

UNOFFICIAL TRANSLATION



THAI AGRICULTURAL STANDARD

TAS 4404-2012

**GOOD MANUFACTURING PRACTICES
FOR GERMINATED BROWN RICE**

**National Bureau of Agricultural Commodity and Food Standards
Ministry of Agriculture and Cooperatives**

ICS 67.020



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GERMINATED BROWN RICE**

National Bureau of Agricultural Commodity and Food Standards

Ministry of Agriculture and Cooperatives

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**Published in the Royal Gazette, Announcement and General Publication Volume 129,
Special Section 144 ง (Ngo),**

Dated 19 September B.E. 2555(2012)

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Germinated Brown Rice**

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(3)

Rice is an important commodity of Thailand for domestic consumption and exports. The production of rice and its related products to meet standards are essential in order to be recognized for their quality and safety. The Ministry of Agriculture and Cooperatives has issued six standards related to rice products and their production systems. In order to cover more rice related products, the Agricultural Standards Committee considers it is appropriate to establish Thai Agricultural Standard on Good Manufacturing Practices for Germinated Brown Rice to improve the quality along the production chain of rice products and to obtain the quality suitable for consumption or use as raw material for further processing.

This agricultural standard is based on the following documents:

TAS 9023-2007. Thai Agricultural Standard. Code of Practice : General Principles of Food Hygiene.

TAS 4001-2008. Thai Agricultural Standard. Thai Aromatic Rice.



**NOTIFICATION OF THE MINISTRY OF AGRICULTURE AND COOPERATIVES
ON THE ESTABLISHMENT OF THAI AGRICULTURAL STANDARD:
GOOD MANUFACTURING PRACTICES FOR GERMINATED BROWN RICE
UNDER THE AGRICULTURAL STANDARDS ACT, B.E. 2551 (2008)**

Whereas the Agricultural Standards Committee deems it necessary to establish an agricultural standard on Good Manufacturing Practices for Germinated Brown Rice as a voluntary standard in accordance with the Agricultural Standards Act, B.E. 2551 (2008) to promote such agricultural commodity to meet its standard on quality and safety.

By virtue of Sections 5, 15 and 16 of the Agricultural Standards Act, B.E.2551 (2008), the Minister of Agriculture and Cooperatives hereby issues this Notification on the Establishment of Thai Agricultural Standard for Good Manufacturing Practices for Germinated Brown Rice (TAS 4404-2012) as a voluntary standard, details of which are attached herewith.

Notified on 6 July B.E.2555 (2012)

(Mr. Theera Wongsamut)
Minister of Agriculture and Cooperatives

THAI AGRICULTURAL STANDARD
GOOD MANUFACTURING PRACTICES FOR GERMINATED BROWN RICE

1. SCOPE

This Thai Agricultural Standard covers establishment and production processes of germinated brown rice from raw material selection, germination, heating, moisture reduction, hulling, sorting, packaging, storing to transportation in order to obtain products with quality and safety for consumers.

2. DEFINITIONS

For the purpose of this standard, definitions given in TAS 4003 and the following shall apply:

2.1 Establishment means areas of operations covering areas for raw material receiving, raw material selection, cleaning, production building and processing, packaging and storage.

2.2 Embryo means a rudimentary plant that has not developed into a complete plant.

2.3 Dehusk means removing of rice husk.

2.4 Head rice means broken kernel of which the length remains more than five parts but less than the whole kernel.

3. REQUIREMENTS AND INSPECTION METHODS

Requirements and inspection methods are as in Table 1.

Table 1. Requirements and Inspection Methods.

(Section 3)

Items	Requirements	Inspection Methods
1. Establishment 1.1 Location	1.1.1 Locate in the area that does not cause problems to the community.	1.1.1 Inspect environment, noise protection, dust from rice, and waste water.
	1.1.2 Locate in the area which does not pose contamination to germinated brown rice.	1.1.2 Inspect located area and preventive measures.
1.2 Buildings and operation areas	1.2.1 Building structures, floors, walls, and ceilings shall be sturdy, durable, and easy to clean and maintain.	1.2.1 Inspect buildings and operation areas.
	1.2.2 Production areas shall be designed to provide adequate spaces, convenient to work, and clearly separated and not close to the toilets.	1.2.2 Inspect buildings, operation areas, and preventive measures for contamination.

