

## Quality Control of Raw Materials for Poultry Feed

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### Abstract

Quality management is very much important in any feed industry. Only quality raw materials can deliver the quality output product. Different types of raw materials are received every day in feed mill, such as corn, soybean meal, meat and bone meal, rice bran, lime stone etc. To sort out the quality one, some rapid tests and inspection methods are applied commonly, such as moisture, insect, smell, fungus, hull test, urease activity test, particle size test etc. All raw material samples are sent to the feed mill laboratory to inspect by the quality control unit for sorting out quality raw materials. If the raw materials satisfy the necessary quality standard, would be entered to the production cycle.

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### 1. Introduction

The purpose of quality control is mainly concerned with determining and applying a feasible method with regular professional plan, which would certainly provide the acceptability of raw and finished products as per prescribed essential standards. Quality control (Early, 1995; Islam *et al.*, 2015a) is an important part in almost all industries, especially animal feed and human food industries. The importance of quality control is related with the beginning of procurement of raw materials in the farms/factory to export of the product Without a strong quality control, the production of high quality products are practically impossible. Our stringent quality control programme leads to increase in the quality and also to reduce deleterious principles from animal feed and consequently caused to increase the quality of our human food.

Feed ingredients should be routinely evaluated to ensure they are safe, they contain the correct amount of the specified nutrient, and to ensure the finished feed quality will optimize animal performance. Permitted analytical variation (PAV) guidelines help to identify deficiencies or excesses of an ingredient in a product (Bao *et al.*, 2011). If the assay indicates the ingredient is outside the PAV, the feed does not conform to label requirements.

Quality Control in feed production is of utmost importance in the success and profitability of animal enterprises (Islam *et al.*, 2015b; Website 1, 2008; Frank, 2008). There is no other directly or indirectly

related to the proper nutrition and high performance of animals, which is more critical than feed quality control and ration consistency. Quality has been defined as "any of the features that make something what it is" and "the degree of excellence which a thing possesses". The degree of quality is the consistency in which feed is formulated, processed, mixed and delivered as compared to what is expected.

Obviously, a finished feed should match label claims - protein, fat, fiber, vitamins and other micro-ingredient levels, active drug level in medicated feeds and other ingredients if claimed (Andrews, 1991; Anonymous, 1974). Animals thrive on a routine and respond better if the feed is low in nutrient variation as offered to them; and are similar in moisture content, texture and rate of energy availability.

Quality control department is the major and most important sector in any feed producing industry. Without this Department a feed mill cannot proceed or cannot maintain the quality of the product. Some routine jobs are performed during receiving raw materials in all feed producing industry (Blankenship *et al.*, 1984; Jones, 1989; MaEllhiney, 1981). Everyday morning quality control department starts their activities with some routine sequence. General activities of quality control department are as follows: Collection of truck list (Raw material) from raw material department; Sample collection from every truck of each raw material according to the serial (30%); Sample preparation for analysis or rapid test; Analysis and rapid test; Result note down and pass to the raw material department; Sending of rejected raw

material truck outside from the feed mill; Selected raw material trucks are received by checking the quality of each raw material (100%); Raw materials are stored according to the standard for further production plan. Normally raw materials are used in feed depending on the nutrient source and values. Different raw materials according to the nutrient values are represented in the Table 1-2.

## 2. Materials and Method

The laboratory of feed mill factory is equipped with advanced equipment for laboratory analysis of feed and raw materials include Kjeldahl apparatus, Soxhlet extractor, digital spectrophotometer, digital hydrometer, electric stoves and ovens which can help to analyze the test chemical, biological, Aflatoxin and heavy metals by experts and professional staffs (NGFA, 2002; Rydell, 2005). Chemical tests are including measurement of moisture, crude protein, crude fat, crude fiber, ash, calcium, phosphorus, salt and Aflatoxin (Richardson, 2011; Richardson, 1995).

When raw material trucks are entered in feed mill, then sample is taken from each truck for individual checking of raw materials. Some common checking as well as different types of individual experiment is done for different types of raw materials. Some sequential work is done while checking the raw materials (Blankenship *et al.*, 1984; Jones, 1989).

