International Journal of Multidisciplinary Research and Development

IJMRD 2014; 1(3): 41-48
www.allsubjectjournal.com
Received: 01-08-2014
Accepted: 14-08-2014
e-ISSN: 2349-4182
p-ISSN: 2349-5979

Nguyen Phuoc Minh
Agro-Aquaculture Faculty, Tra Vinh University, Vietnam.

Correspondence:
Nguyen Phuoc Minh
Agro-Aquaculture Faculty,
Tra Vinh University, Vietnam.

Different factors affecting to waxy black rice malt production

Nguyen Phuoc Minh

Abstract
Black glutinous rice contains many nutritious substances such as essential amino acids, vitamins, minerals, and especially effective antioxidants. In this research, we determined chemico-physical properties of black glutinous rice material and its optimum malting conditions. Soaking, incubating and drying conditions were studied to get the dried black glutinous malt – the essential material for nutritious flour and beverage production. The optimized humidity for malting 38.97% gained at the room temperature of soaking process in 72 hours with the ratio of material and solvent 1:3. After soaking, the black glutinous rice incubated at 30 ºC in 8 days and then carried out drying at 45 ºC - 8 hours, 65 ºC - 8 hours and 75 ºC - 8 hours to reached the humidity of the material 3.87% and the mashing capability 181.8WK that safe for storing to study the following technology processes.

Keywords: Black glutinous rice, soaking, incubating, drying, malting

1. Introduction

1.1 Waxy (glutinous/ sticky) black rice

Rice is an important food crop of more than half the world's population and is the main food source in Asia. According to numerous scientific studies at home and abroad about the uses and applications of the type of rice, then sticky black rice (or cam) is a type of cereal has high nutritional value. Gu Defa (2006) shows the presence of nutrients especially in sticky black rice as fiber, protein, essential amino acids, B vitamins, minerals etc., stand out from the others and completely beneficial to human health. Especially very high anthocyanin content with superior antioxidant anthocyanin in sticky black rice material help prevent the harmful effects of free radicals (Kanitha Tananuwong, 2010), at the same time protects the grain from being peroxyd, does not cause the smell of rancidity when preserving (Duong Thanh Liem, 2010). In addition, sticky black rice also contains glutinous structures, many deaths created distinctive scent, more attractive than the other (C. Bounphanousay, 2008). Rice sprouts contain high levels of nutrients are easy to absorb, the amino acids, vitamins, minerals and fiber. The amino acids such as lysine 3-fold higher gamma-amino butyric acid, 10 times the regular rice, besides tocotrienol factor (TRF), antioxidant, protects the lipoprotein-cholesterol in the blood is high. Add to that the use of food products from rice gave up germ helps prevent headaches, relieve symptoms of constipation, colon cancer prevention, adjust blood sugar levels, prevent heart disease, lower blood pressure and prevent Alzheimer's disease (Kayahara and Tsukahara, 2000). Youn (2007) found that the antioxidant activity of the extract from rice germ is higher than 1.3-1.6 times the regular rice. Rice germ also found that have the ability to improve mental health and immunity in women who are breast feeding (Shigeko *et al*., 2007). Besides the increased nutritional value, seed sprouts process would create divisions and slight sweetness subdued (Klaus, 1980).

1.2 Some studies about sticky black rice

In 2006, in China there are studies on the nutritional composition of sticky rice, "Astudy on special nutrient of purple glutinous rice", by Gu Defa *et al*.. Research the presence of nutrients especially in sticky rice as fiber, protein, B vitamins, minerals (Ca, P, Fe, etc.), much higher than ordinary rice and completely beneficial to human health. In 2008, Laos has a study on the characteristics of molecule created the aroma of sticky black rice,"Chemical and molecular characterization of fragrance in Black glutinous rice from Lao PDR", of C. Bounphanousay. This is the first study on the structure and molecular properties of glutinous varieties Lao. In 2010, in Thailand there is exploitation and application research of antioxidants from blackglutinous rice, "Extraction and application of antioxidants from black glutinous rice", by

Kanitha Tananuwong *et al*. study on determination of the optimum extraction conditions of anthocyanins and antioxidant of fish oil. Black glutinous rice flour is mixed in the extraction of water for 70%: aceton 30% at pH 6.8 delicacy, in 4 hours to bring crude extracts with the highest antioxidant. And the dry content of the supplement to the fish oil is 1000 mg/kg for the antioxidant results well.

