تصنيع علائق الاسماك

4 - تقييم المواد الأولية

الصف الثالث

قسم الأسماك والثروة البحرية

د. عادل يعقوب الدبيكل

مفردات المنهج

الجزء النظرى (2 امتحان)

1- اساسيات تركيب العلائق
2- تقسيم الأغذية
3- المواد الأولية
4 - تقييم المواد الأولية
5- طرق تركيب العلائق
6- أنواع العلائق
7- الإضافات الغذائية
8- أجهزة تصنيع العلائق
9- خطوات تصنيع العلائق
10- تقييم العلائق
11- تخزين العلائق
12- جداول و طرق تغذية الأسماك

Ref . Bureau *et al.* –Hepher –Houlihan *et al*. -- Edwards and Allan Halver and Hardy, Tacon *et al*. 2009

أهمية تقييم المواد أولية

مواد من نفس المجموعة تحتوي مغذيات مختلفة

اختلاف المجهز واختلاف الموسم

ملائمتها للعليقة

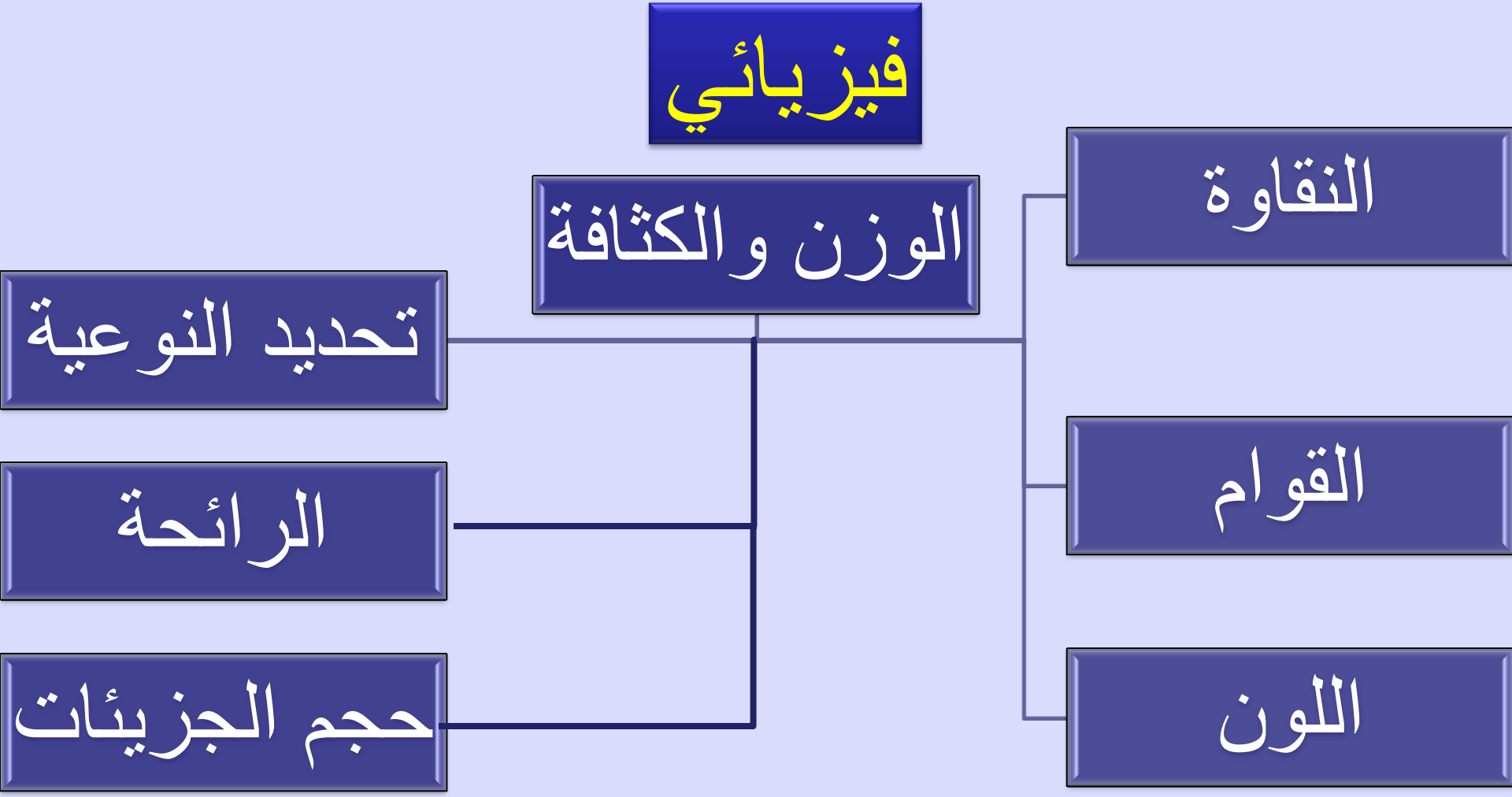
تقدير كفاءتها في الانتاج

فيزيائي

كيميائي

ميكروبي

حياتي


فيزيائي
الوزن والكثافة
النقاوة
القوام
اللون
تحديد النوعية
الرائحة
حجم الجزيئات

حجم الجزيئات

- استخدام منخل مختلف الاحجام
- تحديد الحاجة للطحن
- حجم الجزيئات الأصغر افضل

الوزن والكثافة

- علاقة مع الرطوبة
- النقل والتعبئة
- تأثير على التركيبة

اللون والرائحة

- علاقة مع البروتين الحيواني (غامق)
- الرائحة السمكية افضل

- Physical properties of the feed ingredient :
- Particle size range (screen analysis – and consequent possible requirement for further grinding prior to usage – for most aquatic species, the smaller the particle size and narrower the particle size range the better),
- Bulk density (important when transporting large volumes and when formulating nutrient dense feeds),
- Physical appearance and texture (homogenous free flowing products being preferred, with no visible lumps or cakes),
- Color (in general, darker ingredients usually being indicative of animal protein sources),
- Smell (fresh, not musty, and not sour or burned – the more fishy the smell the better).
- Physical characteristics and consequent handling/processing requirements of a product are more often than not as important as the nutritional characteristics of the product itself. Moreover, simple microscopic examination will quickly indicate the purity of an ingredient and the presence or not of unwanted foreign materials. For standard methods of measuring the bulk density of feed ingredients and microscopic characteristics of different plant and animal feed ingredient sources

Bulk density can vary significantly for the same ingredient due to differences in particle size, moisture content, or compaction. When a feed ration requires blending ingredients that differ widely in bulk density, the feed processor should ensure that the particle size of the feed ingredients is similar, use a binding agent (fat or molasses), and load the mixer using an ingredient sequence that optimizes the blending action of the mixer.

