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Aquaculture Feeds



BUREAU OF AGRICULTURE AND FISHERIES PRODUCT STANDARDS
BPI Compound Visayas Avenue, Diliman, Quezon City 1101 Philippines
Phone (632) 920-6131; (632) 455-2856; (632) 467-9039; Telefax (632) 455-2858
E-mail: bafpsda@yahoo.com.ph

Foreword

The request for the development of a standard for aquaculture feeds was initiated by the National Agricultural and Fisheries Council (NAFC) Committee on Fisheries and Aquaculture (CFA) which was tasked to select priority products for standardization based on identified criteria. The criteria were based on consumer and public health concerns, volume of production and consumption, as well as the volume and value of exports. The development of this standard is likewise consistent with the Medium Term Development Plan of the Department of Agriculture.

A Technical Working Group (TWG) was created, composed of members representing the Bureau of Animal Industry (BAI), Bureau of Fisheries and Aquatic Resources (BFAR), Southeast Asian Fisheries Development Center Aquaculture Department (SEAFDEC AQD), Central Luzon State University-Freshwater Aquaculture Center (CLSU-FAC), Association of Philippine Aquaculture Feed Millers, Incorporated (APAFMI), San Miguel Foods, Incorporated (SFMI), Santeh Feeds Corporation, Hoc Po Feeds Corporation, Vitarich Corporation, Sahara Feeds and 3H Enterprises with the Bureau of Agriculture and Fisheries Product Standards (BAFPS) as Secretariat. The TWG formulated the draft standard and conducted public consultations in Bacolod City (Region 6), Dagupan City (Region 1), Davao City (Region 11) and Quezon City (NCR) in collaboration with the respective Regional Field Units of the Department of Agriculture. Among the participants during the public consultations were representatives of aquaculture feed millers/manufacturers, traders, academe, local government units and consumer groups. This final draft is composite of the recommendations made by the TWG and the relevant stakeholders who participated in the four (4) public consultations.

This Philippine National Standard for Aquaculture Feeds identifies the feed products and forms, specifies their essential composition and quality factors (including nutrient standards for complete feeds, physical requirements at plant and pellet feed water stability and floatability), provides the presentation, packaging and labeling requirements, indicates the methods of sampling, examination and analyses, and defines the types of defectives. It is hoped that this standard accomplishes our two-pronged goal of protecting consumer health and making the Philippine fish and fishery products globally competitive.

Aquaculture feeds

1 Scope

This standard applies to the preparation and formulation of nutritionally adequate aquaculture feeds such as pellet, mash and crumble feed forms used in culturing any aquatic organisms such as, but not limited to, crustaceans, fish, and mollusks.

For the purpose of this standard, custom-mixed feeds and feed products for aquaculture use are also covered.

2 References

The titles of the standards and publications referred to in this standard are listed on the back cover.

3 Definition of terms

For the purpose of the standard, the following terms shall mean:

3.1**adulterant**

any biological or chemical agent, foreign matter and other substances intentionally added to feed during the production, manufacture, processing, preparation, treatment, packing, packaging, transport or holding of such feed which may compromise feed safety, or suitability. It may be added to more expensive substances to increase visible quantities and reduce manufacturing costs, or for some other deceptive or malicious purpose

3.2**aflatoxins**

a group of highly toxic mycotoxins produced by fungi of the genus *Aspergillus*

3.3**ash**

the mineral matter of a feed or feed ingredient remaining after burning off the dry matter

3.4**aquatic animal**

an animal normally maintained in an aquarium, tank, pond or cage either used for food such as but not limited to, milkfish, tilapia, carp, grouper, pompano, shrimps, prawns, etc. or for pleasure or ornamental purposes such as tropical fishes like goldfish, silverfish, damsel fish, koi fish, etc

3.5**batch number**

a designation in numbers or letters or combination thereof assigned by the manufacturer to a particular batch of feed or feed ingredient produced during a given cycle of manufacture/production that identifies the batch and permits the tracing or tracking of the batch

