

# CHALLENGING AQUAFEED FORMULATION



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# THE CHALLENGE OF MAKING AQUAFEED

## CURRENT CHALLENGES

Diseases

Sustainability

Cost efficiency



New raw materials

# THE CHALLENGE OF MAKING AQUAFEED

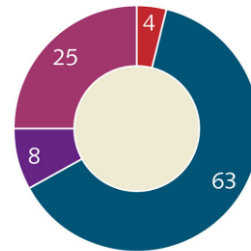
## SUSTAINABLE FEED

Aquaculture is the most sustainable way to produce animal protein!

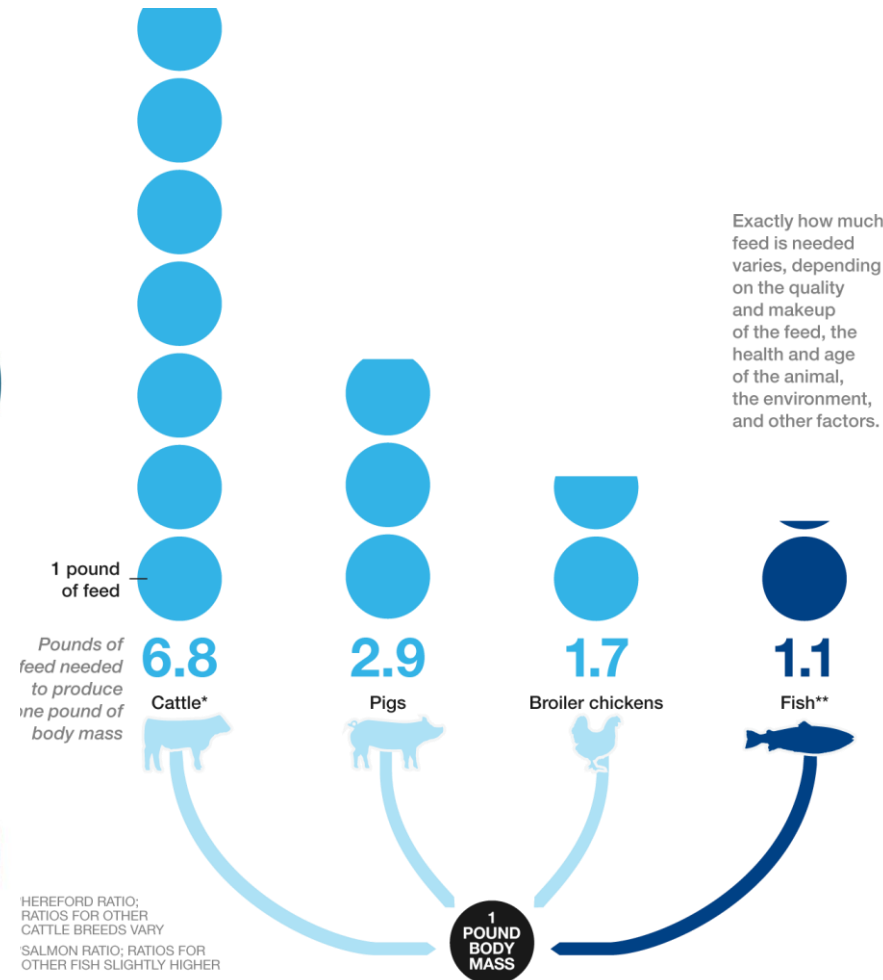
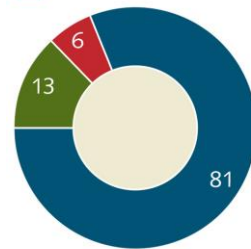
However, what is in the feed? Eventhough FCR is low, aquaculture has monopolised wild catch Fishmeal usage.

**How sustainable is this?**

Percentage of fishmeal usage per market



Percentage of fish oil usage per market

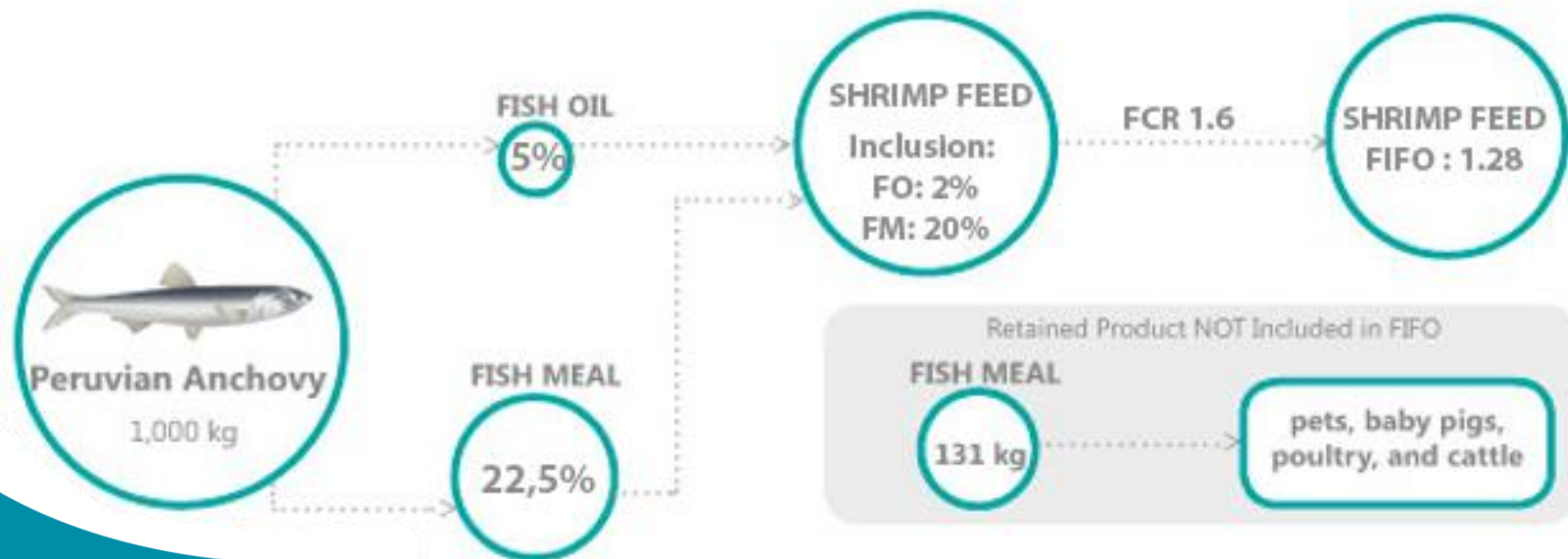


# THE CHALLENGE OF MAKING AQUAFEED

## SUSTAINABLE FEED: FISH IN FISH OUT RATIO (FIFO)

« *Quantity of whole wild fish needed for feeds/quantity of farmed fish produced* »

$$FIFO\ ratio = \left( \frac{\text{level of fishmeal (\%)} + \text{level of fish oil (\%)} \text{ in the diet}}{\text{Yield of fishmeal (\%)} + \text{yield of fish oil (\%)}} \right) * FCR$$