Fig 1: Instant sticky black rice

Fig 2: Instant dried sticky black rice

Fig 3: Sticky black yourt

Fig 4: Sticky black wine

Fig 5: Red glutinous dairy rice flour

Fig 6: Black sticky rice ice bar

Fig 7: Sticky black bread

Fig 8: Black sticky rice wine

Fig 9: Black glutinous rice flour

However, at present the production and consumption of products from raw materials of sticky black rice is not yet wide spread. In order to facilitate the development of products from this useful source material, as well as contribute to improving commercial, protect valuable genetic resources of similar sticky black rice in traditional Vietnam, we proceed to make the subject "research on production technology of malt", namely identification of the physiochemical of sticky black rice the survey, the process of maceration (influence of the rate of rice: water and of time soaking up moisture sprouts), surveys the process of annealing (effect of pre-incubation time to active amylase of rice sprouts), surveys the drying mode (the influence of temperature, drying time and moisture balance and the capability of the malt).

2. Material & Method

2.1 Material

2.1.1Sticky black rice: Vietnam. The main raw material for the product is rice glutinous varieties Oryza sativa L. glutinosa Tanaka bought at the Vinh Hung plant protection stations, Long An province, Vietnam.

Fig 10: Raw sticky black rice

2.1.2 Water: meeting standard TCVN 5502:2003

2.1.3 Refine sugar: Use refined sugar is produced at Bien Hoa sugar joint stock company in Bien Hoa I industrial zone, Bien Hoa, Dong Nai, Vietnam.

2.1.4 Kali sorbat: Potassium sorbate is the additive group in additives for preservation, anti-oxidation, stable. The INS: 202, ADI: 0-25 (3742/2001/QD-BYT). Against the decision on the drinking water from the sticky rice malt products there are 1000 ML: ppm (non-carbonated soft drinks).

2.1 Chemicals and equipments

2.2.1 Chemical

$CoSO_4.7H_2O$	H_2SO_4
Iod solution	HCl
Ethanol	NaOH
Glucose	Phenolphtalein

Equipments

- Water bath
- Electric cook
- Brix meter
- Dry oven
- Analytical balance
- pH meter
- Philip mixer
- Spectrophotometer UV-VIS
- Vaccum filtration
- Vaccum packing
- Sterilizer
- Others.

2.3 Research method

Quality control of raw materials, the survey defined the parameters for processing in the soaking, incubating, drying in the build work flow manufacture of malt from sticky black rice. Quality control of the finished malt. Pour the rice into the basket, wash brought sharply in hot running water spills, dirt sticking on the surface of the particles will move into the phase of water and then decanting off the lighter impurities, rice will rise and remove. Rice later cleaned are soaked in temperature is often the rate of rice: water and of time soaking nuts just enough to reach the humidity of popping up. Block nuts are soaked in water for 3 hours instead of 30 minutes once water stir once. Particle mass after soaking are strewn on the mesh tray, on the surface layer of thin fabric-covered seeds black, incubated at room temperature until it sprouts seeds blocks and reaches the highest amylase enzyme activity. When brewed, after 24 hours, misting once aimed to maintain the moisture necessary for the sprouts. The process of brewing up long roots to conduct germ 1.5-2 times the length of seeds, and sprouts 2/3-1 times the length of the particle stops (Hoang Dinh Hoa, 2002). Malt was strewn all over the tray and brought in three stages: drying Malt was dried at 45 ^oC to around 20% remaining moisture content (physiological drying); Raise the temperature up to 60 ^oC dryer moisture content is still about 10% (drying enzymes); Raise the temperature up to 75 ^oC and drying malt before reaching the moisture balance then stop the drying process (chemical drying), the moisture balance of malt, 3-5% (Hoang Dinh Hoa, 2002). Malt after getting out of the drying then proceeded to rip the roots immediately by manually manipulation as its well to, and then use the basket ladies ready to remove. After separating the roots, dried malt was checking the physiochemical and stored awaiting processing for the following products.

2.4 Analyzing method

Moisture:	Drying at 105 ^oC to constant weight
Dry matter:	Refractometer Atago 0-32%
Amylase activity:	Klimopski and Rozdevic method
Mashing capability:	Le Thanh Mai *et al*., 2005
Anthocyanin:	Compare color to $CoSO_4$ standard
Extraction recovery:	Weight method
Reduced sugar:	Ferrycyanure
Total sugar:	Ferrycyanure
Sensory evaluation:	TCVN 3215 – 79

2.5 Statistical analysis

Using Statgraphics Plus, Excel softwares to handle experimental data.