For example, high-density ingredients should be added early to vertical mixers and late in the batching sequence for horizontal mixers.

Ingredient purity refers to the absence of contaminants. The source of these contaminants may be physical (e.g., glass), chemical (e.g., seed treatment), and microbial (e.g., mycotoxin). The use of hand sieves to inspect for physical contaminants enables rapid evaluation of material.

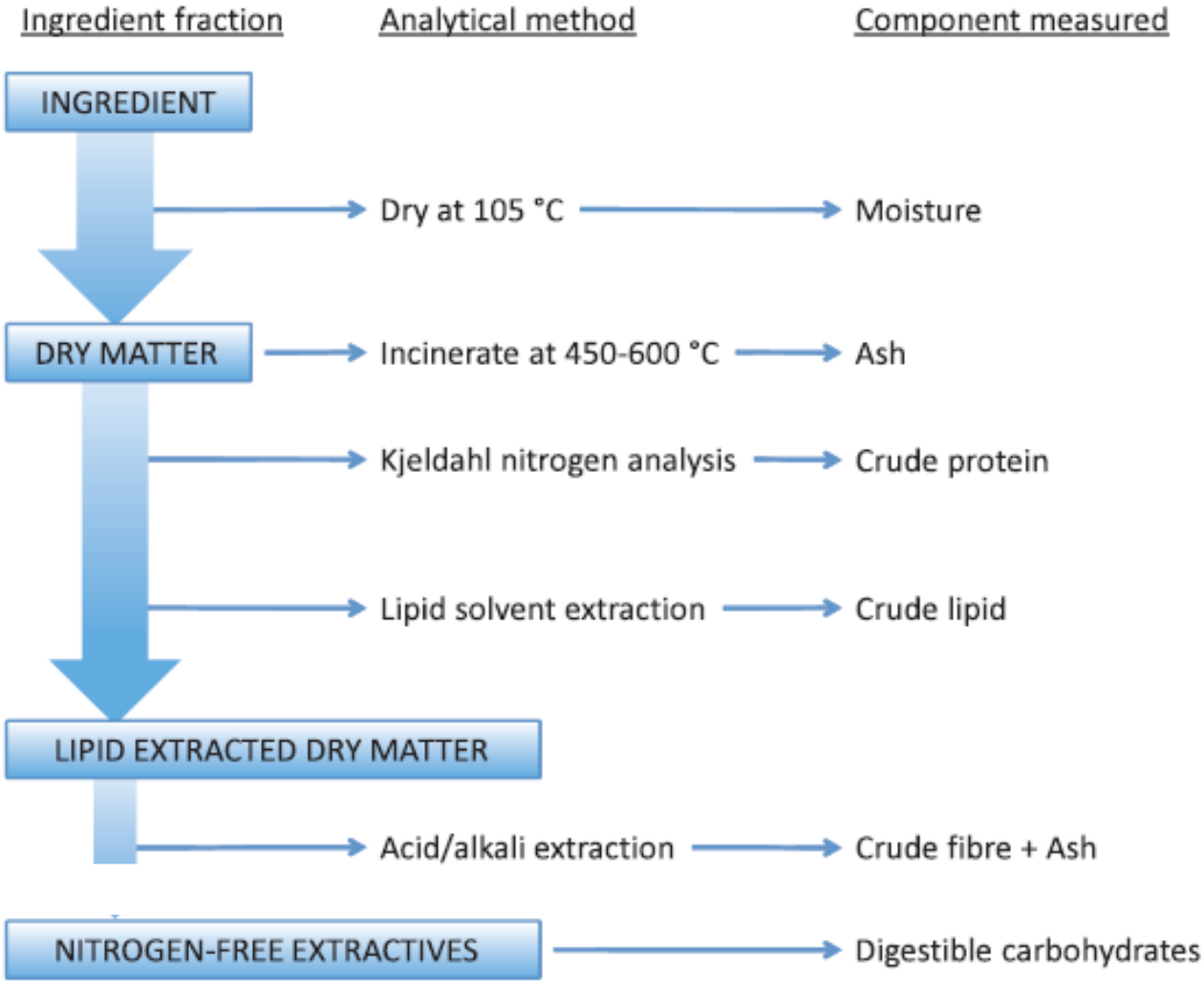
The proximate analysis:
a system for routine description of animal feedstuffs developed in 1865 by Henneberg and Stohmann of the Weende Experiment Station in Germany

كيميائي


Food
Dry Matter
Water
Inorganic
Organic
Minerals
Carbohydrates
Nucleic Acid
Organic Acid
Lipid
Protein
Vitamins

تحليل المواد الأولية والعلائق
Proximate analysis

Weende proximate analysis flow diagram



Association of Official Analytical Chemists (AOAC)

1- البروتين الخام Crude protein

Kjeldahl method

Total nitrogen content

Converting to a total crude protein

Factor 6.25

Average protein contains about 16 percent nitrogen by weight (12- 19)

5.60 being more appropriate than 6.25

1) 15-20 percent error
2) Does not differentiate between protein and non-protein nitrogen (NPN) sources, including nucleic acids, amines (chitin), uric acid, urea,

Kjeldahl method

1- Digestion

$$\text{Organic N} + H_2SO_4 \rightarrow (NH_4)SO_4 + H_2O + CO_2$$

2- Distillation

$$(NH_4)2SO_4 + 2NaOH \rightarrow 2NH_3 + Na_2SO_4 + 2H_2O$$

3- Titration

$$NH_3 + \underline{H_3BO_3} \rightarrow \underline{NH_4\ H_2BO_3}\ + H_2O$$

(color change occurs)

(Red color)

(Green color complex)

$$\underline{NH_4\ H_2BO_3}\ + HCl \rightarrow NH_4Cl + \underline{H_3BO_3}$$

(Green color complex)

(Red color)

Mean nitrogen conversion factors recommended for different protein sources

Protein sources	Conversion factor
Milk and other products	5.85
Egg (whole)	5.68
Corn	5.62
Fish	5.58
Gelatin	5.55
Chicken	5.53
Soybean	5.50
Wheat	5.49
Beef	5.48
Barley	5.45
legumes	5.40
Rice	5.34
Sunflower	5.29

more direct analysis of true amino acid protein nitrogen
be developed, and that crude protein be dispensed with as an analytical tool.