# THE CHALLENGE OF MAKING AQUAFEED

## SUSTAINABLE FEED: FISH IN FISH OUT RATIO (FIFO)

Fish Meal Free cost effective Diet has already been achieved for FreshWater species,

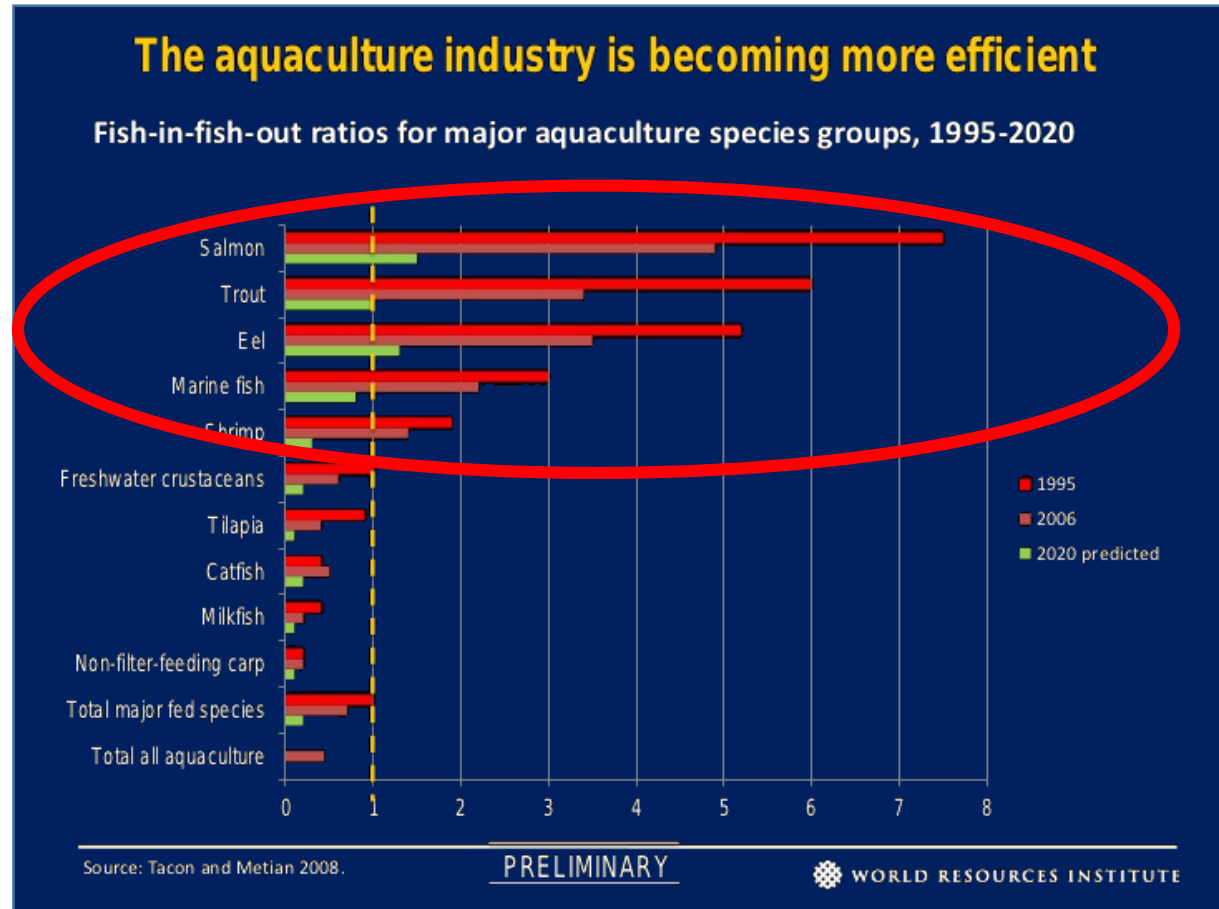


Still a long way to go for Marine fish and shrimp

THE UNIVERSITY OF ARIZONA

Monterey Bay Aquarium

New England Aquarium



# THE CHALLENGE OF MAKING AQUAFEED

## USE OF ANIMAL AND PLANT BY PRODUCTS

Relying on only one FM replacer is not suitable:

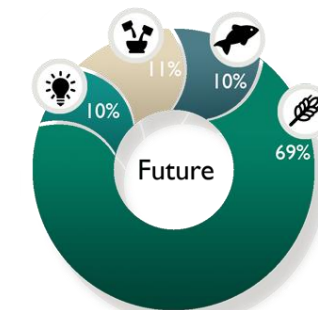
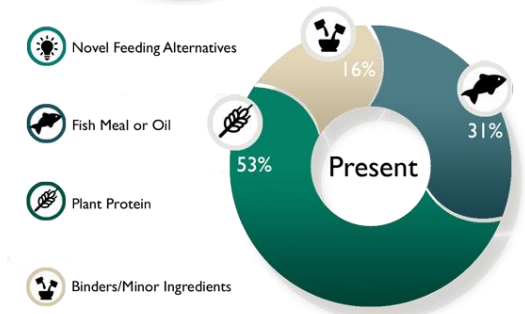
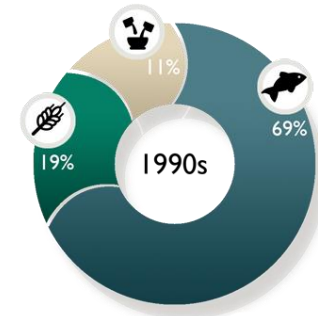
### 1. Plant proteins:

- i. ANF, mycotoxins and others toxic substances
- ii. Phosphorus availability
- iii. GMO concerns for Soya based product
- iv. Nutritional imbalance