3. Result & discussion

3.1 Materials: test results of quality raw materials of sticky black rice

Table 1: Test results of raw material (by the volume of dry substance)

Parameter	Unit	Result
Moisture	%	11.7
Crude protein	%	8.9
Lipid	%	3.3
Glucid	%	75.5
Dietary fiber	%	13.18
Anthocyanin	%	0.49
The absolute mass of the particle	(g/1000 grains)	25.10
Percentage of impurities	%	2.12
Decay	%	0
Sprout	%	95.40
Color the rice husk		Specific colored rice
Colors likely when peeled husks		Black purple
Aroma		Characteristic of rice, no strange smells, does not smell musty

Moisture content of rice by 11.70% moisture is safe to preserve seed grain is no more than 13.5% according to ISO 1776-2004. If moisture beads on 16-17% will happen hot self-damaging phenomenon of particle mass (Nguyen Thi Hien, 2007). Sticky black rice over 3 months stored in room temperature conditions, cool not damage phenomena occur. Sticky black rice has a higher rate of 8.90% protein compared with remaining rice (5.8 percent). for rice brought up the higher the protein content, sprouts will show the amount of enzyme when grain sprouts is high. A favorite protein is 10-11% of the dry weight of the seed, too little content, no guarantee of booked for processing drinking

water products from malt, if excessive amounts of malt and fine stuff hardly make the less (Nguyen Thi Hien, 2007). Anthocyanin content in grain of sticky black rice (49,0 mg/g) accounted for 4.9% of the dry ingredients, much higher than the vegetables left purple red Strawberry fruit as we (1.188), purple cabbage (0.909) (Huynh Kim Cuc, 2010). The absolute mass of the higher the national rice endosperm as much leverage ratio of raw materials in the manufacture of larger (Le Thanh Mai *et al*., 2005). The absolute mass of the particles sticky black rice is lower than the absolute volume of rice, blue (33-37 g/1000 seeds) should rate the disposing of sticky black rice is higher than the remaining rice. Raw materials of sticky black rice used in the experiments was the same rice bought in plant protection stations should rate the impurities (sand, stone, gravel, straw, grain, nuts ... the half empty) was 2.12% and 95.04% sprouts capacity than the standard varieties of rice seeds (TCVN 1776-2004) is not less than 80% of the raw materials supply and sprouts well. Sticky black rice when removing the husk layer flip black purple rice, science has proven this bold colours, the iron content and the higher the anthocyanins, it is also the prominent characteristics of the varieties of sticky black rice versus conventional rice. Sticky black rice after 3 months of maintenance have damaged the phenomenon of color odor, retains the color characteristic smell of raw materials. According to ISO 1776-2004 the quality of rice varieties, the quality of sticky black rice used as standard to make rice varieties as well as up sprouts.

3.2 Effect of soaking time

Immersion mode affects the quality of barley malt. Moisture in the seeds is grain determinants which are eligible or not for the sprouts seeds exposed to moisture making activation of the enzymes that initiate the process of sprouts (Posner and Hibbs, 1997). Humidity sprouts in about 30-45% (Nguyen Ngoc De, 2008). The higher the humidity of grain sprouts sprouts easily, at the same time the enzyme amylase during more sprouts (Hoang Dinh Hoa, 2002). Amylase activity of seeds sprouts depends greatly onthe different conditions of immersion mode such as water temperature, water-soaked rice ratio: soak and soak time. The proper temperature for the soaking process is 25-30 ^{o}C gives malt obtained is of good quality, very suitable for use in manufacture of beverages (Nguyen Minh T *et al*., 2008). Soaking time also affects the characteristics of malt, short immersion periods, the concentrations of extracts, amino acids and mashing capacity will be lower. Time is too long and soaked in water rates more than needed, then the amount of oxygen not sufficient can produce toxins harmful to the product and hinder the ability of sprouts (Nguyen Thi Hien, 2007; Nguyen Thach Minh., 2008).

