DISCUSSION

Table 1. Fermentation Result

Time (hour)	pH	Total Sugar Concentration (ppm)	Reduced Sugar Concentartion (ppm)	Lactic Acid Concentration (ppm)
0	4,5	58270	74080	55525
24	3	45329	70080	59025

Calculation of yield

Δ [reduced sugar] = 4000 ppm (mg/L)

Δ [lactic acid] = 3500 ppm (mg/L)

$Yield_{p/s}$ = [product] / [substrate] = 3500 / 4000 = 0.875

Or 87,5%

The medium used in this study was starfruit juice. Initially sterilization of the media, to reduce the risk of contamination of unwanted microorganisms. Furthermore, *Lactobacillus plantarum* inoculation was performed. To determine the success of lactic acid fermentation, there are several parameters measured such as pH, total sugar, reduced sugar, and lactic acid.
After incubation, we found different lactic acid concentrations between 0 hour and 24 hours. Through the fermentation, it is known that lactic acid concentration in the media with treatment is higher than the media without treatment.
Other results indicating the formation of lactic acid in the treatment medium is a decrease in

Print ISSN: 2397-7728, Online ISSN: 2397-7736

pH, decreased total sugar and reduction of reduced sugar. The decrease in pH is due to the formation of lactic acid that affects the pH of the environment to become acidic. Lactic acid fermentation pH ranges from 4.5 to 5.5. Lactic acid is produced from a glucose substrate contained in a starfruit juice medium. Increasing lactic acid levels followed by reduction of reducing sugar in the medium.

If *L.plantarum* produces lactic acid through homofermentative pathways, then from every 1 mol of glucose there will be 2 moles of lactic acid. On measurable glucose concentration measurements, glucose decreased as much as 4000 ppm. Meanwhile, it is also known that lactic acid concentration increased by 3500 ppm. When viewed comparison of concentration, yield obtained 0,875 or 87,5%. Whereas according to theory, should yield obtained is 1, because 1 lactic acid produced from 1 molecule of glucose. This difference may be due to both the measurement error and the conversion of the substrates to a product other than lactic acid. Or possible contamination that occurs after sterilization, unintentionally the opening of starfruit juice. This assumption is further strengthened by the high concentration of lactic acid in negative control. So the possibility of starfruit juice samples used already contain other lactic acid bacteria contaminants before, and after the sterilization of lactic acid they produce is not lost. Other lactic acid bacteria contaminants may also be alive as they are resistant to high temperatures or new incoming contaminants. Contaminants certainly not from non-lactic acid bacteria groups because lactic acid produced by lactic acid bacteria is able to inhibit the growth of other bacteria that can not stand acid.

CONCLUSSION AND RECOMMENDATION

Lactobacillus plantarum is able to ferment sugars in starfruit juice into lactic acid. The success fermentation showed by the decreased pH, reduction of reduced sugar concentration, and the increase of lactic acid concentration. The lactic acid measured 59025 ppm as yield 87,5%.

REFERENCES

Aktac, S., Haskoylu, A., & Gunes, E. (2015). Nutritional Properties of Hardaliye. In proceedings of the 3rd International Symposium on Traditional Foods from Adriatic to Caucasus, Sarajevo, Bosnia and Herzegovina

Borel, N. N. M., Foba-Tendo, J., Yufanyi, D. M., Etape, E. P., Eko, J. N., & Ngolui, L. J. (2014). *Averrhoa carambola*: A Renewable Source of Oxalic Acid for the Facile and Green Synthesis of Divalent Metal (Fe, Co, Ni, Zn, and Cu) Oxalates and Oxide Nanoparticles. Journal of Applied Chemistry. 767695

Filannino, P., Cardinali, G., Rizzello, C. G., Buchin, S., de Angelis, M., Gobbetti, M., & di Cagno, R. (2014). Metabolic Responses of *Lactobacillus plantarum* strain during Fermentation and Storage of Vegetable and Fruit Juices. Applied and Environmental Microbiology 80: 2206-2215

Patil, A. G., Patil, D. A., Phatak, V., & Chandra, N. (2010). Physical and Chemical Characterization of Carambola (*Averrhoa carambola* L.) Fruit at Three STages of

Print ISSN: 2397-7728, Online ISSN: 2397-7736

Maturity. International Journal of Applied Biology and Pharmaceutical Technology 1: 624-629

Shui, G. & Leong, L. P. (2006). Residue from Star Fruit as Valuable Source for Fuctional Food Ingredients and Antioxidant Nutraceuticals. Food Chemistry 97:277-284

Turentas, F. (1998). Microorganism that Play a Role in Fermentation. Food Microbiology, 2nd ed: 433-453

Print ISSN: 2397-7728, Online ISSN: 2397-7736