Average default factor – mixed proteins, 5.60

2- الدهن الخام Crude lipid

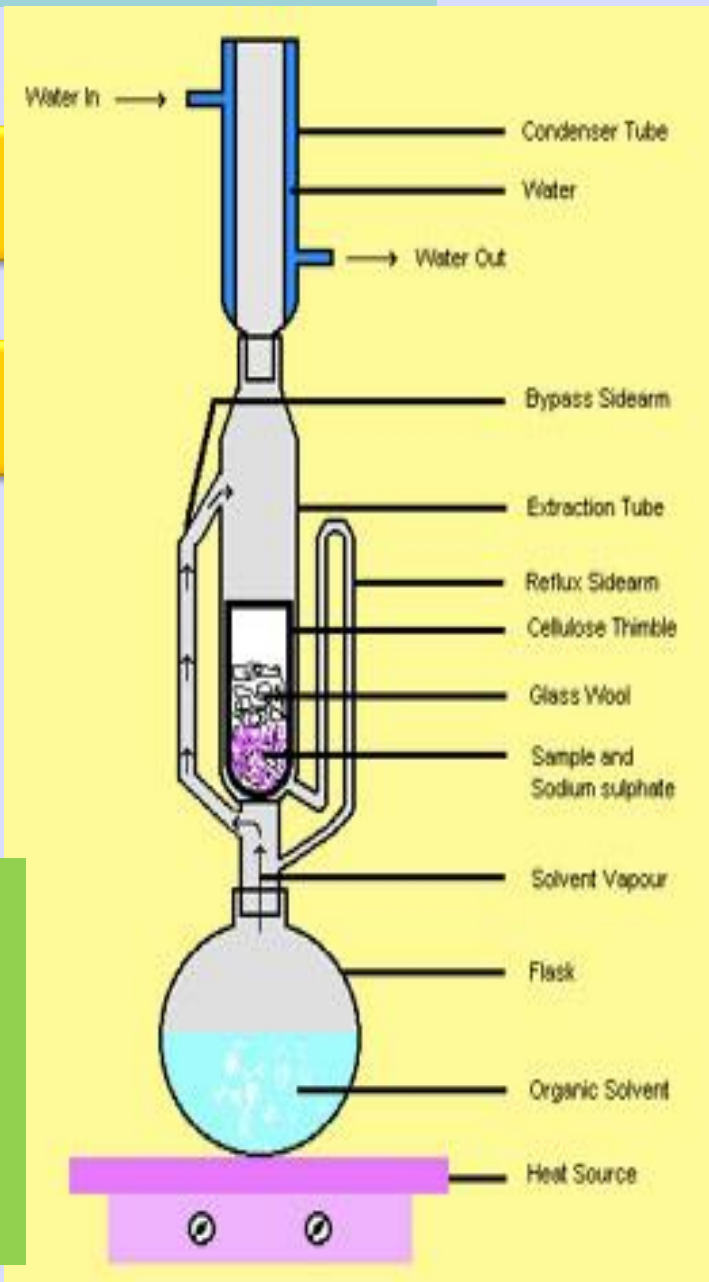
solvent extraction

Soxhlet Method

ether

chloroform: methanol 2:1

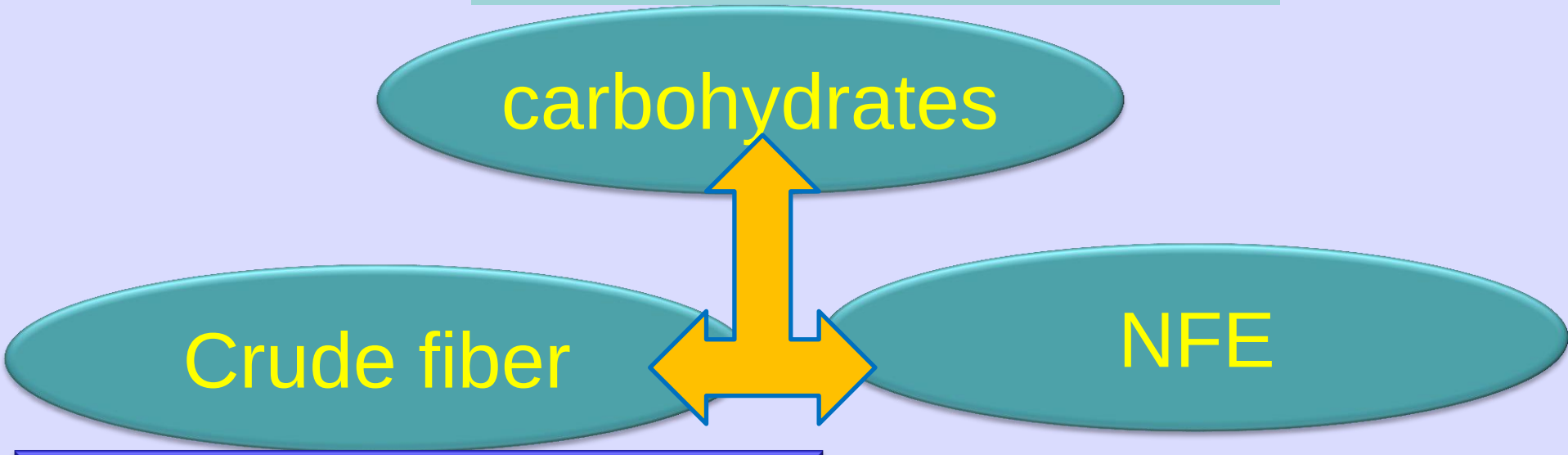
hexane: methanol 4:1



This process assumes ALL substances soluble in ether are fats This assumption is NOT TRUE.

- Plant pigments, wax which are also soluble in ether, but do NOT have the same nutritional values of fats However, this error is generally small.