### 2. Animal by product:

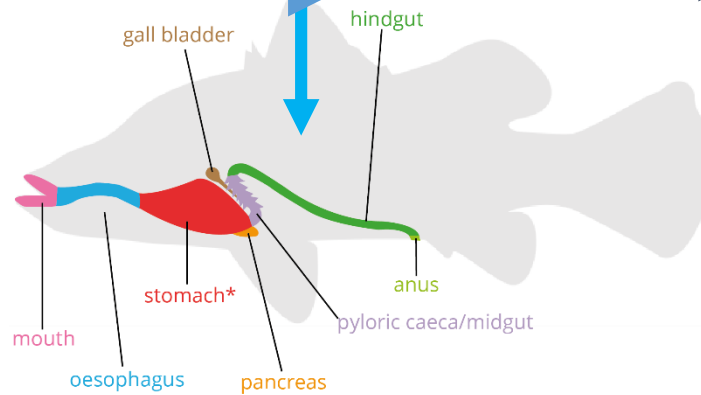
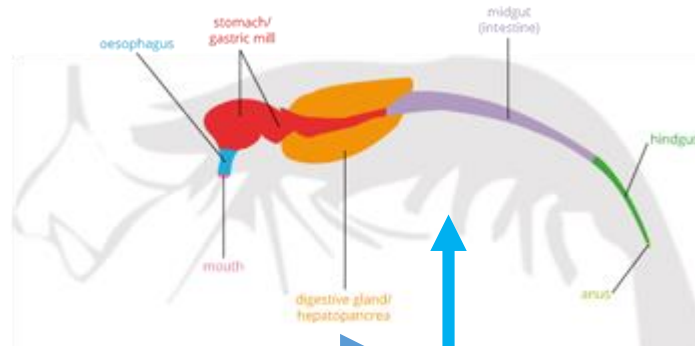
- i. Nutritional imbalance
- ii. Availability
- iii. Oxidation promotion

→ General : physical, palatability and digestibility issues.



# THE CHALLENGE OF MAKING AQUAFEED

## LOW PALATABILITY AND DIGESTIBILITY



### Undigested feeds

- Lower Protein Retention: 20%\* - 35%\*\*
- ➔ Huge N release
- High phosphorus realised (2/3 if plant origine)
- Imbalance of EAAs intake, potential lower immunity.

### Digested feed for growth

# THE CHALLENGE OF MAKING AQUAFEED

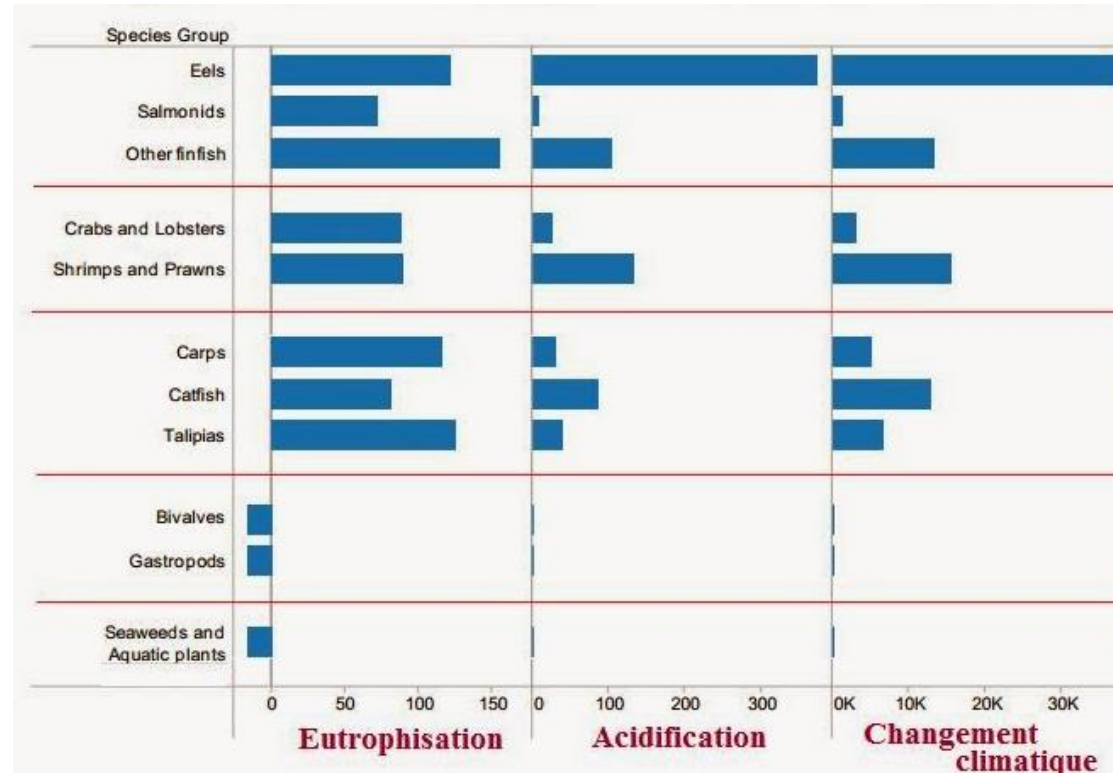
## AMONIA AND PHOSPHORUS

### 1. Environmental concerns:

- i. Eutrophisation,
- ii. Acidification,
- iii. Climate change,

### 2. Health concerns:

- i. Emerging diseases
- ii. Antibiotics



World fish Center



# THE CHALLENGE OF MAKING AQUAFEED

## IMPROVE DIGESTIBILITY WITH THE USE OF ENZYME

### 1. Organic molecules that needs:

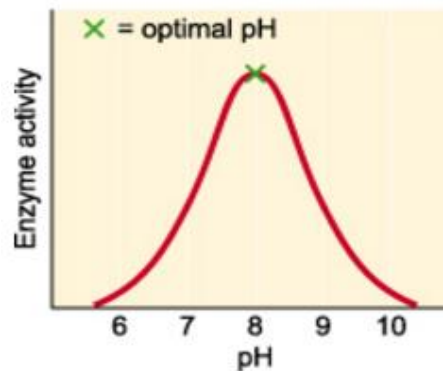
- i. Optimum Temperature
- ii. Optimum pH
- iii. Specific substrate