This translation is made by The National Bureau of Agricultural Commodity and Food Standards (ACFS) to establish correct understanding about this standard to foreigners. Reference to Thai Agricultural Standard in any jurisdiction shall be made to the Thai version only.

Items	Requirements	Inspection Methods
	1.2.3 Provide preventive measures against pets and pest	1.2.3 Inspect operation areas and reports of preventive and control plans for pets and pests.
2. Machines, equipment and tools	<p>2.1 They shall be suitable types and production capacity.</p> <p>2.2 They shall be sturdy, durable, made of suitable materials, no loose or cracked parts. They shall not cause contamination harmful to consumers.</p> <p>2.3 Inspect effectiveness and accuracy of machine, equipment and tools before use.</p> <p>2.4 Regularly clean and maintain in good condition.</p>	<p>2.1 Inspect machines, equipments and tools.</p> <p>2.2 Inspect machines, equipments and tools and preventive measures for contamination.</p> <p>2.3 Inspect operations and records of machine, equipment and tools inspection.</p> <p>2.4 Inspect cleaning and maintenance programme.</p>
3. Facilities	<p>3.1 Operation areas shall be well ventilated.</p> <p>3.2 Provide with adequate lighting for operation.</p> <p>3.3 Water for cleaning, soaking, or steaming shall be clean and free from contaminants harmful to consumer. It shall be at least as of potable underground water standard (Annex B).</p> <p>3.4 Availability of secured and separated storage for chemicals.</p> <p>3.5 Availability of adequately cleaning, drainage, and waste disposal.</p>	<p>3.1 Inspect operation areas.</p> <p>3.2 Inspect operation areas and light intensity.</p> <p>3.3 Inspect water analysis results at least once a year.</p> <p>3.4 Inspect area and storage methods.</p> <p>3.5 Inspect operation areas, drainage, and waste water treatment.</p>
4. Control of operations 4.1 Raw material receiving	<p>4.1.1 Paddy or brown rice shall be received from:</p> <p>(1) Field that is certified according to the Good Agricultural Practices for Rice (TAS 4401) or Thai Hom Mali Rice (TAS 4400) or Organic Rice (TAS 9000 Part 4); or</p> <p>(2) Field that practices the Good Agricultural Practices for rice (TAS 4401) or Thai Hom Mali rice (TAS 4400) or Organic Rice (TAS 9000 Part 4); or</p>	<p>4.1.1 Inspect purchasing records and operations.</p>

Items	Requirements	Inspection Methods
	(3) Known sources of production.	
	4.1.2 Paddy: (1) moisture, not exceed 14%; (2) sound kernels, true to varieties and has been stored not more than one year.	4.1.2 Inspect purchasing records and randomly inspect quality of raw material.
	4.1.3 Brown rice: (1) has been dehusked not more than 2 weeks; (2) embryo shall be intact; (3) germination rate is not less than 70%.	4.1.3 Inspect: - purchasing records or - evidence from suppliers specified rice husking time and/or - random sampling for quality testing.
4.2 Germination: (1) during soaking; (2) after soaking.	4.2.1 Before and after germination, clean containers, equipments and tools every time.	4.2.1 Inspect operation records.
	4.2.2 Before and after germination, wash paddy or brown rice .	4.2.2 Inspect operation records.
	4.2.3 Change soaking water every 4 to 6 hour, or when abnormal odour or bubbling occurred.	4.2.3 Inspect operation records.
	4.2.4 Embryo of paddy or brown rice shall develop 0.5 to 1.0 mm in length.	4.2.4 Inspect operations, records of operations, and/or randomly check embryo development.
4.3 Heating	4.3 Germinated paddy or brown rice shall be heat treated to reduce microbial load.	4.3 Inspect operation records.
4.4 Moisture reduction	4.4.1 Moisture of germinated paddy shall be reduced not to exceed 14%.	4.4 Inspect operation records and measure moisture content.
	4.4.2 Moisture of germinated brown rice shall be reduced not to exceed 12%.	
4.5 Dehusking (in case of production from paddy)	4.5.1 Removing dust occurred during dehusking process.	4.5.1 Inspect operation records.
	4.5.2 Inspect effectiveness and accuracy of the dehusking machine before each operation.	4.5.2 Inspect operation records or training evidence.
	4.5.3 Operators shall have knowledge or training on rice dehusking machine.	4.5.3 Inspect operation records or training records.