3- الالياف الخام Crude fiber



extraction of a defatted sample with 1.25% H_2SO_4 and 1.25% NaOH.

% NFE = % DM - (% EE + % CP + % ash + % CF)

% NFE = 100 - (% EE + % CP + % ash + % CF)

4- رطوبة Moisture

5- رماد Ash

Grain Moisture Meter

1- Near Infrared (NIR)

2- Radio Frequency (RF)

Unsatisfactory principle of the Proximate Analysis.
Major problem:

1. acid and base solubilize some of the true fiber (particularly hemicellulose, pectin and lignin).
2. Cellulose too is partially lost. Hence, crude fiber underestimates true fiber.

Most laboratories have phased out the CF term and replaced it with the Van Soest "Detergent Fiber" determination.

NFE

This is the ONLY component in the Proximate Analysis which is not determined ANALYTICALLY but is calculated by difference. Therefore, NFE accumulates all of the errors that exist in other proximate analysis components (CF is the biggest error)

- Proximate analysis is only a crude estimate of the major classes of nutrients, should be only used as a general guide to the potential nutritional merits of a feed ingredient.
- It follows therefore that the next step is to conduct chemical analyses for specific dietary nutrients.

تحاليل متقدمة

1- مواد غير بروتينية non-protein compounds

2- احماض امينية Amino acids

3- احماض دهنية Fatty acids, phospholipids and sterols

4- سكريات sugars

5- فيتامينات Vitamins

6- عوامل مضادة للتغذية Anti-nutritional factors

7- طاقة Energy

8- معادن Minerals

Checklist for proximate composition analysis

- Moisture % of wet weight
- Protein % of dry matter (DM)
- Total fat % of DM
- Crude fibre % of DM
- Total ash % of DM
  - soluble ash
  - insoluble ash
- Other carbohydrates (nitrogen-free extractives) % of DM

In recent years the proximate analysis procedure has been replaced by other analytical procedures. Alternative procedures for fibre have been developed (Van Soest):

- Neutral Detergent Fibre (NDF), eNDF, peNDF
- Hemicellulose
- Acid Detergent Fibre (ADF)
- Lignin (ADL)
- Cellulose

Also the carbohydrate methodology has been revised:

- Non-structural carbohydrates (NSC): sugars, starches, fructans, galactans, pectins, β-glucans, etc.
- Non-starch polysaccharides (NSP): NSC minus starch and sugars

Protein can also be specified:

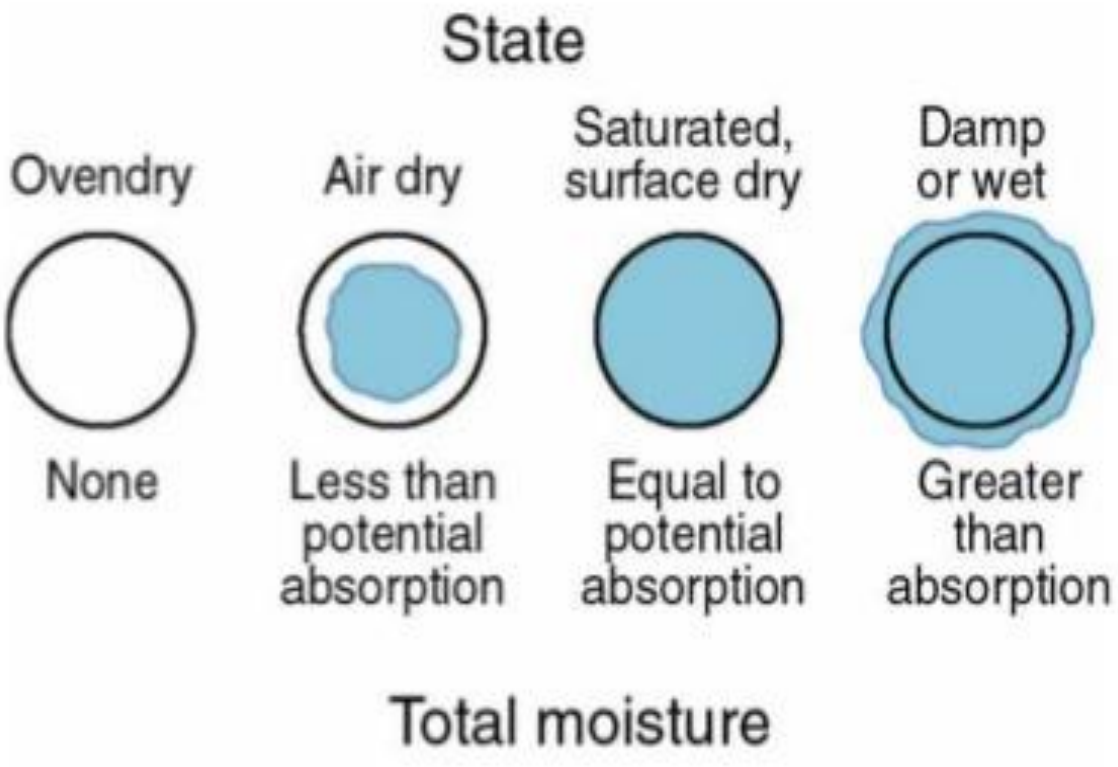
- NPN (non-protein nitrogen) % of DM
- Amino acids % of DM and % of total amino acids
  - Essential and semi-essential amino acids: arginine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, valine, and others according to the species of monogastric animals
  - Non-essential amino acids: alanine, asparagine, aspartic acid, cysteine, cystine, glutamic acid, glutamine, glycine, proline, serine, tyrosine

- Mineral composition and trace-elements
  - Minerals (g/kg): Ca, Cl, K, Mg, Na, P, S
  - Trace-elements (mg/kg): Co, Cu, Fe, I, Mn, Mo, Se, Zn

- Vitamins
  - Fat soluble vitamins: Vitamin A (retinol) (μg/100g), Vitamin D_3 (cholecalciferol) (μg/100g), Vitamin D2 (ergocalciferol) (μg/100g), Vitamin E (α-tocopherol) (mg/100g), Vitamin K (phylloquinone) (mg/kg), β-carotene (mg/kg)
  - Water soluble vitamins: Vitamin B_1 (thiamine) (mg/kg), Vitamin B_2 (riboflavin) (mg/kg), Vitamin B_6 (pyridoxine) (mg/kg), Niacin (mg/kg), Pantothenic acid (mg/kg), Folic acid (mg/kg), Biotin (mg/kg), Vitamin B_{12} (cobalamin) (mg/kg), Vitamin C (ascorbic acid) (mg/kg)