3.6

carnivore

animal that feeds exclusively on animal matter in the natural environment

3.7

complete feed

a mixture or combination of feed ingredients, supplements and additives by specific formula to be fed directly as sole ration to animals which is capable of furnishing the nutritional needs or requirements of the animal in order to maintain life, promote growth, production and reproduction without any additional substance except water

3.8

aquaculture feed

any complete feed prepared, manufactured by duly registered feed mill/processing plant, distributed and traded for consumption by aquatic animals, which are either raised for food or for pleasure

3.9

feed or feed ingredient

feeds, feed ingredients, feed supplements, feed additives, base mixes, concentrates, specialty feeds, special feed nutrient preparations and other feed products which are manufactured or processed with the intention to sell to the general public, to a limited clientele or to a specific buyer or consumer

3.10

contaminant

any biological or chemical agent, foreign matter and other substances not intentionally added to feed, which is present in such feed as a result of the production, manufacture, processing, preparation, treatment, packing, packaging, transport or holding of such feed or as a result of environmental contamination which may compromise feed safety or suitability

3.11

crude fat or ether extract

the fats, oils, waxes and similar components found in feeds and feed ingredient, which are extracted with warm ether in chemical analysis

3.12

crude fiber

the coarse, fibrous and indigestible portion of feeds and feed ingredients, relatively low in digestibility and nutritive value such as cellulose, hemi-cellulose and lignin

3.13

crude protein

the proteins and all other nitrogenous compounds in feeds and feed ingredients

3.14

custom-mixed feed

a feed which is compounded or mixed according to the specifications of the final buyer or user for his own use/consumption or for use of a limited clientele and not intended for sale to the general public

3.15

feed additive

an ingredient or combination of ingredients which is added to the basic mixed feed to fulfill a specific need which include, but not limited to, duly registered acidifiers, antioxidants, aromatics, deodorizing agents, flavor enhancers, mold inhibitors, pellet binders, preservatives, sweeteners, toxin binders, artificial color attractants, astaxanthin, etc. It is usually used in micro quantities and requires careful handling and mixing. A feed additive may have no nutritive value but is added to the feed to improve its quality and efficacy

3.16

feed digestibility

the percentage of the dry matter or particular nutrient in the diet that the animal absorbs into the body through the digestive tract

3.17

feed fines

fine feed particles produced after pelleting at plant

3.18

feed ingredient

a substance which enters into the composition or which is used as raw material in the formulation of a ration or mixed feed, base mix, concentrate, feed supplement, feed additive, specialty feed and/or special feed nutrient preparation. It embraces all such articles to be used as raw material for feeds purporting to supply proteins, carbohydrates, fats, minerals, vitamins, growth promoting factors and/or correcting nutritional disorders. Such substances maybe locally produced or imported, mixed or in the form of simple ingredients

3.19

feed stability

an ability of feed to maintain its integrity in the water thus becoming available to aquatic animals

3.20

herbivore

animal that feeds exclusively on plant matter in the natural environment

3.21

label

any written, printed or graphic matter attached, affixed to or found in any package, bag, bale, sack, barrel, bin, can, canister or any other container of mixed feeds, feed ingredients, feed supplements, feed additives, base mixes, concentrates, specialty feeds, special feed nutrient preparations and/or other feed products

3.22

lot number

a designation in numbers or letters or combination thereof assigned to a particular feed product produced under the same raw material source with the same formulation assigned by the manufacturer

3.23

mesh size

the number of openings per square inch of mesh (e.g. number 4-4 openings per square inch; 16-16 openings per square inch)

3.24

omnivore

animal that derives their nutrients from both animals and plants in the natural environment

3.25

package

a sack, bag, barrel, box, bin, can, canister or any other container for feeds and/or feed ingredients

3.26

supplemental feed

feed supplied to meet the nutrient requirement of fish for maintenance and growth when natural food is inadequate

3.27

toll feed manufacturer

a duly registered feed manufacturer with existing feed plant facility which mixes feed ingredients or raw materials for a commercial or non-commercial feed trader through a Memorandum of Agreement

4. Description

4.1 Product definition

4.1.1 Pellet feed

Aquaculture feed or feed ingredient in agglomerated form produced by compacting and forcing the product through die openings by a mechanical process.