Items	Requirements	Inspection Methods
4.6 Packaging	4.6.1 Areas or equipments and tools used for packaging of germinated brown rice shall be able to prevent contamination from dust, metals, glasses and plastic fragments, and chemicals including insects and etc.	4.6.1 Inspect operation records and preventive measures.
	4.6.2 Packages are clean, in good condition without damage. Used packages for hazardous materials shall not be allowed.	4.6.2 Inspect packages and operation records.
	4.6.3 Regularly verify machines, equipments and tools before use.	4.6.3 Inspect verification and calibration records.
5 Storage	5.1 Storage areas shall be kept clean, hygienic and well ventilated; and able to prevent pets, pests, rice store pests, sunlight, and wetness.	5.1 Inspect storage areas and preventive measures.
	5.2 Germinated brown rice products shall be placed orderly into groups with clear identifications.	5.2 Inspect storage areas and operations.
	5.3 Germinated brown rice products shall not be placed directly on the floor.	5.3 Inspect storage areas.
	5.4 germinated brown rice products shall not be store together with pesticides, fertilizers, or other hazardous chemicals.	5.4 Inspect storage areas for products, fertilizers, and chemicals.
6. Maintenance and sanitation	6.1 Buildings, machines, equipment and tools shall be regularly cleaned and maintained.	6.1 Inspect programme and records of cleaning and maintenance.
	6.2 Preventive measures shall be provided to prevent contamination from pets, pests, rice store pests, dust and dirt.	6.2 Inspect operation and preventive measures.

Items	Requirements	Inspection Methods
	6.3 Off- quality germinated brown rice, waste, and garbage shall be removed from processing areas and disposed in a hygienic manner to prevent the contamination to the quality products..	6.3 Inspect methods of waste and garbage disposal, removal of off- quality geminated brown rice, and operation areas.
7. Transportation	7. Vehicles shall be clean and well covered to prevent products from getting wet.	7. Inspect vehicles and cleaning records.
8. Personal hygiene	8.1 Operators and visitors entering into processing areas shall follow the personal hygiene rules and procedures, and maintain their personal hygiene.	8.1 Inspect personal hygiene rules and procedures and inspect personal hygiene of operators and visitors.
	8.2 Toilets and personal hygiene facilities shall be adequately provided for operators.	8.2 Inspect facilities and operation areas.
9. Training	9. Training on good hygienic practices and food safety shall be conducted for the relevant operators.	9. Inspect training evidence and/or interview operators.
10. Recording	10.1 The following information shall be recorded: (1) general information of the establishment; (2) raw material purchasing; (3) processing; (4) cleaning and maintenance; (5) transportation; (6) training records	10.1 Inspect records.
	10.2 Records shall be kept at least 2 years.	10.2 Inspect records keeping.

4. RECOMMENDATION ON GOOD MANUFACTURING PRACTICES FOR GERMINATED BROWN RICE

This recommendation on good manufacturing practices for germinated brown rice is for operators to use as a guideline for hygienic production to obtain safe products suitable for consumption. Details are appear in Annex A.

ANNEX A**RECOMMENDATION ON GOOD MANUFACTURING PRACTICES FOR
GERMINATED BROWN RICE**

(Section 4)

A.1 ESTABLISHMENT**A.1.1 Location**

A.1.1.1 Location shall be in area that does not cause problems to the community. Preventive measures for noise, dust from rice, and waste water from the operation shall be provided. For the new establishment, location shall be selected away from the community.

A.1.1.2 Location shall be in area that does not pose contamination to germinated brown rice such as garbage collection sites. In case of unavoidability, there shall be preventive measures for contamination from pests and other contaminants affecting quality of germinated brown rice.

A.1.1.3 Location shall be in area that does not subject to flooding. It shall be stable with no splitting or shrinkages which may cause building to crack or subside.

A.1.1.4 Location shall be selected to provide adequate space for separation of operation areas from offices, residence, parking lots, wastewater treatment pond, and other necessary facilities.

A.1.1.5 Location is in the area where transportation is convenient and infrastructure is adequate.