### 2.1 Common Procedure

Sample is collected from the truck (From maximum layer of the bag as per as possible). The sample is mixed well by hand shaking to get homogeneity. First sieving is performed (3 mm and 5 mm) for find out insects and add-mixer. 100 g of sample is taken for further experiment. Moisture is measured by moisture meter. In case of corn sample, MG, DG, BG, ADM etc. as well as the BGYF label are measured (800g grounded sample is taken and kept it to a box and pass UV-light and find out the glazing particle and finally measured BGYF label). In case of soybean meal, smell, fungus, over toast and urease activity is measured. In case of meat and bone meal, feather meal, urea test and particle size is measured. In case of rice bran fine (RBF) and rice bran coarse (RBC), smell and percentage of hull is observed. In case of paddy, broken rice and wheat, percentage of damage grain is measured. In case of wheat bran, smell and percentage of fine is observed. In case of mustard meal, smell, fungus and particle size is observed. For oil sample, smell, color, pH, density and free fatty acid level is observed. For lime stone, coarse and fine, add-mixer and particle size is measured. In case of fish meal, smell, fungus and percentage of bone is

observed. Finally, all tasted parameters are compared with the standard and also grading according to standard. Final decision is made according to the comparing result.

### 2.2 Standard Feed Testing Protocol

Some common raw materials testing protocols are described according to the standard of feed producing industry.

#### 2.2.1 Corn

The sample is mixed at airtight condition by hand shaking. Weight is taken about 100 g. The sample is slowly poured into moisture meter. The reading is taken out from the moisture meter monitor. Finally find out the moisture by comparing it with the correspondence chart. Another parameter is measured one by one (DG, BG, MG, ADM etc.)

#### 2.2.2 Measurement of BGYF (Bright Green Yellow Fluorescence)

At first the sample is mixed well. The sample weight is taken about 800 g. Total 800 g sample is ground by grinding machine. The ground sample is placed on a big tray. Then the tray is put inside the UV-Lamp box. The Fluorescence light spots are counted and compared with standard. All parameters are noted down and finally compared with the standard. Standard specification of corn is given in the Table 3.

#### 2.2.3 Urease Activity of Soybean Meal

Some amount of S.B.M sample is grounded by a blender/grinder. The grind S.B.M sample is taken in a dry petridish. The sample is made label with a glass rod. Phenol red solution is sprayed on the sample and on a filter paper. The filter paper is kept on the sample and covered with another petridish. After 3 minutes observation, carefully the number of red color spot on the filter paper are observed and compared with the standard (Fig 5).

#### 2.2.4 Urea Test of Soybean Meal

10 g grounded sample is taken in 100 ml beaker. 50 ml distilled water is added to the beaker. Then it is filtered. 3 drops of this filtrate are taken in a dry porcelain basin. 3 drops of urease active meal solution are added to the porcelain basin. Then 3 drops of cresol red solution are added, then allowed to stand for 5 minutes. If red color appears the test is positive. Along with a blank test is performed with distilled water (Fig 6).

#### 2.2.5 Determination of % hull of RBF and RBC

R.B.F or R.B.C sample is taken in a dry petridish. The sample is made label with a glass rod.

Table 1: Name of raw material according to the nutrient source

Carbohydrate	Protein	Fat	Calcium
Corn	Soybean meal	Rice bran fine	Lime stone coarse
Broken rice	Meat and bone meal	Rice bran coarse	Lime stone fine
Wheat	Rape seed meal	Soya boiled	Mono calcium phosphate
Rice bran fine	De-oiled rice bran	Palm fatty acid oil	Di-calcium phosphate
Rice bran coarse	Coconut meal	Rice bran oil	
Wheat bran coarse	Wheat	Wheat	
Paddy	Wheat bran coarse	Wheat bran coarse	
Mushuri bran	Fish meal	Coconut meal	
Mustard meal	De-oiled and dried grain solvent	Mustard meal	

Table 2: Density of different types of raw materials

SL NO.	Raw Material Name	Density (Kg/Cubic meter)		Grinding net size
		Before Grinding	After Grinding	
1	Corn	761	780	(8.0 X 8.0) mm
2	Paddy	641	607	(8.0 X 4.0) mm
3	SBM	708	671	(8.0 X 8.0) mm
4	Broken Rice	943	989	(3.0 X 3.0) mm
5	Mustard Meal	791	757	(3.0 X 3.0) mm
6	Coconut Meal	791	722	(3.0 X 3.0) mm
7	Wheat	790	673	(3.0 X 3.0) mm
8	MBM	818	-	
9	WBC	313	-	
10	DORB	534	-	
11	RBF	509	-	
12	RBC	404	-	
13	LSC	1591	-	
14	LSF	1508	-	
15	Mushuri Bran	533	-	
16	PFAO	902	-	