- (i) Dry compressed/pressure/steam-pelleted feeds are aquaculture feeds that are prepared through the use of heat, moisture and pressure to create larger feed particles.
- (ii) Extruded feeds are aquaculture feeds that are prepared through extrusions, involving plasticizing and cooking of feed ingredients by a combination of pressure, heat and friction.

4.1.2 Crumble feed

Aquaculture feed or feed ingredient in granular form.

4.1.3 Mash feed

Aquaculture feed or feed ingredient in meal form.

4.2 Process definition

4.2.1 Pelleting

Feed mixtures are compressed into a circular or cubic mass, forced through die openings by a mechanical process and cut at predetermined lengths.

4.2.2 Extrusion

Feed mixtures are subjected to high heat and steam pressure using an extruder.

4.2.3 Crumbling

The broken pellets are sieved and then size-graded to crumble form.

4.2.4 Mashing

Grinding of feeds producing desired particle size.

5 Essential composition and quality factors

5.1 Aquaculture feeds

5.1.1 This feed should be prepared from sound and wholesome quality raw materials and shall provide nutritionally adequate requirements to produce acceptable performance to the crustaceans, fish and mollusks reared in aquaculture farms/ponds.

5.2 Raw materials

5.2.1 Raw materials for aquaculture feeds shall be sourced from duly registered local feed ingredient suppliers and in accordance with Rules and Regulations Governing the Quality Standards of Commercial Feed Ingredients (DA-BAI Administrative Order Number 40, series of 1976).

5.2.2 Imported raw materials must comply with requirements of BAI.

5.2.3 Raw materials shall have good digestibility and utilization, and have less polluting effect to the environment.

5.2.4 Raw materials shall be good sources of needed nutrients like protein, lipids, carbohydrates, vitamins and minerals.

5.2.5 Animal protein sources shall be free from *Salmonella* and other pathogenic microorganisms.

5.2.6 Raw materials containing molds shall not be used.

5.3 Diet composition

5.3.1 The aquaculture feed shall be composed of protein, lipids, carbohydrates, vitamins and minerals at levels that meet the nutrient requirements for each intended species.

5.3.2 The use of pigments, binding agents, preservatives, attractants and other feed additives shall be in compliance with good manufacturing practices (GMP).

5.3.3 No veterinary drugs i.e. antibiotics shall be used in aquaculture feeds (Annex A).

5.4 Other composition

5.4.1 Salt

Salt shall be of food grade quality.

5.4.2 Water

The water to be used in manufacturing shall be clean and according to Codex standards.

5.5 Final product

5.5.1 The final product must be nutritionally balanced, palatable, water stable, and has the proper size and texture.

5.5.2 The final product shall meet all the requirements enumerated below:

Table 1 – Nutrient standards for complete feeds

Feed type	Crude protein % NLT	Crude fat % NLT	Crude fiber % NMT	Ash % NMT
I. Prawns/Shrimps				
A. <i>P. monodon</i>				
a. Larval diet	(50) ¹	4	4	16
b. Fry mash	38	4	4	16
c. Starter crumble/pellet	37	4	4	16
d. Grower pellet	35	4	4	16
e. Finisher pellet	32	4	5	16
f. Broodstock pellet ²	-	-	-	-
B. <i>P. vannamei</i>				
a. Larval diet	(50) ¹	4	4	16
b. Fry mash	38	4	4	16
c. Starter crumble/pellet	35	4	4	16
d. Grower pellet	30	4	4	16
e. Finisher pellet	26	4	5	16
f. Broodstock pellet ²	-	-	-	-
II. Finfishes				
A. <i>Herbivore/Omnivore fishes (e.g. Milkfish³, Tilapia etc.)</i>				
a. Larval diet	(38) ¹	4	5	16
b. Fry mash	35	4	5	16
c. Pre-starter crumble/pellet	35	4	5	16
d. Starter crumble	29	4	8	16
e. Grower pellet	27	4	8	16
f. Finisher pellet	25	4	9	16
g. Broodstock pellet	(40) ¹	4	9	16
B. <i>Pangasius spp.</i>				
a. Larval diet	-	-	-	-
b. Fry crumble	28	4	5	16
c. Starter crumble/pellet	26	4	5	16
d. Grower/juvenile pellet	22	4	6	16
e. Finisher/Adult pellet	22	4	6	16
f. Broodstock/Breeder pellet	22	4	5	16
C. <i>Carnivore fishes (e.g. Grouper, etc.)</i>				
a. Larval diet	(48) ¹	8	6	16
b. Fry mash	44	8	6	16
c. Starter crumble	40	8	6	16
d. Grower pellet	38	8	6	16
e. Finisher pellet	35	8	6	16
f. Broodstock pellet ²	(44) ¹	-	-	-
Legend: NLT-Not less than NMT-Not more than				
¹ values are requirement levels				
² no existing feed type in the market				
³ the following protein levels (%) suggested for supplemental feeds for Milkfish for ponds are a) starter crumble 30, b) grower pellet 28, and c) finisher 27.				