A.1.2 Buildings and operation areas

A.1.2.1 Building structures shall be constructed with materials which are sturdy, durable, easy for maintenance and cleaning:

(1) walls, partitions, and floors should be made of materials impervious to water and no toxic effect in intended use;

(2) floors, walls, and partitions should have a smooth surface;

(3) floors should be constructed to allow adequate drainage and no detained water.

A.1.2.2 Production areas shall be designed for adequate space, convenient to work, and clear separation. Toilets should be located away from production areas..

A.1.2.3 Preventive measures for pets and pests entering into operation areas shall be in place.

A.2 Machines, equipment and tools

A.2.1 Designs and installation of machines, equipment and tools used in the production should be suitable in line with the production capacity. Proper selection of types and sizes in accordance with production steps in sufficient number for operations, and in good conditions for use. In addition, they should be installed at the location which facilitates operations, cleaning, and maintenance, taking into account potential contamination,

A.2.2 Machines, equipment and tools shall be sturdy, durable, made of materials suitable for production processes without causing contamination harmful to consumers. No cracked parts such as scrap metals, stones, coated paints or lubricants contaminating into germinated brown rice.

A.2.3 Machines, equipment and tools shall be inspected for their effectiveness and accuracy before each operation.

A.2.4 Regularly clean and maintain machines, equipment and tools used in production to ensure that they are in good conditions for use.

A.3 FACILITIES

A.3.1 Production areas shall be well ventilated.

A.3.2 Suitable and adequate lighting shall be provided according to the nature of works. Generally, light intensity shall be as follows:

- (1) inspection point 500 lx;
- (2) operation point 200 lx;
- (3) general areas 100 lx.

A.3.3 Water used for cleaning, soaking or steaming of rice shall be clean. It shall be free from contaminants harmful to consumers. The water shall be of quality and safety at least in accordance with the standard for potable underground water (Annex B) and should be used hygienically.

A.3.4 Storage for chemicals shall be provide in a secured and separated area.

A.3.4.1 All hazardous substances such as detergents and pesticides shall be clearly identified with labels and kept separately in suitable and secured places. In addition, such hazardous substances shall be separately stored, away from production areas to avoid contamination.

A.3.4.2 Hazardous substances shall not be kept inside the production building, packaging and storage areas..

A.3.4.3 Issue of materials withdrawn, used and inventory of hazardous substances should be recorded.

A.3.4.4 Operators shall have the knowledge or be regularly trained on correct and safe use of hazardous substances.

A.3.5 Water drainage, waste disposal systems, and garbage bins in the production areas shall be adequately provided. They shall not be the harboring place for insects, pathogens and disease carrying animals such as birds and rodents. There shall be methods of identification, separation, and storage of waste or defect germinated brown rice from the production process .

A.4 CONTROL OF OPERATIONS

A.4.1 Raw material receiving

A.4.1.1 Paddy or brown rice used as raw materials for germinated brown rice production shall be received from:

- (1) certified field under the Thai Agricultural Standards : Good Agricultural Practices for Rice or Thai Hom Mali Rice (TAS 4400 or TAS 4400) or organic rice (TAS 9000 Part 4); or
- (2) field that practice the Thai Agricultural Standards : Good Agricultural Practices for Rice or Thai Hom Mali Rice (TAS 4400 or TAS 4400) or organic rice (TAS 9000 Part 4); or
- (3) known sources of production.

A.4.1.2 Paddy as raw materials for germinated brown rice production:

(1) paddy received shall contain moisture not exceeding 14%. Since most of the producers do not germinate the entire paddy received at one time, they have to store paddy for a period of time and bring into production in a successive manner. Selection of raw material with low moisture content will extend the storage time without causing the rapid decrease of germination rate;

(2) viable, true to the type of variety paddy should be selected. Paddy should not be stocked for more than 1 year because using stale paddy would cause low germination rate and musty odour.

A.4.1.3 Brown rice as raw materials for germinated brown rice production:

husk shall be removed no longer than 2 weeks with embryo intact. The germination rate should not be lower than 70%.

A.4.2 Germination

Using paddy or brown rice as raw materials for germinated brown rice, there are generally two methods as follows:

(1) Germination under soaking condition: this method, paddy or brown rice will be soaked in water until embryo develops 0.5 to 1.0 mm in length. The water is then drained and germinated paddy or germinated brown rice is cleaned and heated to eliminate microorganisms ;

(2) Germination after soaking: this method, paddy or brown rice has been soaked until saturated (soaking time depends on producer's technique, type of raw materials, quantity of rice, amount of water, including water temperature), then water is drained. The saturated paddy or brown rice is cleaned and packed in containers such as bags or other containers, then covered with cloth or gunny bags and left until the embryo develop between 0.5 to 1.0 mm in length.