### 2. Principal limitation for Aqua:

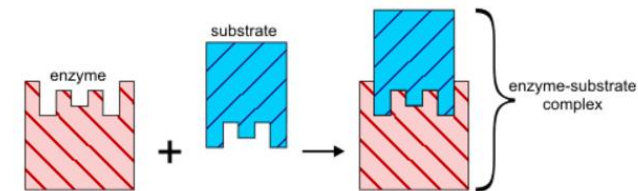
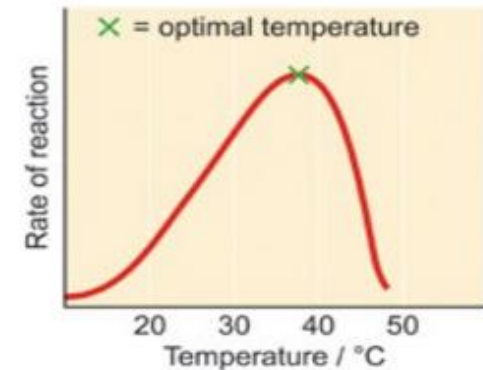
- I. developed for livestock,
- II. Not tolerant to heat (extruders)
- III. Possible leaching loss within water

→ Only Phytase provide consistante results in Aqua

pH



Temperature



Source: RSC

# HOW TO IMPROVE

Digestive efficiency?

Phosphorous and Nitrogen Retention?

Health status of the animal?

Animals performance?



# THE CHALLENGE OF MAKING AQUAFEED

## ALGAE GREEN TECHNOLOGY: OLMIX SOLUTION





# mFeed+

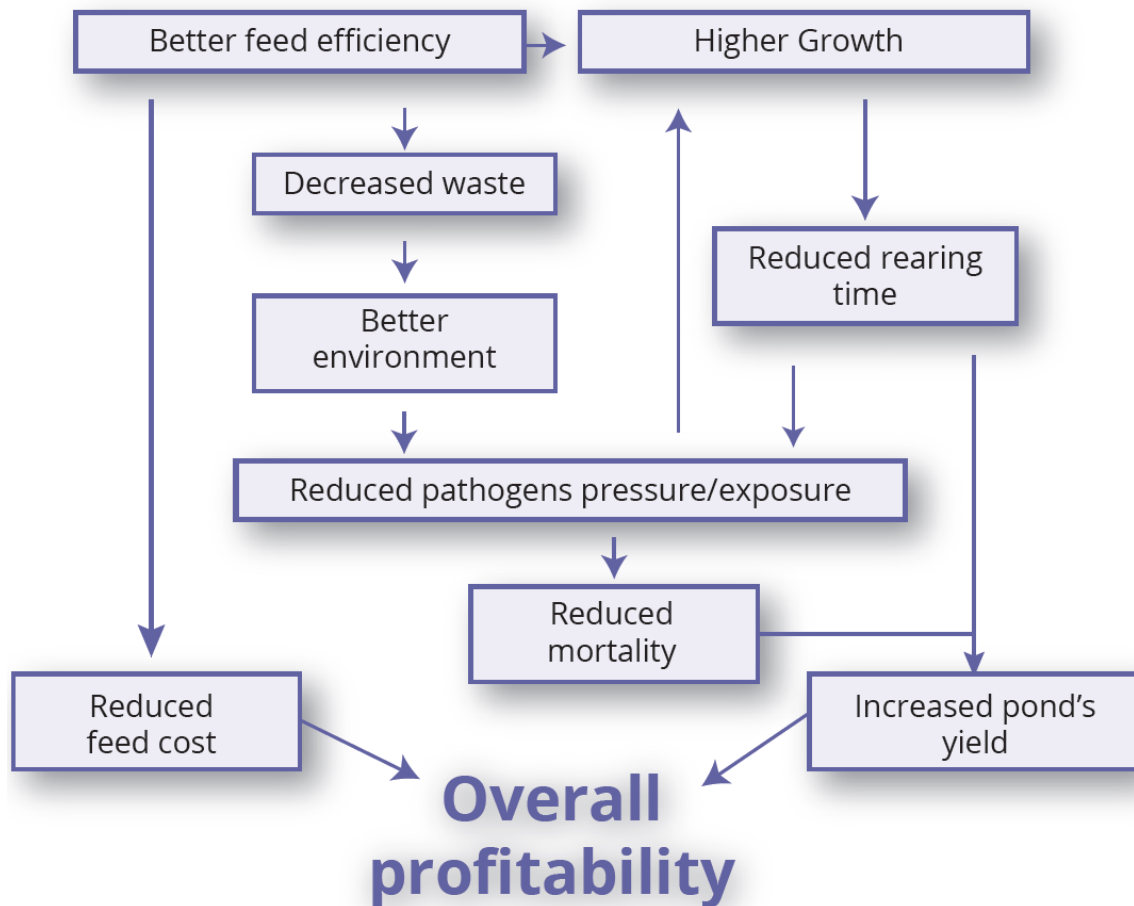
**INCREASING FEED EFFICIENCY  
BY OPTIMIZING ENZYMATIC  
ACTIVITY**

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All information only for export outside Europe.*



# SEEKING GREEN PERFORMANCE

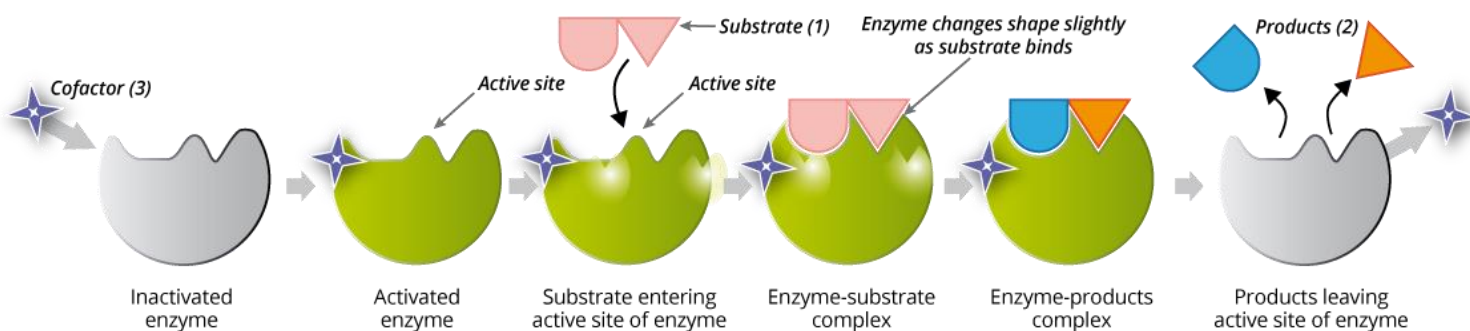
## IMPROVING FEED EFFICIENCY



## DIGESTION PROCESS

### IMPORTANCE OF ENZYMATIC ACTIVITY

- Enzymatic activity is **necessary to hydrolyze feed** into nutrients.
- Nutrients are necessary for the proper functioning of the organs and for **growth and production**.