Table 2 – Physical requirements at plant

A. Fish and prawn or shrimp

Feed form	Fines ⁴ (%)	Moisture content maximum (%)
a. Mash⁵	100	12
b. Crumble	Not more than 10	12
c. Pellet (Sinking)		
Starter	Not more than 2	12
Grower	Not more than 2	12
Finisher	Not more than 2	12
d. Extruded		
Starter	Not more than 2	12
Grower	Not more than 2	12
Finisher	Not more than 2	12

⁴ measured using a sieve having mesh size of 16 openings per square inch
⁵ 1 mm and 0.5 mm particle sizes for fish and prawn/shrimp, respectively

Table 3 – Pellet feed water stability and floatability

Pellet feed Type	Water stability % / minute	floatability % (minimum)
a. Pellet for fish		
Floater (Extruded)	90% / 45	90
Slow sinker	90% / 3	10 ⁶
Sinker	90% / 3	0
b. Pellet for prawn/shrimp	90% / 180	

⁶most of the feed is slow sinking

5.5.3 Any feed that does not comply with levels in Table 1 is considered supplemental feed and must be labeled as such.

6 Hygiene and handling

6.1 The final product shall be free from any foreign material and contaminants, microorganisms or substances originating from microorganisms, and any other substances which may present a hazard to the aquaculture species and human health.

7 Packaging and labeling

7.1 Packaging

The product shall be packed in sacks, bags, barrels, boxes, bins, cans, canisters or any other containers for feeds and/or feed ingredients that are clean and free from any foreign matters or contaminants.

7.2 Labeling

7.2.1 All containers or packages of feeds, feed ingredients, specialty feeds and other nutrient/feed preparations for sale or offered for sale shall bear a complete label or tag.

7.2.2 Labels shall be attached or affixed to the package or to the container in such a way that the whole content of the label can be read without detaching it. Labels can also be printed directly to the container or package of the feed product.

7.2.3 Each label shall be printed in English, must be legible, clear and distinct in its meaning. Translations in Filipino and other languages shall be allowed provided English is the main language used.

7.2.4 Brand name and feed type or class of the feed, feed ingredient, feed supplement, feed additive, concentrate, base mix, specialty feed, special feed nutrient preparation or other feed products shall be printed with the biggest font size and located at the upper front portion of the tag or label.

7.2.5 Labels shall not contain any form of advertisement and/or claims that are false and misleading. Any advertisement containing any claim that the feed is suited for all purposes shall not be allowed and shall be considered a misleading advertisement.

7.2.6 Labels shall be placed on a conspicuous place on the container or package showing the following information:

- (i) brand name or trademark of the product;
- (ii) generic name, type or class and form of the product;
- (iii) recommended species and species life stage;
- (iv) guaranteed analysis of the product which includes the following:
 - (a) minimum percent of Crude Protein;
 - (b) minimum percent of Crude Fat;
 - (c) maximum percent of Crude Fiber;
 - (d) maximum percent of Moisture;
 - (e) maximum percent of Ash; and/or
 - (f) other information relevant to the product;
- (v) accepted or official name of each and every ingredient used in the product;
- (vi) name and complete address of the company
- (vii) Bureau of Animal Industry Registration Number of the company and the product;
- (viii) storage condition;
- (ix) Control/Code/Batch/Lot Number;
- (x) Date of Manufacture (MM/YYYY);
- (xi) Best Before Date (MM/DD/YYYY);
- (xii) Net Weight in metric equivalent; and

(xiii) the name of Product of the Philippines.