Table 2: Moisture content of rice after soaking

Rice:water Time (minutes)	1:2	1:3	1:4	1:5
48	21.75^{a}	25.56^{b}	27.11^{cd}	27.73^{d}
60	26.85^{c}	33.12^{f}	33.78^{fg}	34.05^{g}
72	28.81^{e}	38.97^{h}	39.03^{h}	39.13^{h}
84	28.97^{e}	39.01^{h}	38.86^{h}	39.19^{h}

Note: a, b, c, d, e, f, g, h ($p < 0.05$); meaningful differences; the value is the average of 3 times repeated.

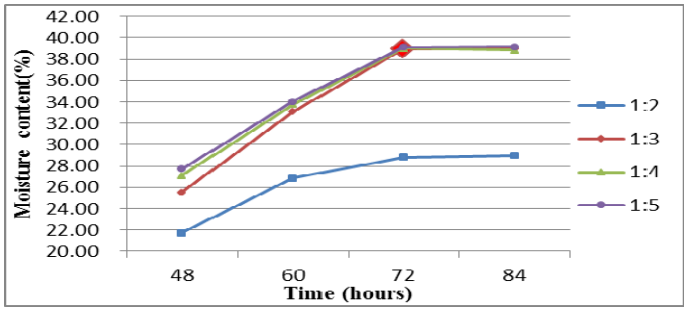

Fig 11: Moisture content of rice after soaking

Empirically, noticed the soaking time sticky black rice to reach the humidity maximum sprouts is quite long (72 hours) compared to barley and rice, blue (36-48 hours). The rate of water soaking the nuts just enough to reach the maximum humidity is 1: 3. Water uptake by seeds is mainly affected by the possibility of osmosis shell beads. The composition of seeds, soak water content, the concentration of dissolved substances in solution also affects the ability to absorb water (Klaus, 1980). Composed primarily of water absorption is protein, starch has very weak affinity with water while lipids are absolutely no affinity with water (Miller, 2010). Sticky black rice has a hard, thick crust structure and grain protein content of high (8.88% of weight of dry rice, about 10.3% of the weight of dry rice). Rice: water ratio is 1: 3 is equivalent to the ratio of rice to water soaking barley (Hoang Dinh Hoa, 2002). Immersion mode sticky black rice was chosen to use are: rice ratio: water is 1: 3; soaking time is 72 hours; soak at room temperature (around 30 ^{o}C); stir 30 seconds/time; change the water 3 hours/time and humidity after dipping about 38.97%.

3.3 Effect of incubation

Along with extended incubation time then the physiological properties of the particle will change, and the active presence of the enzyme amylase. Amylase activity depends greatly on the different incubation conditions. For rice, the minimum temperature is 10-12 ^{o}C, the optimal temperature is 30-37 ^{o}C and the maximum temperature is 40-42 ^{o}C inside (Klaus, 1980). Sprouts are living should have respiratory, O_2 uptake and CO_2 emissions. Therefore experiments conducted germ incubated at room temperature, annealing on mesh trays are draped in black gauze-thin and misting every day.

Table 3: Amylase activity by soaking time

Soaking time (days)	1	2	3	4	5	6	7	8	9
Amylase activity (active unit.A)	2.40^{a}	2.69^{a}	2.78^{a}	4.54^{b}	7.53^{c}	14.46^{e}	24.04^{g}	16.84^{f}	12.65^{d}

Note: a, b, c, d, e, f, g ($p < 0.05$); meaningful differences, value is the average of 3 times repeated

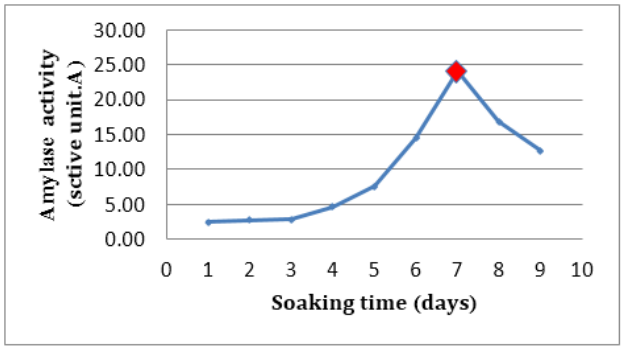

Fig 12: Amylase activity by soaking time

In the early days of activity, germ-brewed amylase rises very slowly, then soared on Friday and reached at on Saturday, then descending. Corder and Henry (1989) found that of the enzyme amylase increased slowly in the four days early sprouts is due at the beginning of the process of sprouts, the enzymes accumulate from, when the process of of sprouting going strong, the enzymes penetrate more into the endosperm. Sticky black rice has a high protein content should be when sprouts for active high malt amylase, higher than white rice (glutinous varieties in Taiwan) after the brewing is 44.21%. Time of brewed malt sticky black rice was selected as 7 days, then active amylase reach 24.04 active unit A is the highest.