Germinated paddy or germinated brown rice is transferred from containers to the next steps. This method is preferable to the first one which potentially produces more sour smell.

Requirements for germination of paddy or brown rice are as follows:

A.4.2.1 Water used for cleaning, soaking, or steaming paddy or brown rice shall be clean, safe, no residues harmful for consumption, and hygienically used. Used water shall not be reused since the microorganisms which occur during soaking may cause sour smell in rice. In addition, water quality shall be tested at least once a year. However, frequency of testing depends on the water quality.

A.4.2.2 Containers used for soaking paddy or brown rice shall be cleaned after each use by removing all left over rice and soils, and then washed with clean water to prevent contamination and accumulation of molds.

A.4.2.3 Water soaking: paddy or brown rice shall be soaked in clean water. Duration of soaking until saturation depends on temperature, type of raw material and technique used by the producer. In addition, there shall be frequent changes of water during soaking to prevent microbial contamination which is the cause of sour smell. Generally, water is changed every 4 to 5 h or when bubbling is observed or when unpleasant odor, such as sour smell is detected.

A.4.2.4 Soaked paddy or brown rice before and after germination shall be washed. For brown rice, washing should be done by gently stirring to keep embryo intact.

A.4.2.5 Germinated paddy or germinated brown rice, embryo shall develop as a pustule of 0.5-1.0 mm in length

For germination by incubation method, it may take 24-36 h at room temperature and 95% relative humidity to obtain the required growth of embryo. However, incubation shall be terminated immediately when such development is observed.

A.4.3 Heating

A.4.3.1 Germinated paddy or germinated brown rice shall be treated with heat to stop enzymatic reaction and to eliminate microorganisms to meet the requirements as specified in A 4.3.2. Germinated brown rice should undergo any of the following heat treatment methods: steam, oven or boil; depending on raw materials and production techniques.

In case of germinated paddy, it shall be heat treated until part of the husk starts to crack. However, cooking of germinated paddy will result in uniform colour with no chalky grains.

In case of germinated brown rice, it shall not be heated until cooked i.e. the grains should not puff.

A.4.3.2 Microorganism count of germinated paddy or germinated brown rice after heat treatment and moisture reduction shall not exceed the following requirements:

Microorganism	Count (colony/g sample)
Total microorganisms	not exceed 1×10^6
Yeasts and molds	not exceed 500
<i>Bacillus cereus</i>	not exceed 1×10^3

A.4.4 Moisture reduction

For germinated brown rice, moisture can be immediately reduced. For germinated paddy, it should be placed under shade to emit heat before moisture reduction. This will obtain good quality kernels that yield high percentage of whole kernels and head rice, when husked.

A.4.4.1 For sun drying, suitable layer of germinated brown rice or germinated paddy should not exceed five cm thick. The layer should be frequently spread out to remove moisture rapidly and thoroughly. Over drying is not recommended. Duration for drying will depend on initial-moisture content, thickness of layer and frequency of spreading. In general, drying should be finished when moisture of germinated brown rice and germinated paddy are about 12% and 14%, respectively.

In case sun drying cannot be carried out continuously due to rain, places with good ventilation and proper ventilation equipment, e.g. fans should be provided for subsequent drying.

A.4.4.2 For hot air oven, layer of germinated brown rice or germinated paddy should not exceed 1.5 cm thick at the temperature between 40 °C and 60°C with 60% relative humidity. Drying duration depends on initial moisture content, temperature, quantity and type of rice. In general, drying should be finished when moisture of germinated brown rice and germinated paddy are about 12% and 14%, respectively. However, moisture should not be reduced at the overly rapid rate; otherwise, it would cause broken kernels during hulling and low yield of whole kernels and head rice.

A.4.5 Dehusking

A.4.5.1 There shall be systems or preventive measures against dust and dirt spreading not to be over the legal limits of air pollution during husking process or their spread should be minimized.

A.4.5.2 The effectiveness and accuracy of machines, equipment and tools should be examined according to the operational manual. The efficiency of the husking machine should be tested before use.