7.2.7 Label or tag on each container shall show the plant net weight in kilograms of the feed and/or feed ingredient. Such statements as "50 kilos gross" or "50 kilos when packed", etc. shall not be allowed.

8 Methods of sampling, examination and analyses

8.1 Method of sampling

Sampling of lots for physico-chemical examination of the product shall be in accordance with sampling plans based on FAO/WHO Codex Alimentarius Commission Sampling Plans for Prepackaged Foods (AQL =6.5) (CAC/RM42-1969). A sample lot (N) shall be the quantity of the product under similar conditions. A sample unit shall be the primary container where the product is in bulk, while the individual feed sack is the sample unit for retail packaged products.

8.2 Method of physical examination

Samples taken for physical examination shall be assessed by persons trained in such examination and using procedures elaborated in 8.3.

8.3 Methods of analyses

8.3.1 Proximate analysis and nutritional composition

8.3.1.1 Determination of ash (animal feeds)

According to Association of Official Analytical Chemists (AOAC) International Official Methods of Analysis (OMA), Method No. 942.05, 18th Ed., Rev. 2, 2007.

8.3.1.2 Determination of crude fat (animal feeds)

According to Association of Official Analytical Chemists (AOAC) International Official Methods of Analysis (OMA), Method No. 920.39, 18th Ed., Rev. 2, 2007.

8.3.1.3 Determination of crude fiber (animal feeds)

According to Association of Official Analytical Chemists (AOAC) International Official Methods of Analysis (OMA), Method No. 962.09, 18th Ed., Rev. 2, 2007.

8.3.1.4 Determination of crude protein (animal feeds)

According to Association of Official Analytical Chemists (AOAC) International Official Methods of Analysis (OMA), Method No. 968.06, 18th Ed., Rev. 2, 2007.

8.3.1.5 Determination of moisture (animal feeds)

According to Association of Official Analytical Chemists (AOAC) International Official Methods of Analysis (OMA), Method No. 925.04, 18th Ed., Rev. 2, 2007.

8.3.2 Determination of aflatoxins B₁ content

According to Association of Official Analytical Chemists (AOAC) International Official Methods of Analysis (OMA), Method No. 975.36, 18th Ed., Rev. 2, 2007.

8.3.3 Determination of feed floatability

According to Method of Determining Floatability as described in Annex C.

8.3.4 Determination of feed water stability

According to Method of Determining Water Stability as described in Annex B.

8.3.5 Determination of pesticides

According to Association of Official Analytical Chemists (AOAC) International Official Methods of Analysis (OMA), Method Nos. 990.06 and 992.14, 18th Ed., Rev. 2, 2007.

8.3.6 Determination of veterinary drugs in feeds

According to Association of Official Analytical Chemists (AOAC) International Official Methods of Analysis (OMA), Method No. 957.23, 18th Ed., Rev. 2, 2007.

9 Definition of defectives

The sample unit shall be considered as defective when it exhibits any of the properties defined below.

9.1 Foreign matter

The presence in the sample unit of any matter, which has not been recognized as feed composition (excluding packing material), that can cause harm to the aquaculture species, and is readily recognized without magnification or is present at a level determined by any method including magnification that indicates non-compliance with good manufacturing and sanitation practices.

9.2 Aflatoxin contaminations

Sample unit having a higher level of Aflatoxin (B₁) of more than 20 ppb at the plant level (production level).

9.3 Veterinary drugs

The presence in the sample unit of veterinary drugs i.e. antibiotics.

9.4 Pesticides

The presence in the sample unit of any pesticides.