Classify coarse aggregate according to their moisture conditions

Moisture Conditions



فحوصات فيزيائية للعليقة

Physical characterization

$$\% \text{ Dust} = \frac{\text{Dust weight/bag (g)}}{\text{Feed weight/bag (g)}} \times 100\%$$

Percentage of feed dust in the bags

فحوصات فيزيائية للعليقة

Physical characterization

$$\% \text{ Floatab.} = \frac{100 - \text{immerse pellets}}{100} \times 100$$

$$\% \text{ Integrity} = \frac{\text{Whole pellets}}{100} \times 100$$

Pellet floatability (30 min)
Physical integrity in the water (30 min)

فحوصات فيزيائية للعليقة

Physical characterization

$$\text{Water absorption rate} = \frac{\text{Wet weight (g)}}{\text{Initial dry weight (g)}} \times 100\%$$

$$\text{Leaching loss} = 1 - \frac{\text{Final dry weight (g)}}{\text{Initial dry weight (g)}} \times 100$$

Water absorption rate (10 min)
Leaching loss (10 min)
Means analyzed by ANOVA ($p<0.05$) and Tukey's test

فحوصات فيزيائية للعليقة

Physical characterization

$$\text{Feed particle size class} = \frac{\text{Particle class weight (g)}}{\text{Sample weight (g)}} \times 100$$

eed ingredients particle sizes
850 µm; 500 to 850 µm; < 500 µm

فحوصات فيزيائية للعليقة

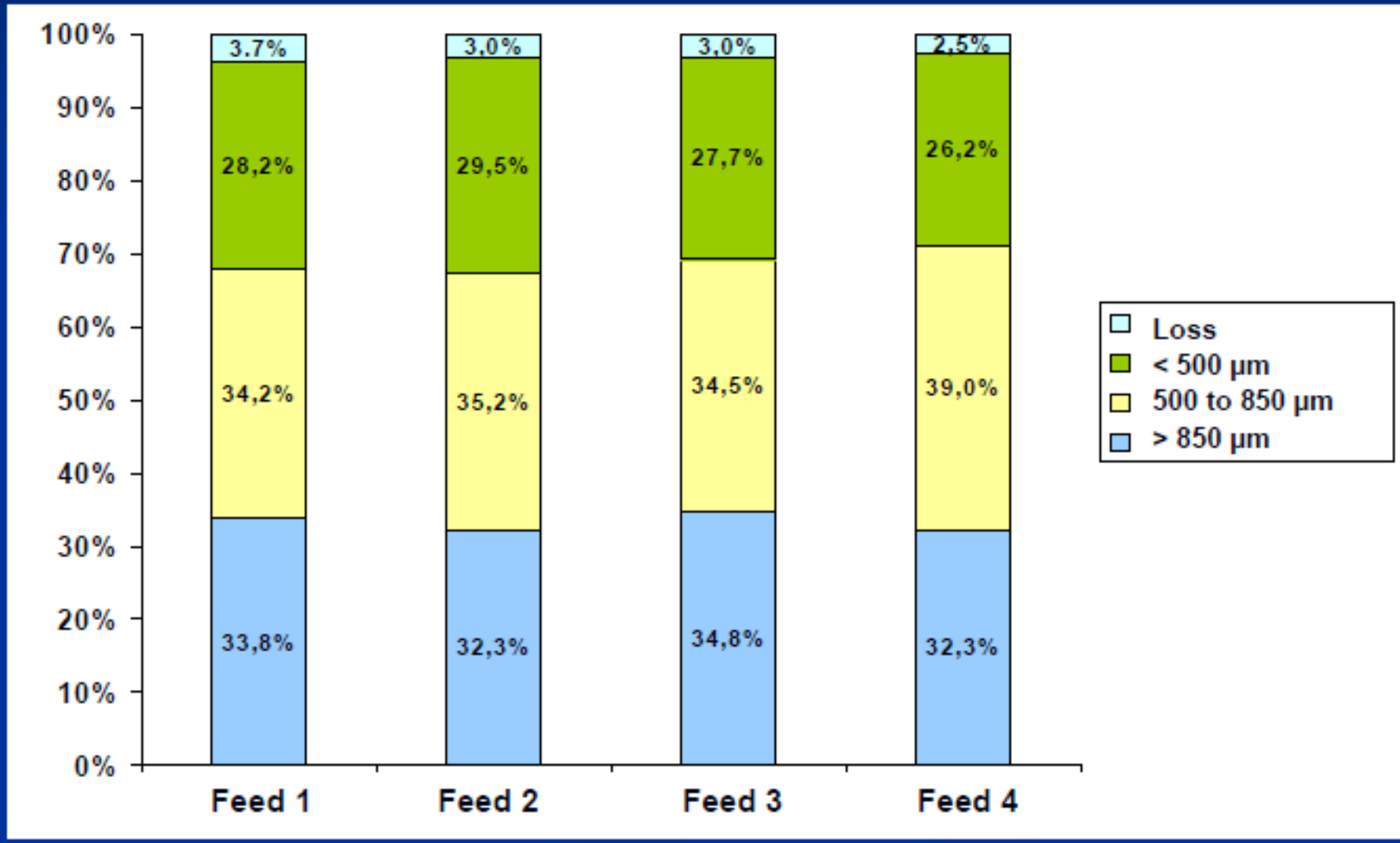
Physical characterization

Parameter	Feed 1	Feed 2	Feed 3	Feed 4
Net weight in the bag (kg) [1]	24.11	24.49	24.72	24.89
Dust in the bag (%) [2]	1.47	0.96	0.86	1.16
Floatability 30 min (%) [2]	96	100	99	99
Physical integrity 30 min (%)	99	100	99	99
Water absorption rate - 10 min (%)*	340[a]	270[b]	389[a]	344[a]
Leaching loss - 10 min (%)	1.63[a]	1.27[a]	2.95[b]	1.83[a]

*Same letters on a row indicate no significant difference (P >0.05)
[1] INMETRO [2] ANFAL (National Association of Animal Feed Manufacturers)