Table 3: Standard specification of corn according to different grade

Item		Corn grade				
		2S	2	3	4	5
Moisture for dried corn	% Max	14.0	14.0	14.0	14.0	14.0
Aflatoxin	Ppb. Max	20	50	100	100	100
Total damaged grain (Mold grain+ Other damage)	% Max	2	4	8	12	16
Mold grain	% Max	1	4	8	8	8
Broken grain	% Max	8	8	16	16	16
Foreign material on 2mm+2mm. sieve	% Max	1	1	1	1	1
Foreign material on 5mm. sieve	% Max	1	1	1	1	1
Severe mold grain	Number of grain/800gm.	0	12	12	12	12



Fig-1: Normal grain and different damage grain of corn



Fig 2: Admixer and broken grain of corn



Fig 3: Inspection of corn



Fig 4: BGYF checking of corn

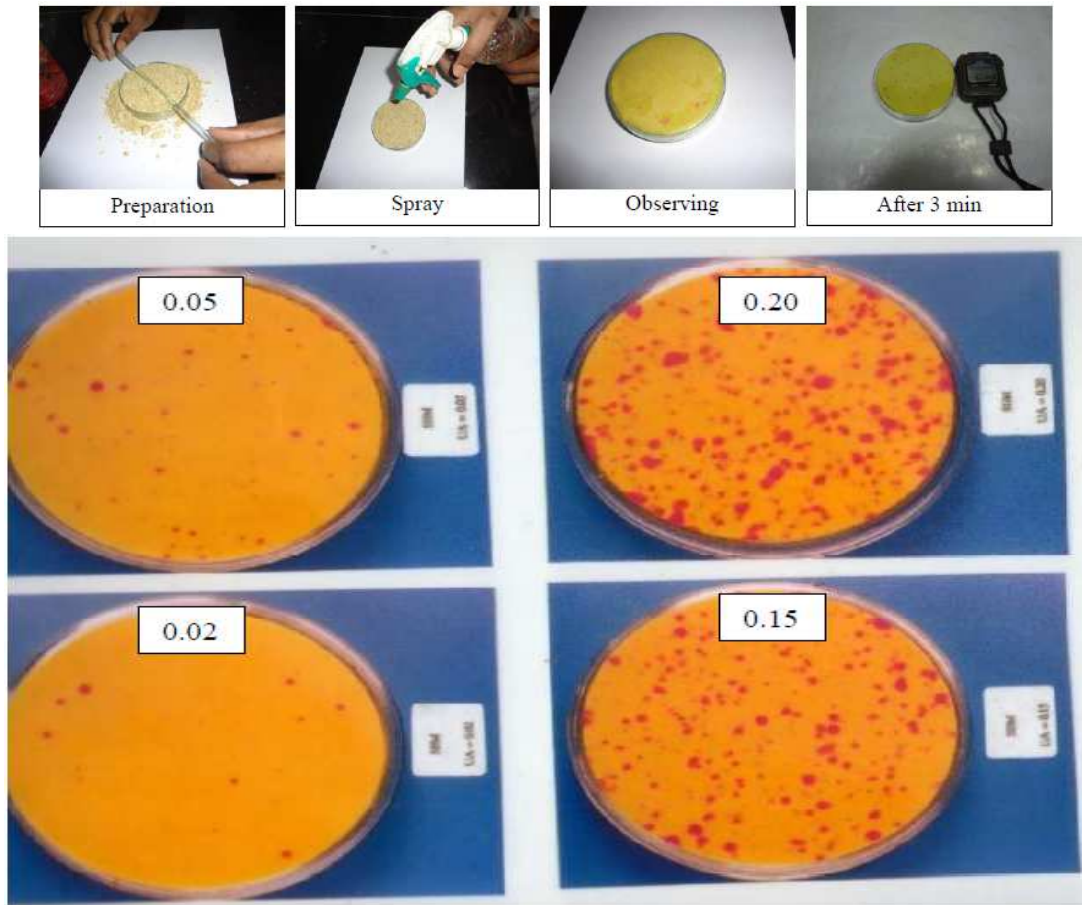


Fig 5: Urease activity of Soybean meal

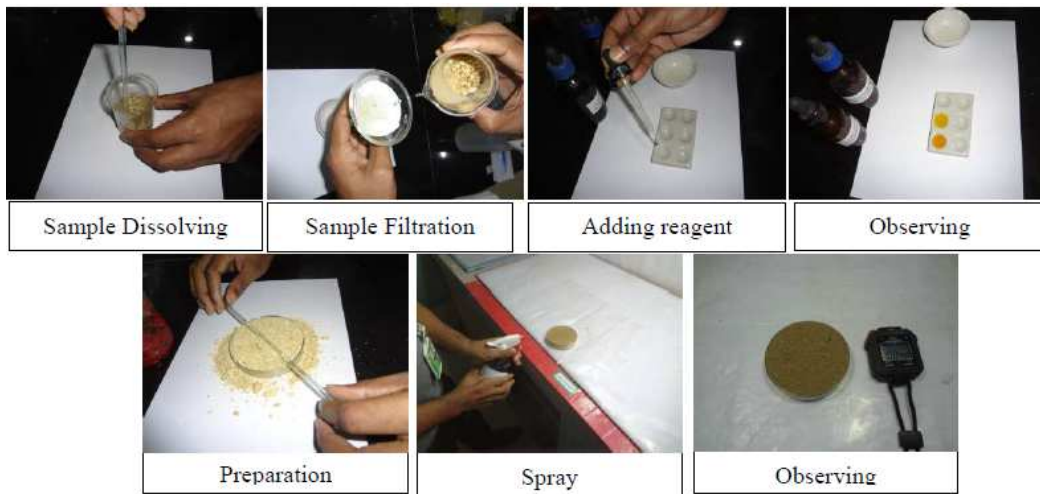


Fig 6: Urea test of soybean meal



Phloroglucinol solution is sprayed on the sample smoothly. After 10 minutes (R.B.F), 7 minutes (R.B.C) the petridish is observed properly. The red colorations are observed and compared with standard (Table 4, Fig 7) with standard (Table 4, Fig 7).

#### 2.2.6 Rancidity Test of RBF and RBC

5 g of sample is taken in a 250-ml conical flask and 40 ml of the acetic acid-chloroform mixture is added. Then 1 ml of the saturated potassium iodide solution is added. The content is agitated thoroughly. Then 50 ml distilled water and starch indicator is added. The development of a blue color indicates the rancidity.

Note: 1. Combine 60 ml of concentrated glacial acetic acid and 40 ml of chloroform. 2. Saturated potassium iodide solution. 3. Starch indicator (1% Solution).