A.4.5.3 Operators shall have skills or be trained in using husking machine and be able to perform the operation properly and effectively to obtain quality products.

A.4.6 Packaging

A.4.6.1 Contamination of dust, dirt, scrap metals, glass and plastic fragments or chemicals such as used lubricants and greases, including insects and others shall be controlled in the packaging areas, conveyors and packing machines.

4.6.2 Container shall be clean. Used containers for chemicals or hazardous substances are not allowed. Containers shall be made of unharmed materials, good condition and ready to be used. They are able to prevent contamination and moisture. The containers shall be inspected and regularly checked for their quality and kept in a clean place.

4.6.3 Verify the accuracy and precision of scale, equipment and tool before each use. -.

4.6.4 Inspect readiness and cleanliness of equipment and tool before and during the operation. In addition, after daily operation the equipment shall be cleaned and maintained in good condition.

A 4.6.5 Germinated brown rice shall be packed in a sealed container. In case of vacuum sealed container, shelf-life will stay longer than that of non-vacuum sealed in a normal storage condition.

A.4.6.6 Label shall be displayed according to the requirements of relevant laws and at least contain the information that is clearly legible, indelible and non-deceptive, specified in the accompanying document, label or adhered on the package. The details shall be in accordance with the Thai Agricultural Standard entitled Germinated Brown Rice.

A.5 STORAGE

A.5.1 Storage areas shall be hygienically clean, well ventilated and able to prevent pets, pests, rice pests, sunlight and wet.

A.5.2 Germinated brown rice shall be kept orderly by categorizing into groups and displaying with clear tags.

A.5.3 Germinated brown rice products in the storage area shall not be placed or piled directly on the floor. It should be placed on the pallet. Wooden pallet shall be avoided not to cause the harboring sources of pathogen and rice pests. If pallet is not available, the products shall be placed on any suitable supporting materials so that the containers have no direct contact to the floor to prevent contamination and absorption of additional moisture.

A.5.4 Germinated brown rice products shall not be stored in the same area with pesticides, fertilizers or other hazardous chemicals. Separate storage areas for germinated brown rice products from those of hazardous substances.

A.5.5 Adequate Spacing between stacks should be provided to allow access for working or inspection. The space between germinated brown rice products stacks and the wall shall be at

least 0.5 m and between stacks should be about 1.0 m for air flow, inspection and cleaning. In addition, germinated brown rice products shall not be stacked too high since accidents may take place and could cause injury to workers.

A.6 MAINTENANCE AND SANITATION

A.6.1 Building, machine, equipment, and tools are regularly cleaned and maintained. Building, operation areas and surroundings shall be kept clean, and no water logging. Waste water drainage shall be drained properly and covered with lids. Garbage and unused materials shall not be accumulated to become the harborage of pests such as rodents, cockroaches and ants.

A.6.2 Availability of preventive measures on products contamination against pets, pests and dust and by good maintenance of building. The inspection for traces of pests, damage signs or fragments of pests shall be in place in the production area to take immediate actions.

A.6.3 The defect germinated brown rice products, waste and garbage shall be separated out of the production areas to prevent contamination to the quality ones in a hygienic manner as follows:

(1) The defect germinated brown rice products shall be separately kept from the quality ones by proper storage and identified with clear tags to prevent mixing.

(2) Waste and garbage shall be segregated, identified and discarded out of the production areas in a hygienic manner, taking into account the risk of contamination to the products and environment.

(3) Machine, equipment and tools that are unused, out of order or not related to the production process shall be removed from the production areas by collecting, placing at the designated areas.

(4) Buildings and surroundings shall be equipped with good drains and no waste remaining. The drainage system should not be designed to pass through the buildings or working areas since it may be the passage of pests.

A.7 TRANSPORTATION

A.7.1

(1) Vehicle used for transportation shall be clean, covered or able to prevent wetness to the products. It is not recommended to use vehicle that has been loaded with soils, live animals, animal manures, fertilizers, chemicals or pesticides to transport germinated brown rice products unless such vehicle is properly cleaned before use.

(2) There shall be preventive measures to control pets, pests, wet, chemicals and filth from contamination to the products. For example, before loading, the vehicle should be checked and cleaned, and during the journey, cares for the products should also be taken to minimize damage to the products.