فحوصات فيزيائية للعليقة

Physical characterization



Feed ingredients particle size class

فحوصات كيميائية للعليقة

Chemical characterization

Chemical composition - AOAC (1985)

- Moisture
- Crude protein
- Fat
- Crude fiber
- Ash
- Calcium and phosphorus

Results were compared with the information presented on the feed bag label (guarantee)

فحوصات كيميائية للعليقة

Chemical characterization

	Feed 1		Feed 2		Feed 3		Feed 4	
Parameter	Label	Anal.	Label	Anal.	Label	Anal.	Label	Anal.
Moisture (max)	13.00	7.50	12.00	7.72	13.00	3.92	13.00	8.19
C. Protein (min)	27.00	22.98	28.00	27.42	28.00	28.91	28.00	29.64
Fat (min)	3.00	6.19	3.50	4.55	3.50	4.74	3.00	4.13
C. Fiber (max)	4.50	4.64	6.50	4.64	7.00	4.76	10.00	6.64
Ash (máx)	10.00	8.52	11.00	11.47	9.00	8.40	14.00	5.41
Calcium (max)	2.00	2.35	3.00	3.00	2.50	1.67	3.00	0.42
Phosp. (min)	1.00	1.37	1.60	1.63	0.80	1.15	0.60	0.81

Art. 45 - Decreto 76.986 Brazilian Ministry of Agriculture Regulation

فحوصات حياتية للعليقة

Biological evaluation

- 240 tambaqui, *C. macropomum*, juveniles of 20 g were distributed in twelve 300 L PVC tanks supplied with water and aeration
- Fish were fed the four diets to apparent satiation, twice a day, during 60 days