Table 4: Moisture and mashing capability of malt by drying time

Time (hours)	2	4	6	8	10	12	14	16	18	20	22	24	26	28
Temperature (ºC)	45				60				75					
Moisture (%)	31.85^{n}	27.29^{m}	24.88^{l}	19.34^{k}	17.31^{h}	14.52^{g}	12.64^{f}	10.75^{e}	8.64^{d}	7.11^{c}	5.31^{b}	3.85^{a}	3.84^{a}	3.84^{a}
Mashing capability (WK)	170.4	177.4	183.5	191.3	194.7	196.2	198.8	192.4	190.8	189.2	186.3	181.8	180	178.8

Note: a, b, c, d, e, f, g ($p < 0.05$); meaningful differences, value is the average of 3 times repeated

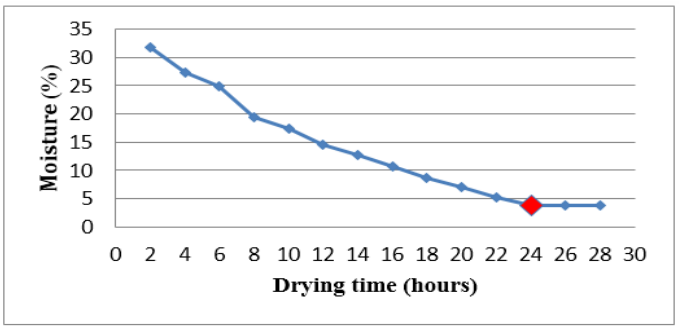

Fig 13: Moisture of malt by drying time

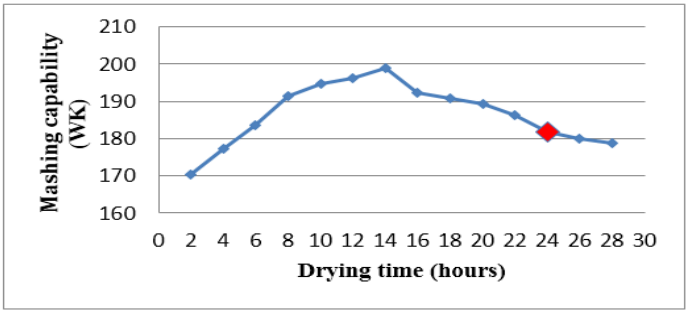

Fig 14: Mashing capability by drying time

Malt was dried at 45 ºC for 8 hours will reach 19.34% humidity; lift up the drying 60 ºC in 8 hours will reach 10.75% moisture and eventually raised in eight hours drying 75 ºC will reach equilibrium moisture is 3.85%, then finish drying malt. Track drying malt, malt's road capacity increases to the drying time of the 14th, the maximum is 198.8WK; then gradually reduced as the drying phase chemistry at 75 ºC and came upon malt balanced humidity reaches the mashing capability at end of 181.8 WK higher with malt when it starts drying, 13.42% lower compared to malt barley (210 WK). According to sorting, malt processing application processing of beverages based on mashing capability , the malt sticky black rice are classified fairly (Hoang Dinh Hoa,2002). Malt drying mode sticky black rice was selected as: 45 ºC drying in 8 hours, up to 60 ºC drying in 8 hours and 8 hours of drying 75 ºC, malt reaching the moisture balance is 3.85% and mashing capability of 181.8 WK.

3.5 Malt recovery after drying The results show the following drying shrinkage rate of (7.08%) of black sticky rice malt higher than barley malt (5%) (Hoang Dinh Hoa, 2002); does this infer that sticky black rice in the process up malt create the roots more weight compared with grains of barley in part compromising the economic value of malt sticky black rice. However the removal of the roots out of the malt to help enhance food safety for using malt because the alkaloid compounds are contain more toxic roots in strong with just a small dose to human body (Duong Thanh Liem, 2010).