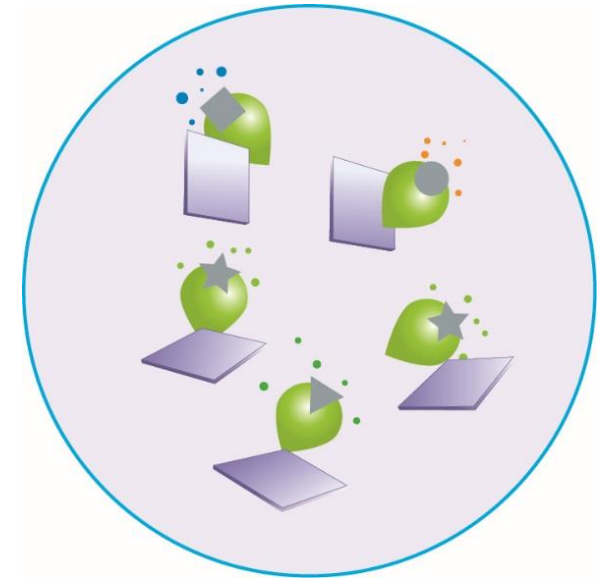
### Principle of enzymatic hydrolysis

Feed compounds (1) are hydrolyzed into nutrients (2) by the activity of an enzyme, which is active under specific conditions (temperature, pH, presence of a cofactor (3)).

## OLMIX EXFOLIATED ALGOCLAY

### STABLE SUBSTRATE-ENZYME COMPLEXE

1. **Physico-chemical** properties of clay particles favor the contact between enzymes and feed substrates (*Reichardt, 2008; Habold et al 2009*)
2. These active stable complexes are resistant to proteolysis
3. Stable complexes increase the amount of active enzymes (*Cabezas et al, 1991*)

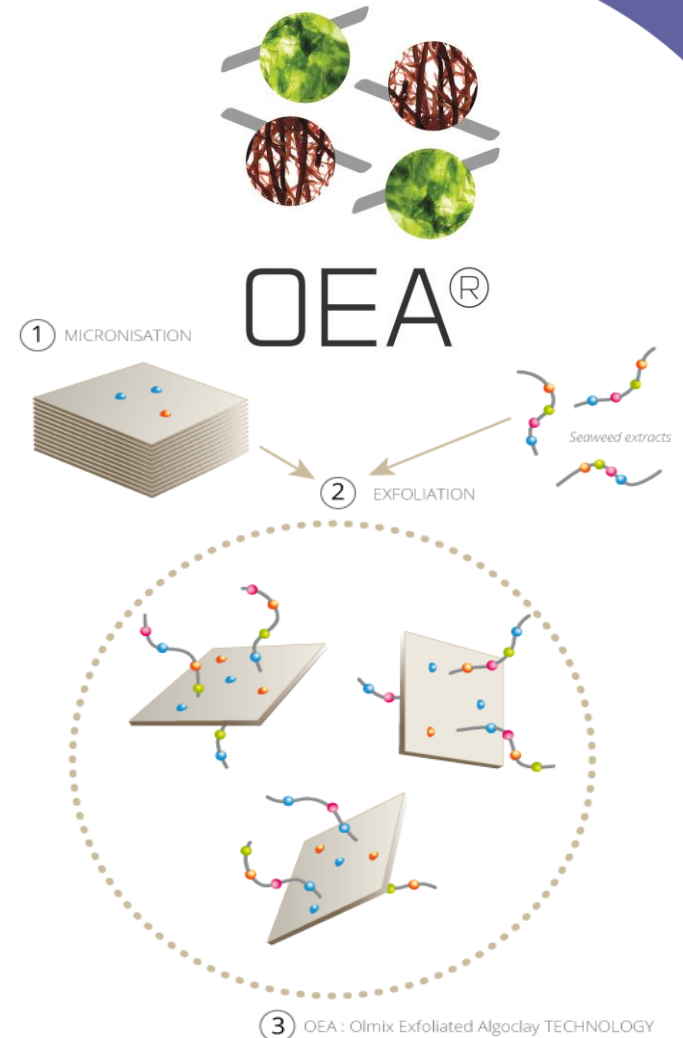


Cabezas et al, 1991; Habold et al, 2009;  
Parsini et al, 1999; Reichardt, 2008; Xia et al, 2004

# OLMIX EXFOLIATED ALGOCLAY

## STABLE SUBSTRATE-ENZYME COMPLEXE

1. MFeed+ is based on the **patented technology OEA**: Olmix Exfoliated Algoclay.
2. Micronized make the structure very fine (<200mesh)
3. Exfoliated layers offer a **very large contact surface** (up to 800 m<sup>2</sup>/g), with which enzymes can interact.





## OLMIX EXFOLIATED ALGOCLAY

### CO-FACTORS, ESSENTIAL FOR ENZYMATIC HYDRO

1. **Co-factors** are helper molecules required for enzymes to be active.
  - Organic: most commonly vitamins
  - Inorganic: most commonly **metallic ions**
2. Metallic ions present in :
  - Specific **algae extracts** (from *Ulva sp.* and *Solieria chordalis*)
  - **Clay**
3. Overall wide range of co-factor (e.g. Fe, Cu, Zn, Ti, Mn, Mo, Pd, W, V, Co, Ni, Pt, Au, Ag, ...)