Annex A

Banned drugs (as of 2009)

Drug	Administrative Order	Subject	Date
Clenbuterol, Salbutamol, Terbutalin, Pirbuterol	No. 14, Series of 2003 (Department of Agriculture)	Ban on the use in food animals of beta-agonist drugs used in human as bronchodilators and tocolytic agents.	May 12, 2003
Furaltadone, Furazolidone, Nitrofurazone	No. 2, Series of 2000 (Dept. of Agriculture & Dept. of Health)	Declaring a ban/phase- out of the use of nitrofurans in food- producing animals.	August 17, 2000
Carbadox, Olaquinox	No. 60, Series of 2000 (Dept. Agriculture) No. 4-A, Series of 2000 (Dept. of Health)	Ban and withdrawal of Olaquinox and Carbadox from the market.	January 11, 2000
Chloramphenicol	No. 60, Series of 1990 (Dept. Agriculture) No. 91, Series of 1990 (Dept. of Health)	Declaring a ban on the use of chloramphenicol in food-producing animals.	April 30, 1990
Source: Philippine Veterinary Drug Directory, 8 th Edition, 2006, pp. 411			

Annex B**Method of determining water stability**

(Source: SEAFDEC AQD May 2002. Nutrition in Tropical Aquaculture. Essentials of Fish Nutrition, Feeds, and Feeding of Tropical Aquatic Species)

1. Wire baskets are totally oven-dried at 100°C (1-3 h), cooled in a dessicator, and weighed to constant weight.
2. A certain amount of feed (about 5 g) with known moisture content is then placed in the wire basket.
3. The wire baskets with feed are then allowed to stay in the water under conditions similar to those of the experimental tanks at designated times (2, 4, 6, and 8 h).
4. The wire baskets are then oven-dried, cooled in a dessicator, and weighed to constant weight.
5. Percent dry weight loss is calculated after subtracting the basket weight.
6. Percent water stability is then computed as:

$$\% \text{ Water Stability} = \frac{F_o}{I_o} \times 100$$

where: I_o = initial dry weight of feed

F_o = final dry weight of feed

Annex C

Method of determining feed floatability

(Source: European Aquaculture Society and World Aquaculture Society ó Aqua 2006.
Physical, Chemical and Biological Evaluation of
Commercial Fish Feeds in Amazonas State)

1. Percent feed floatability can be determined using the equation:

$$\% \text{ Feed Floatability} = \frac{100 - \text{immerse pellets}}{100} \times 100$$

References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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Department of Agriculture
Bureau of Agriculture and Fisheries Product Standards
**Technical Working Group (TWG) on the Development of
Philippine National Standard (PNS) for Aquaculture Feeds**

Chair:

Dr. Relicardo M. Coloso
Aquaculture Department (AQD)
Southeast Asian Fisheries
Development Center (SEAFDEC)

Co-chair:

Ms. Marilou Esterlina D. Arifalo
Animal Feed Standards Division (AFSD)
Bureau of Animal Industry
Department of Agriculture

Members:

Dr. Nelson A. Lopez
Inland Fisheries and Aquaculture Division (IFAD)
Bureau of Fisheries and Aquatic Resources (BFAR)
Department of Agriculture (DA)

Ms. Rodora M. Bartolome
Freshwater Aquaculture Center (FAC)
Central Luzon State University (CLSU)

Engr. Napoleon G. Co
Association of Philippine Aquaculture
Feed Millers, Incorporated (APAFMI)

Mr. Wilfredo G. Yap
Santeh Feeds Corporation

Mr. Neil Edwin G. Cabigon
San Miguel Foods, Incorporated (SMFI)

Mr. Allan B. Maristela
Hoc Po Feeds Corporation

Mr. George Co
Sahara Feeds

Mr. Ed Lazo/Jose Angeles
Vitarich Corporation

Mr. Andy Liang
3H Enterprises

Adviser:

Dir. Gilberto F. Layese
Bureau of Agriculture Fisheries
Product Standards (BAFPS)
Department of Agriculture (DA)

Technical Secretariat:

Mr. Mark F. Matubang
Bureau of Agriculture Fisheries
Product Standards (BAFPS)
Department of Agriculture (DA)



BUREAU OF AGRICULTURE AND FISHERIES PRODUCT STANDARDS

BPI Compound Visayas Avenue, Diliman, Quezon City 1101 Philippines
T/ (632) 920.6131 / 455.2856 / 467.9039
TF/ (632) 455.2858
E-mail: bafpsda@yahoo.com.ph