3.6 Anthocyanin loss in malt after different treatments

Table 5: Anthocyanin loss in malt after different treatments

Treatment	Raw material	Cleaning	Soaking	Incubating	Drying	Treatment after drying	Dried malt
Anthocyanin content (mg/g dry matter)	49.00	43.75	35.05	32.73	26.48	26.14	26.14

Note: value is the average of 3 times repeated

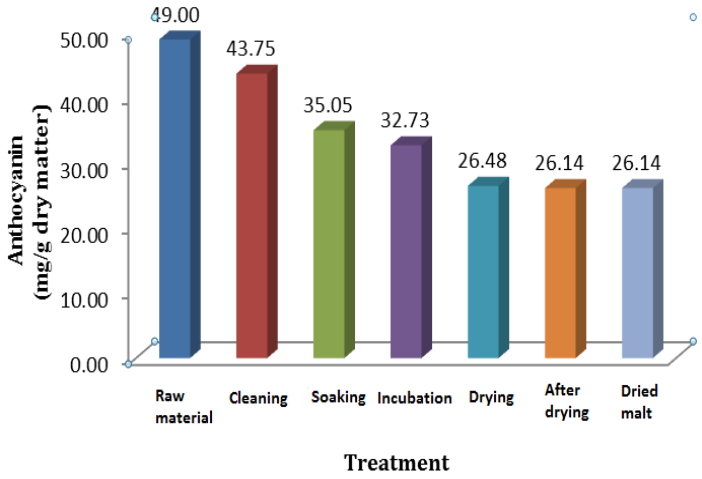

Fig 15: Anthocyanin of malt by different treatments

From results determined levels of anthocyanin production by then, we can calculate the shrinkage rate of anthocyanin content of rice malt products is 46.65%. Through the figures obtained, found levels of anthocyanin losses, many in the soaking and drying. The process of brewing up sprouts have lost small amounts. Characterization of anthocyanin pigment is soluble in water, and are sensitive to heat, light, so the stage soaking for longer (72 hours) in the country, has stirred the water and replaced many times already facilitate much going nuts in anthocyanins. Drying heat lifting several times, for longer periods (24 hours) did take much pigment anthocyanin in seed as defined. After drying the malt processing costs negligible anthocyanins showed sprouts and roots do not contain as much anthocyanin germinal stages.

3.7 Quality of malt product

Sticky black rice once up sprouts with dietary fiber, higher than those not yet up is from13.18% of raw materials increased 21.85% of the malt. However, the anthocyanin content of 46.65% decrease in raw materials due to past the stage where production conditions have made losses as much anthocyanin as the soaking and drying. From table results analysis of nutrient and energy like sugar on black rice malt shows apply sticky develop nutritional products such as nutritional drink, meal, nutrition. The capacity ofthe malt sticky black rice is fairly classified 181.8 in grading table of malt used as drinking water (Hoang Dinh Hoa, 2002).

Table 6: Physico-chemical parameters of malt product (by dry matter)

Parameters	Unit	Result
Moisture	%	3.87
Total protein	%	8.76
Total lipid	%	2.84
Total glucid	%	73.85
Ash	%	3.65
Dietary fiber	%	21.85
Mashing capability	WK	181.8
Anthocyanin	mg/g	26.14

3.8 Production cost of dried malt

Table 7: Production cost of dried malt from 1 kg raw sticky black rice

Description	Unit	Quantity	Unit price (VND)	Amount (VND)
Rice	Kg	1	20,000	20,000
Water	m^3	0,01	11,000	110
Electricity	Kwh	0, 1	2,000	100
Total (VND)				20,210

Note: the total cost of the product is not included in packaging, labor costs, and depreciation of equipment.