(3) Driver and workers for transportation should receive advice in good hygienic practices to prevent any contamination or safety risk against the products.

A.8 PERSONAL HYGIENE

A.8.1 Operators and visitors entering into production areas shall follow rules and procedures specified by the establishment. They shall maintain their personal hygiene.

A.8.2 Personal hygienic facilities and personal protective equipments such as caps, masks, wash basins including adequate toilets shall be provided. Toilets shall be located either distance away or not have direct access to the production area. Toilets shall be hygienic and in good conditions with wash basins in front of the toilets and equipped with devices and accessories for hand washing and drying.

A.8.3 Operators shall work in a hygienic manner to avoid the causes of introducing pests into the production areas. For example, to keep the inside and outside of the production areas clean by collecting waste and defect products, that may be harborage of pests, in covered containers so as to prevent pests and dispose of hygienically.

A.8.4 Operators in the production areas shall perform work hygienically, such as no smoking, spitting and chewing during operations. They shall wash hands after each use of toilet.

A.8.5 Operators shall be in good health, not be carrier of communicable disease. The operators related to the production shall be provided with health examination at least once a year. The results shall be kept as evidence.

A.8.6 Visitors entering into the production areas shall be permitted upon request and follow personal hygiene procedures specified by the establishment.

A.9 TRAINING

Training on good hygienic practices and food safety is basically important to all operators in order to strengthen their roles, responsibility and awareness on food safety. Training should be regularly reviewed and updated to ensure knowledge and understandings for the operators.

A.10 RECORDING

Recording shall be conducted on general information of the establishment, raw material receiving, production processes, cleaning and maintenance, transportation and product delivering, training history of staff. The records shall be kept at least two years for tracing in case of problems arise.

APPENDIX B

Ground Water Quality Standard for Drinking Purposes
(Section 3)

Properties	Parameters	Units	Standards	
			Suitable Allowance	Maximum Allowable
Physical	1. Color*	Platinum-Cobalt (Pt-Co)	5	15
	2. Turbidity*	JTU	5	20
	3. pH*	-	7.0-8.5	6.8-9.2
Chemical	4. Iron (Fe)*	mg/l	≤0.5	1
	5. Manganese (Mn)*	mg/l	≤ 0.3	0.5
	6. Copper (Cu)	mg/l	≤ 1.0	1.5
	7. Zinc (Zn)	mg/l	≤ 5.0	15
	8. Sulphate (SO ₄)	mg/l	≤ 200	250
	9. Chloride (Cl)	mg/l	≤ 250	600
	10. Fluoride (F)	mg/l	≤ 0.7	1.0
	11. Nitrate (NO ₃)	mg/l	≤ 45	45
	12. Total Hardness as CaCO ₃ *	mg/l	≤ 300	500
	13. Non-carbonate hardness as CaCO ₃ *	mg/l	≤ 200	250
Toxic elements	14. Total solids	mg/l	≤ 600	1,200
	15. Arsenic (As)*	mg/l	None	0.05
	16. Cyanide (CN)	mg/l	None	0.1
	17. Lead (Pb)*	mg/l	None	0.05
	18. Mercury (Hg)*	mg/l	None	0.001
	19. Cadmium (Cd)*	mg/l	None	0.01
Bacterial	20. Cadmium (Cd)	mg/l	None	0.01
	21. Standard Plate Count	Colonies/cm ³	≤ 500	-
	22. Most Probable Number (MPN) *	MPN/100 cm ³	< 2.2	-
	23. <i>E. coli</i> *	-	none	-

Remark: * means that it is recommended for farmers to test.

Source: Notification of the Ministry of Natural Resources and Environment: Technical Criteria and Measures to Prevent Public Health and Environment Hazard B.E. 2551 (2008), issued under the Ground Water Act B.E. 2520 (1977), published in the Royal Gazette, Vol. 125, Special Part 85 D, dated May 21, B.E. 2551 (2008).

APPENDIX C

UNITS

Units and symbols used in this standard and units allowed by International System of Units or *Le Système International d' Unités* (SI) are in the following table:

Measurement	Unit e	Symbol
Length	millimeter	mm
	centimeter	cm
	meter	m
Time	hour	h
	minute	min
Temperature	degree Celsius	°C
Light intensity	lux	lx