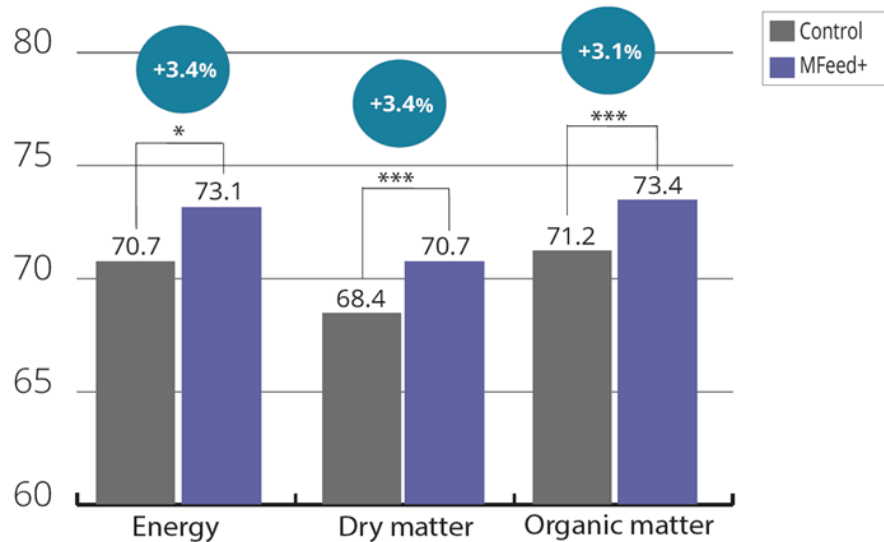




# OLMIX EXFOLIATED ALGOCLAY

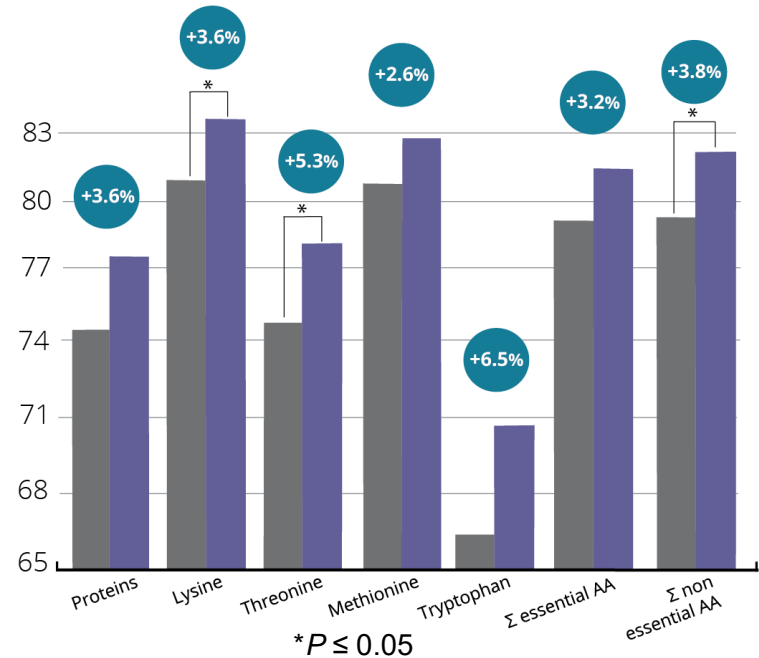
INCREASE THE ILEAL DIGESTIBILITY OF NUTRIENTS