#### 2.2.7 Analysis of Free Fatty Acid (PFAO and RBO)

Sample must be well mixed and entirely liquid before weighing. 0.5 to 1.0 g sample is taken in 250 ml conical flask. 75 ml hot ethanol (95 %) is added to the conical flask. Titration is done against 0.1 N NaOH solution using phenolphthalein as indicator. Titration is done till appearance of first permanent pink color.

$$\%FFA = \frac{ER \times N \text{ NaOH} \times 28.2}{\text{Wt of sample in g}}$$

#### 2.2.8 Wheat

Wheat inspection system is same as corn. Sieving is done to find out the add-mixer and insect. Other damage grain, BGYF is checked by the same procedure.

#### 2.2.9 Measurement of Black (mold) Grain of Wheat

100 g sample is immersed in 20% NaCl solution. The content is stirred and waited for 5 minutes. The grains are taken out from the solution and kept on a filter paper. The black grains are separated (black spot on the edge of the grain) using magnifying glass. The black grains are dried in the oven and weight is taken. Then % of black grain is calculated. Maximum 0.3% can allow for the quality control.

#### 2.2.10 Meat and Bone Meal (MBM)

Sample is collected from the truck maximum layer of the bag as per as possible. The sample is mixed well. First insect, color, smell and feather meal are observed (Fig 8). The particle size is measured by sieving and compare with standard (Table 5). Presence of urea is checked by the same way as SBM.