4. Conclusion

After the research and conduct of experiments examining the parameters of processing in the dry malt production process from raw material, sticky black rice, draw the following conclusions: in terms of raw materials: raw material waiting to produce moisture preservation is 11.7%; the absolute mass of the particle is 25.10 g/1000 grain; percentage of impurities is 2.12%; no reduce; and the capacity of sprouts was 96.44%. The material provides production with quality components: protein 8.9%; 3.3% lipid, glucid: 75.5%; also there are 13.18% dietary fiber, and anthocyanins accounted for 4.9%. The process of maceration: material after cleaning to be soaked in water at the rate of 1rice: 3 water at 30 ^oC, within 72 hours; they have stirred 30 minutes/time; change the water 3 hours/times. After the moisture soaking reached 38.97% and concentrations of anthocyanins is 35.06 mg/g of dry matter. The process of brewing: after soaking seeds was strewn sheet on the tray and has a thin black cloth cover, in the process of brewing has a misting every day; incubation period is 7 days at room temperature; can grain amylase is maximum active unit 24.04. Drying: drying granule equipment brought back in mode: 8 hours/ 45 ^oC, 60 ^oC, 8 hour, 8 hour/75 ^oC; grain moisture reached 3.85%; mashing capability is 181.8WK; concentration of anthocyanin is 26.48 mg/g of dry matter. After the drying process: to determine the prevalence disposing roots rub the broken is 7.08 percent. Dry malt product obtained with moisture is 3.87%; the protein is 8.76%; lipid is 2.84%; glucid was 73.85%; dietary fiber 21.85%; anthocyanin is 2.614%; mashing capability is 181.8WK; and the price for 1 kg of the product as 24,358 VND. The study was conducted in laboratory scale in schools and also the first step to study the creation of a new product from feedstock sticky black rice should not avoid some restrictions on the devices, an area of investment and funding, so there are a few recommendations in production technology, material source can provide large quantities with post-harvest preservation quality and stability. Further analysis of the many nutrients available in sticky black rice, particularly those ingredients have antioxidant properties aimed at adjusting production methods to minimize the losses of the components has the effect of improving health, preventing illness. The process of maceration: innovation immersion methods to shorten the soaking time reaches the maximum humidity that still preserves are nutrients as well as antioxidants in raw materials, as the survey add the effects when rising water temperatures dip more. Drying: drying regimes survey with temperature and other methods to limit exhausted of nutrients into the lowest level while still achieving required of malt in the production technology of drinking water.

5. Reference

1. Cuc HK. Extraction of anthocyanin from strawberry fruit with water sulfured and some feature of them, food college, Da Nang city.
2. De NN. *Paddy curriculum*, National University of Ho Chi Minh City, 2006.
3. Hien NT. Science and technology in malt and beer science and technology, Hanoi 2007.
4. Hoa HD. Malt and beer production, science and technology publishing house, Hanoi, Vietnam.
5. Liem DT, Functional food-sustainable health, science and technology publishing house 2010.
6. Liem DT. Toxicology and safety of agricultural products -food, Agricultural Publishing House, 2010.
7. Mai LT. The methods of analysis in the field of fermentation technology, science and technology, Hanoi, 2005.
8. May NV. Drying of agricultural products, science and technology, Hanoi, 2004.
9. Minh NT, Liên NX, Anh HK. Effects of soaking conditions on quality of malt barley, industrial University HCMC 2008.
10. Bounphanousay C. Chemical and molecular characterization of fragrance in black glutinous rice from PDR, Metro Manila, Philippines, 2008.
11. Corder AM, Henry RJ. Carbohydrate-degrading enzymes in germinating wheat, Cereal Chem 1989; 66(5):435-439.
12. Defa G, Meizu XA study on special nutrient of purple glutinous rice, Shanghai acdemy of agricultural science, Shanghai, 2006.
13. Tananuwong K, Tewaruth W. Extraction and application of antioxidants from black glutinous rice, Thailand, 2010.

14. Hiroshi K, Kikuichi T. Flavor, Health and Nutritional Quality of Pre-germinated Brown Rice. In: International Chemical Congress of Pacific Basin Societies in Hawaii, 2000.
15. Lorenz K, Cereal sprouts: Composition, nutritive value, food applications, Colorado State University, 1980.
16. Miller B. McDonald. Physiology of Seed Germination, The Ohio State University, Columbus. National Acedamic of Sciences, Washington D. C., 2010.
17. Posner ES, Hibbs AN.Wheat: the raw material. In: Wheat flour milling, American association of cereal chemists, Inc: Minnesota,1997; 2-10.
18. Shigeko S, Takashi H, Keiko H, Fumie M, Miyo H, Koichi K *et al*. Pre-germinated brown rice could enhance maternal mental health and immunity during lactation. Eur J Nutr 2007; 46: 391-396.
19. Lee YR, Woo KS, Kim KJ, Son JR, Jeong HS. Antioxidant Activities of Ethanol Extracts from Germinated Specialty Rough Rice. Food Sci Biotechnol 2007; 16(5):765-770.