## Apparent ileal digestibility (CUDI), %

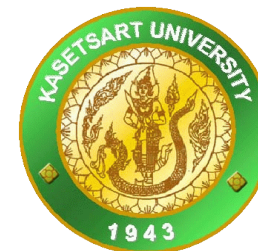


\*\*P ≤ 0.01; \*P ≤ 0.05

## Standardized digestibility of amino acids (CUDs), %



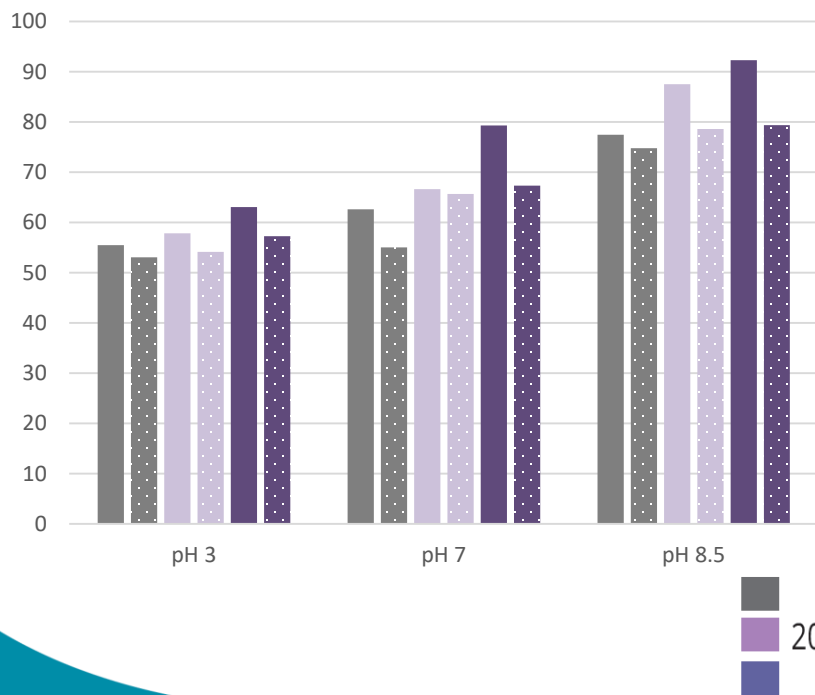
\*P ≤ 0.05



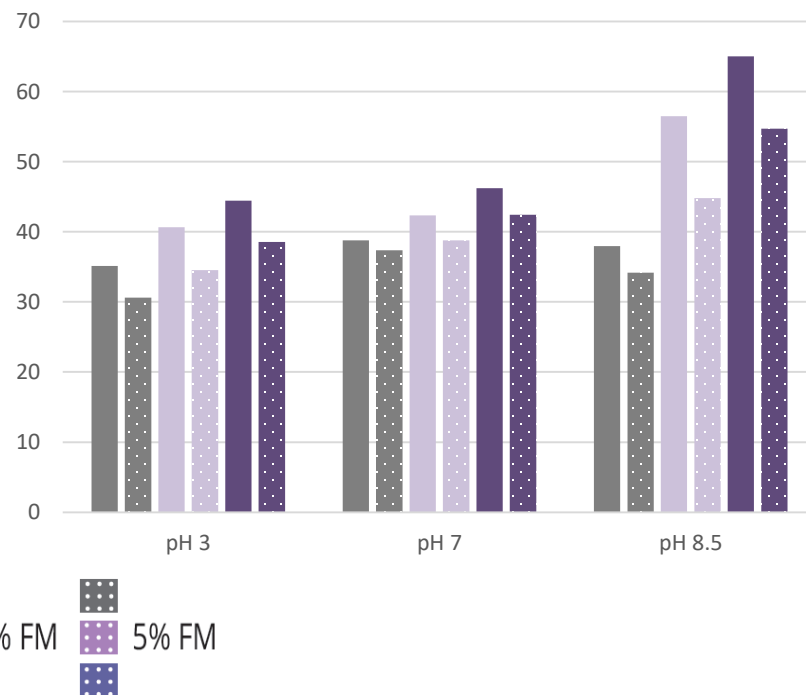
# OLMIX EXFOLIATED ALGOCLAY

## INCREASE OF TILAPIA NUTRIENT DIGESTIBILITY

**Protein digestibility**



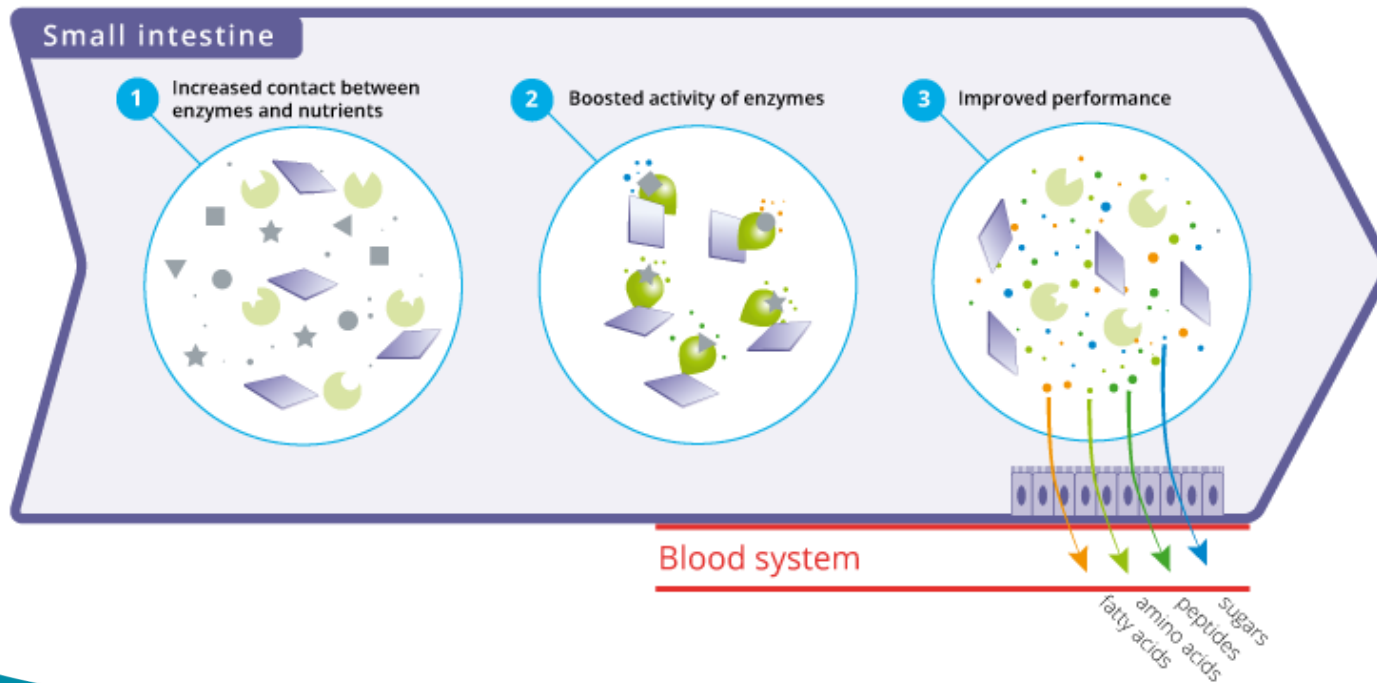
**Carbohydrate protein digestibility**



# OLMIX EXFOLIATED ALGOCLAY

## 3-STEP PROCESS

- 1- **Increased contact** between enzymes and substrate
- 2- **Increased activity and stability** of enzymes
- 3- **Better digestion and more nutrients for absorption**





# mFeed+

- 1. Support high digestible raw material replacement**
- 2. Support low energy or protein diet**

For same performance

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**Kasetsart University  
Thailand**

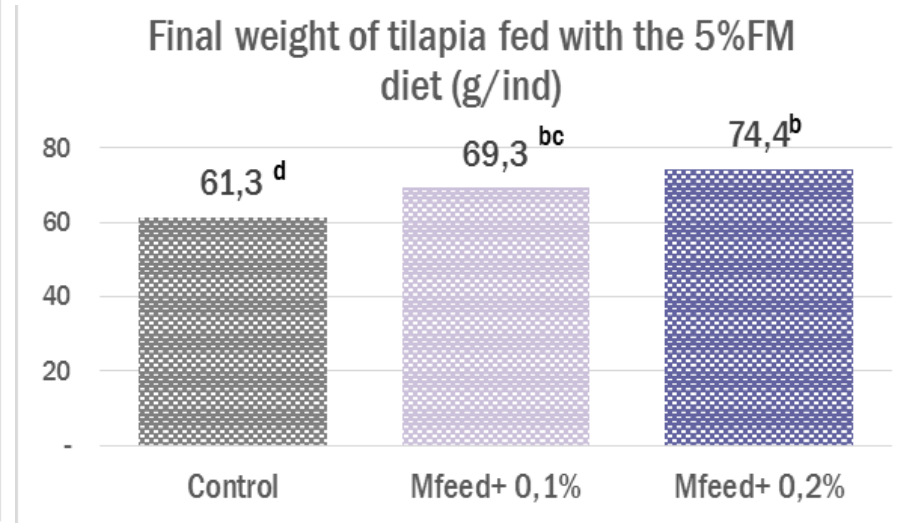
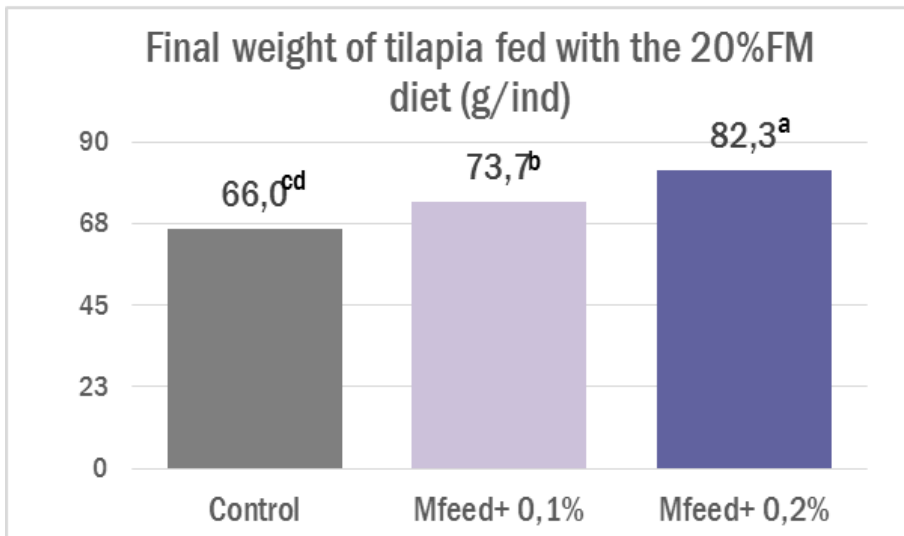