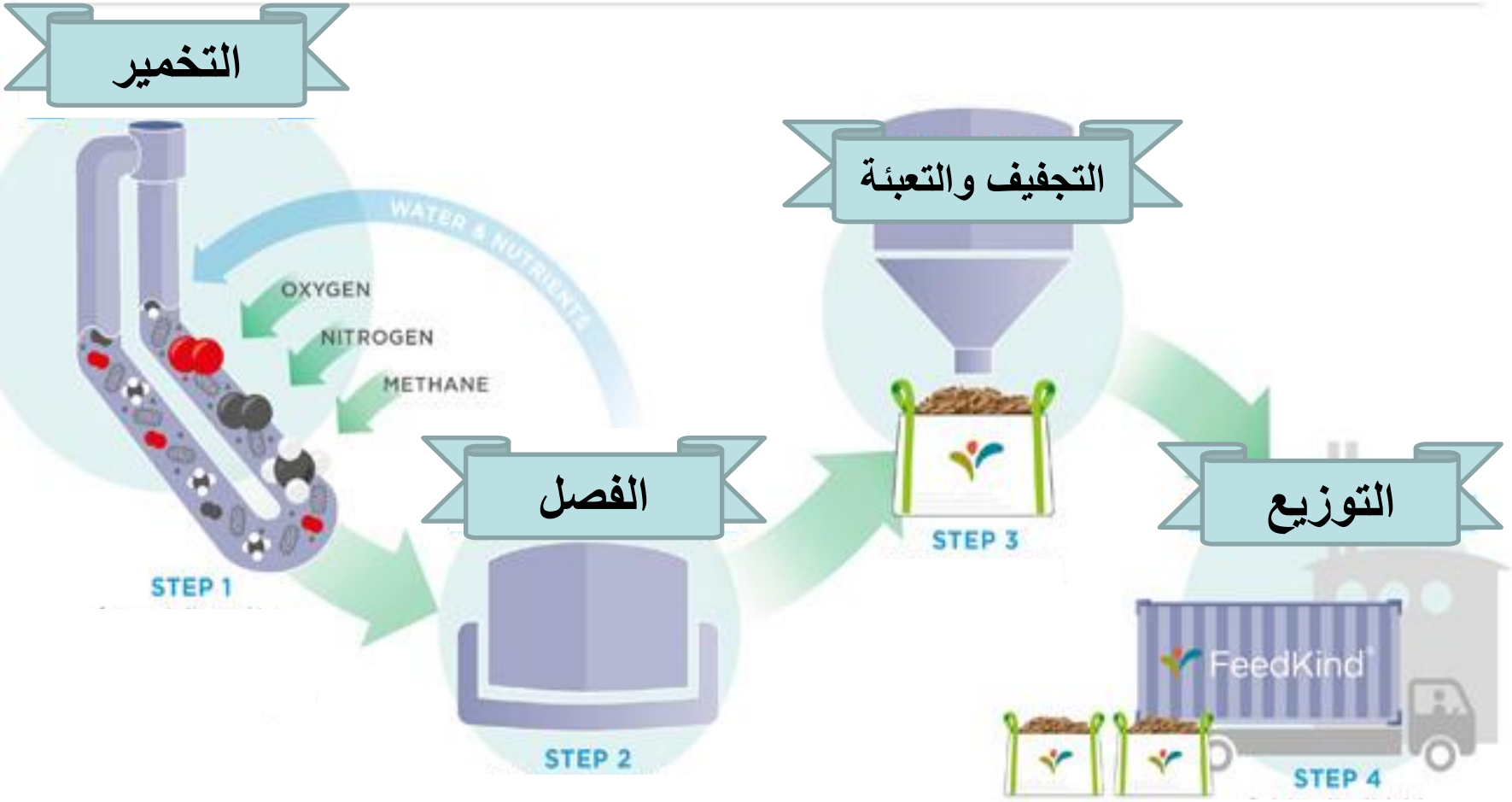
Photo: Jorge Silva

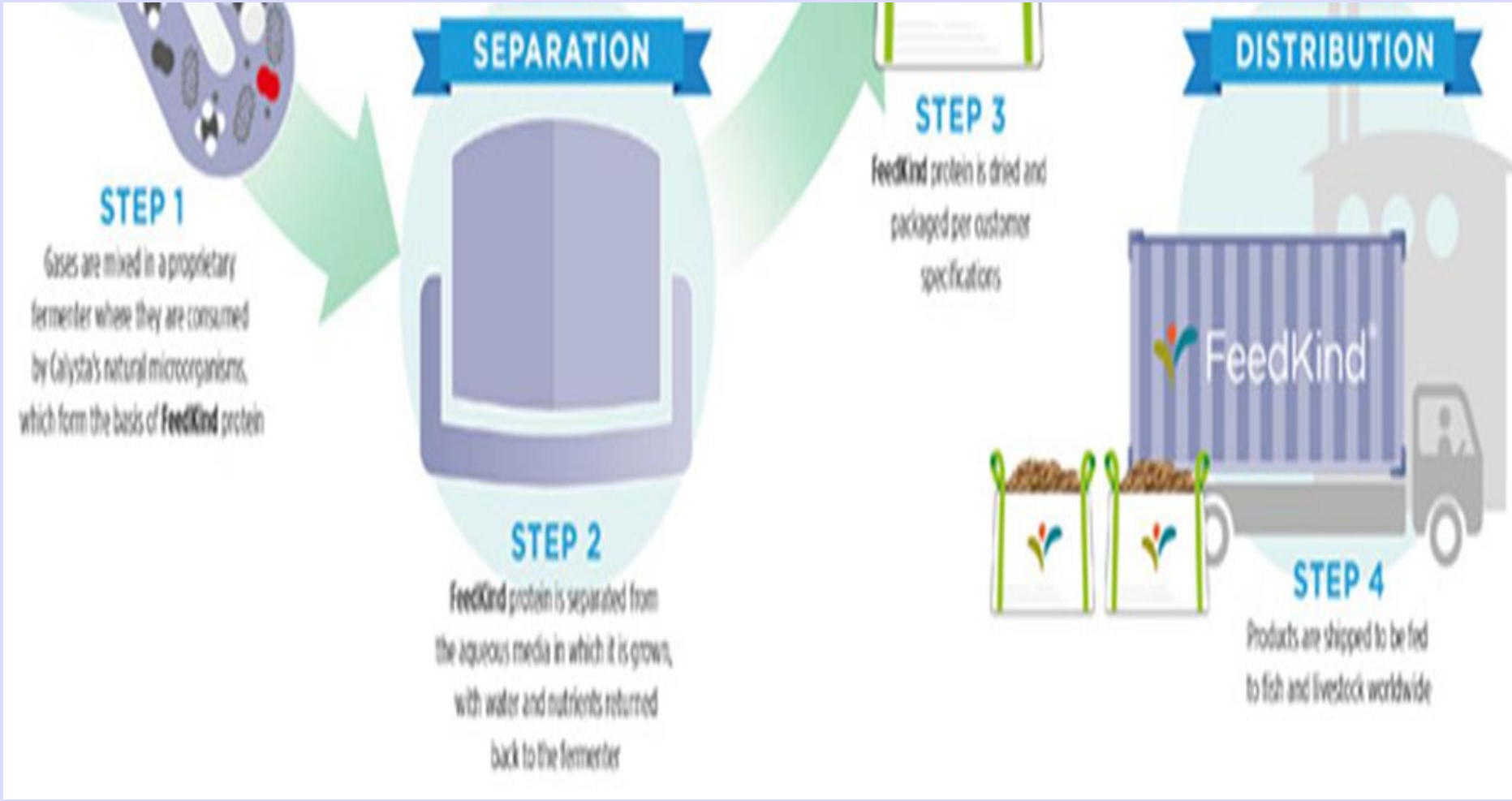
فحوصات حياتية للعليقة

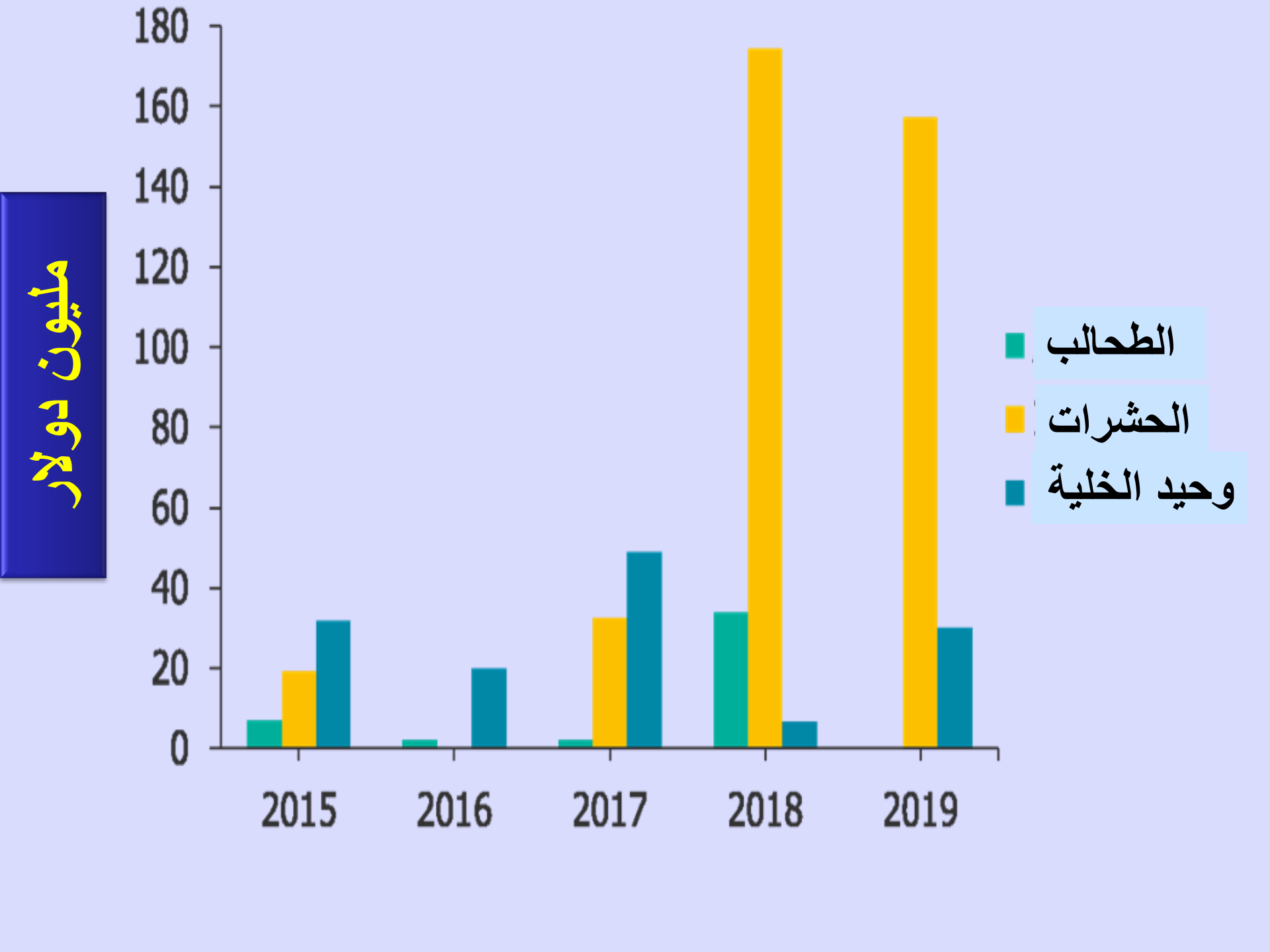
Biological evaluation

Feed	Parameters				
	Weight gain (g)	Daily wt. gain (g/d)	Feed consum. (g)	FCR	SGR
1	20.3 ± 2.5	0.34 ± 0.04	1235.6 ± 70.3	3.5 ± 1.1	1.5 ± 0.1
2	20.9 ± 1.1	0.35 ± 0.02	1148.3 ± 16.3	2.7 ± 0.1	1.6 ± 0.0
3	18.0 ± 1.1	0.30 ± 0.02	1175.0 ± 27.2	3.3 ± 0.2	1.4 ± 0.1
4	19.1 ± 2.0	0.32 ± 0.03	1160.0 ± 61.5	3.4 ± 0.2	1.5 ± 0.1

خطوات تصنيع البروتين




STEP 1
Gases are mixed in a proprietary fermenter where they are consumed by Calysta's natural microorganisms, which form the basis of FeedKind protein
SEPARATION
STEP 2
FeedKind protein is separated from the aqueous media in which it is grown, with water and nutrients returned back to the fermenter
STEP 3
FeedKind protein is dried and packaged per customer specifications
DISTRIBUTION
FeedKind
STEP 4
Products are shipped to be fed to fish and livestock worldwide