#### 2.2.11 LSC and LSF

Sample is collected from the truck maximum layer of the bag as per as possible. The sample is mixed well. The color is compared with the standard. The particle size is measured by sieving and compared with standard. Table 6-7. The reaction is also observed by adding conc. HCl acid (CO<sub>2</sub> will be produced).

#### 2.2.12 Measurement of Add Mixer of LSC and LSF

0.5 g sample is dissolved in appropriate amount of conc. HCl acid. The content is stirred properly and allowed to cool at room temperature. Then the solution is filtered. The filtrate is discarded. The filter paper is dried and the residue is collected from filter paper. The weight of that residue is taken and the % of impurities present is calculated.

#### 2.2.13 Test of Di-calcium Phosphate (DCP)

At first 2.5 g silver nitrate is dissolved in 50 ml distilled water. Around 1 gm. DCP is taken in a dry porcelain basin. 3-5 drops of Silver Nitrate Solution is added slowly, and then allowed to stand for 10 seconds. If yellow color appears then the DCP quality is normal. If gray or black color appears then the DCP quality is abnormal. A blank test is performed with distilled water.

#### 2.2.14 Test of Turmeric Powder

0.5 g turmeric powder and 50 ml distilled water are taken in a 250-ml conical flask and boiled for 5 minutes and then cooled. 10 ml filtrate is taken in a petri dish and added 5-7 drops of 0.025 N Iodine solutions. If light pinkish blue color appears then the powder is normal. If bluish black color appears then the powder is abnormal.

### 3. Results and Discussion

Everyday huge amount of raw material trucks do come in feed mill from different suppliers. After inspection, it is very important to decide quickly whether a raw material is accepted or rejected. So, these rapid inspection methods are very important, active as well as reliable to make a decision for a raw material. Because supplier raw material cannot stay in the feed mill for a long time. It is very necessary to deliver the inspection result quickly to the raw material department, because according to the result, raw material can be received or rejected (Table 8). Table 9 represents the particle size inspection results of lime stone fine and coarse and also meat and bone meal. Other raw materials inspection result has been presented in Table 10.

### 4. Conclusion

Rapid test is essential for the inspection of raw materials in any feed mill. All raw materials used in –

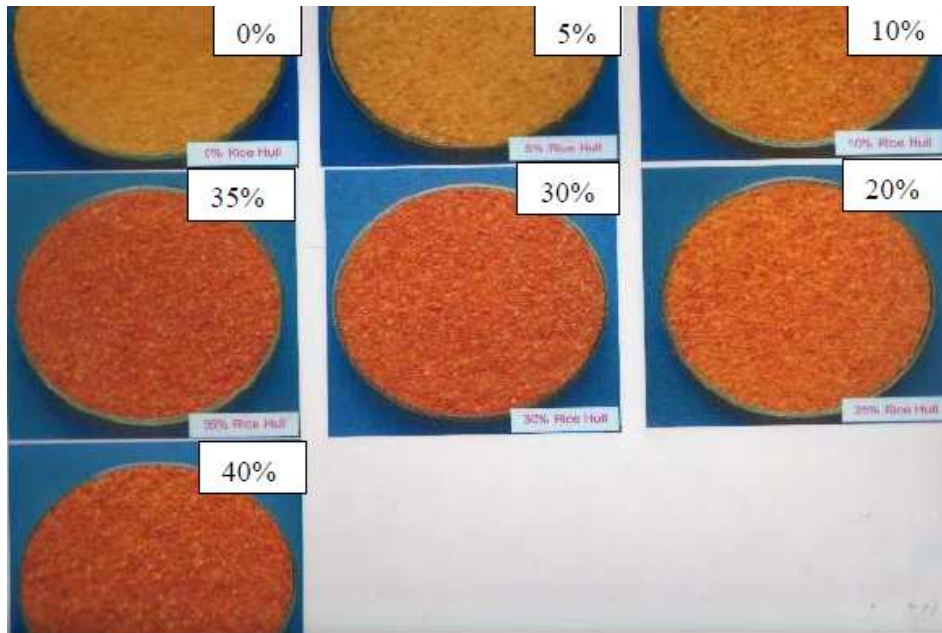


Fig 7: Percentage hull of RBC & RBF



Fig 8: Feather meal of MBM

Table 4: %Crude protein of RBF and RBC correspondence to % hull

Rice Bran Fine		Rice Bran Coarse	
% HULL	% CP	% HULL	% CP
10	12.2	40	7.50
15	11.7	50	7.45
*20	11.2	55	7.40
25	10.5	*60	7.35
30	9.84	65	7.30
35	9.48	70	6.5
40	9.20	75	6.0