مليون دولار
180
160
140
120
100
80
60
40
20
0
2015
2016
2017
2018
2019
الطحالب
الحشرات
وحيد الخلية

Acid insoluble Ash

- The total ash is boiled for 5 min in 25 mL dilute HCl. The insoluble matter is collected on ash less filter paper and washed with hot distilled water. The filter paper is then dried and ignited in tarred silica crucible until free from carbon. The crucible is allowed to cool in desiccator till a constant weight and weighed. The percentage of acid insoluble ash with reference to air dried sample is calculated

a) Kjeldhal Method
b) Enhanced Dumas Method
c) UV Spectroscpic Method
d) Lowry Method

A. Peptide bond

- In proteins aa's are joined covalently by peptide bonds, i.e., amide linkages b/w α-carboxyl of one aa and α-amino group of another. e.g., valylalanine.

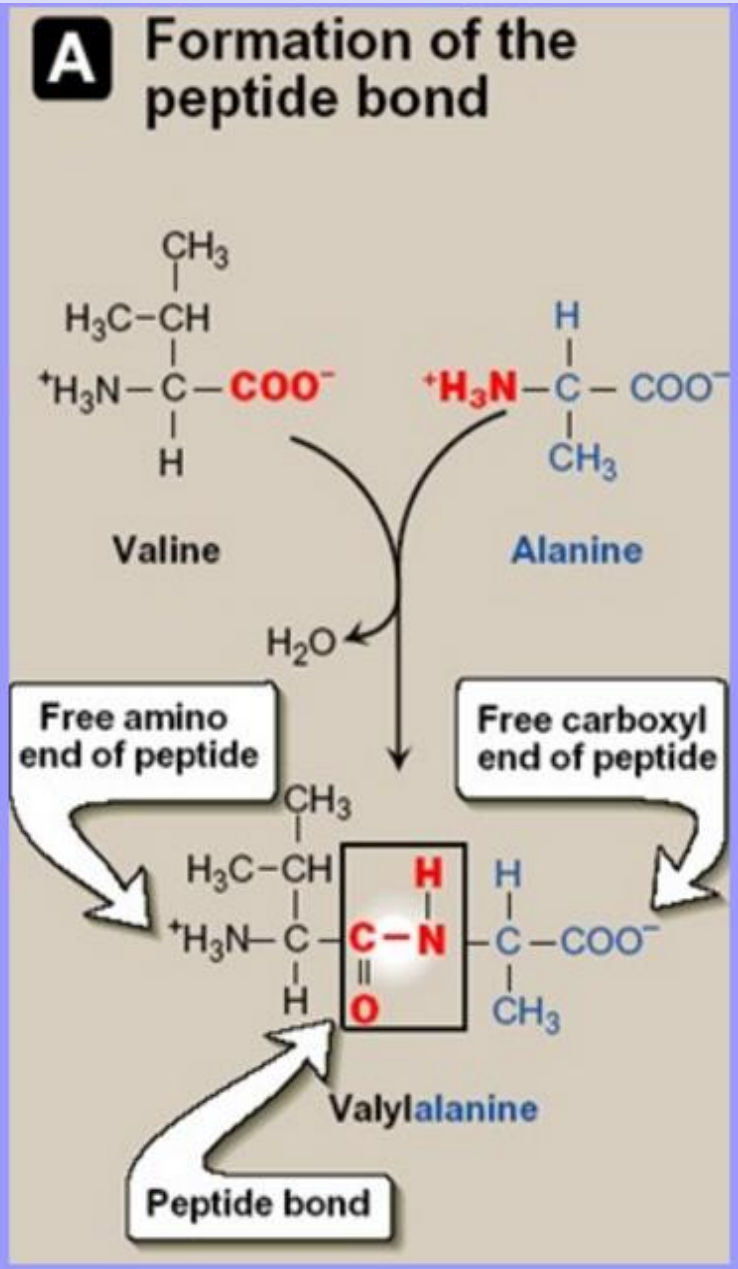


Figure 2.2-A. Formation of a peptide bond, showing the structure of the dipeptide valylalanine.

Separation of Amino Acid Mixtures