Table 5: Standard particle size of MBM

Measurement	4 mm	3 mm	2 mm	1 mm	0.7 mm	0.5 mm	0.5 mm PASS
MAX % Value	Nil	25-30 (BONE)			20	30	25

Table 6: Standard particle size of LSC

Measurement	4 mm	3 mm	2 mm	1 mm	0.7 mm	0.5 mm	0.5 mm PASS
MAX % Value	2	35	50	5	3		

Table7: Standard particle size of LSF

Measurement	4 mm	3 mm	2 mm	1 mm	0.7 mm	0.5 mm	0.5 mm PASS
MAX % Value	0	0	0	0	0	0	100

Table 8: Corn inspection result

%M	Inspection Item					Corn grade	Result	Cause of Reject
	BGYF	%DG	Mold	%BG	ADM			
13.6	80	3.80	2.60	2.80	1.20	3	Normal	
13.7	90	4.80	10.00	2.50	2.80	5	Abnormal	Fungus & Damage
13.9	65	0.70	1.40	2.70	1.70	2	Normal	
13.4	70	3.30	1.60	2.10	1.00	3	Normal	
16.4	65	3.00	5.30	2.60	0.80	4	Abnormal	Fungus, damage and Moisture
17.8	75	4.40	2.60	3.10	2.00	3	Reject	High Moisture
13.2	70	8.24	5.60	4.00	2.40	5	Abnormal	Fungus & Damage
12.7	70	2.50	3.40	2.80	0.70	3	Normal	
16.6	60	1.90	2.80	3.10	1.70	3	Reject	High Moisture

Table 9: Particle size inspection result

RM Name	On 4 mm %	On 3 mm %	On 2 mm %	On 1 mm %	On 0.7 mm %	On 0.5 mm %	Pass 0.5 mm %	Remarks
LSC	1.22	39.56	49.00	7.28	2.03	0.66	0.25	Normal
LSC	5.46	45.55	40.02	7.28	0.78	0.66	0.25	Abnormal
LSF	0.00	0.00	0.00	2.88	4.78	33.24	59.10	Normal
LSF	0.00	0.14	3.14	9.87	7.89	3.32	75.64	Abnormal
MBM	0.00	0.00	2.88	12.46	15.28	3.32	66.06	Normal
MBM	0.00	0.11	4.40	8.66	7.87	56.24	22.72	Normal
MBM	2.15	3.26	9.88	15.33	18.65	46.43	4.30	Abnormal

Table 10: Raw materials inspection result

RM Name	%M	Urea Test	Insect	Smell	%Hull	%UA	Damage/Fungus	%ADM
RBF	8.80	X	X	Bad	20	X	X	0.25
RBC	7.50	X	X	Good	35	X	X	0.18
SBM	11.20	X	X	Good	X	0.25	X	0.02
Wheat	10.50	X	√	Good	X	X	X	0.32
MBM	6.50	X	X	Bad	X	X	X	0.15
BR	11.5	X	X	Good	X	X	0.22	0.18
Paddy	10.20	X	√	Good	X	X	0.20	0.35
Mustard	9.80	X	X	Good	X	X	X	0.18
WBC	9.25	X	√	Bad	X	X	X	0.04
FFS	11.10	X	X	Good	X	X	0.19	0.11
Mushuri	7.50	X	X	Good	X	X	X	0.05



poultry feed manufacturing are provided by different supplier and then transferred to the factory to inspect by the quality control unit and samples sent to the laboratory for quality control. If the raw materials have seen the necessary quality, would be entered to production cycle. Rapid test is very effective and time saving method for sorting out the quality raw materials. Inspection and rapid test method is one of the strong parts of quality control department. To make a quick decision for a raw material, all rapid test and updated inspection protocols should be included in the quality control department to make the quality commitment.

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