## **Support high digestible raw material replacement** Very high FM diet VS Low FM diet in Tilapia

	20% FM commercial diet	5% FM commercial diet
Control (0% MFeed+)	20% FM	5% FM
Test (0.2% MFeed+)	20% FM-MFeed+	5% FM-MFeed+

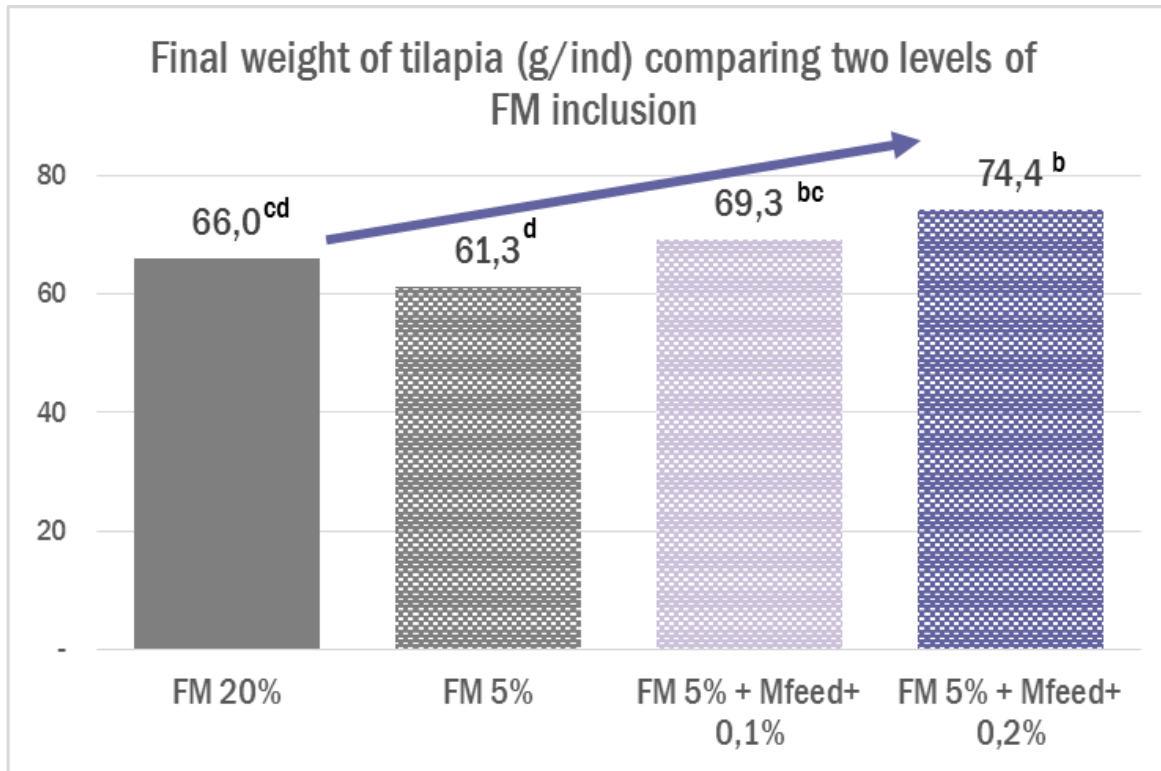
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## FIELD RESULT MFEED+ GROWTH PERFORMANCE



Growth improved using MFeed+ for both diet

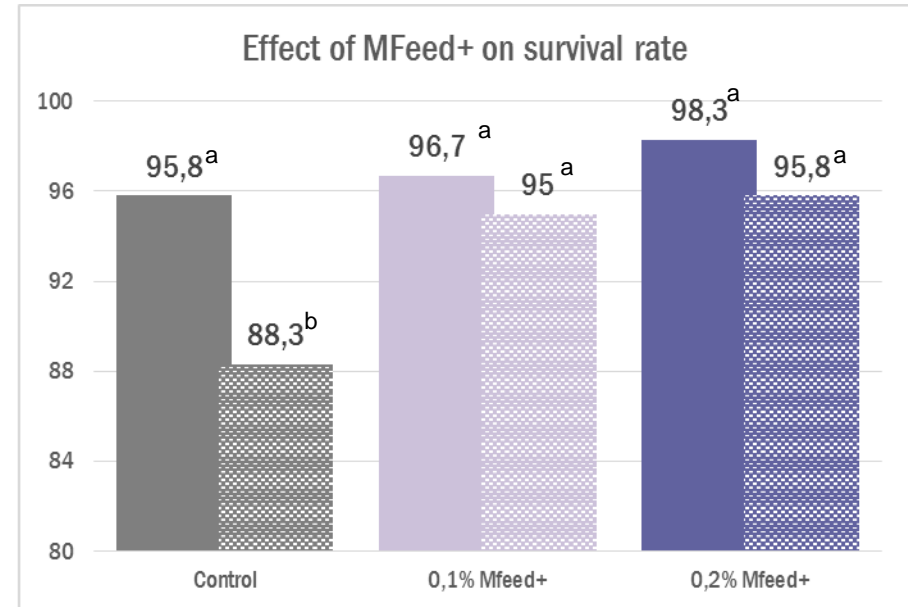
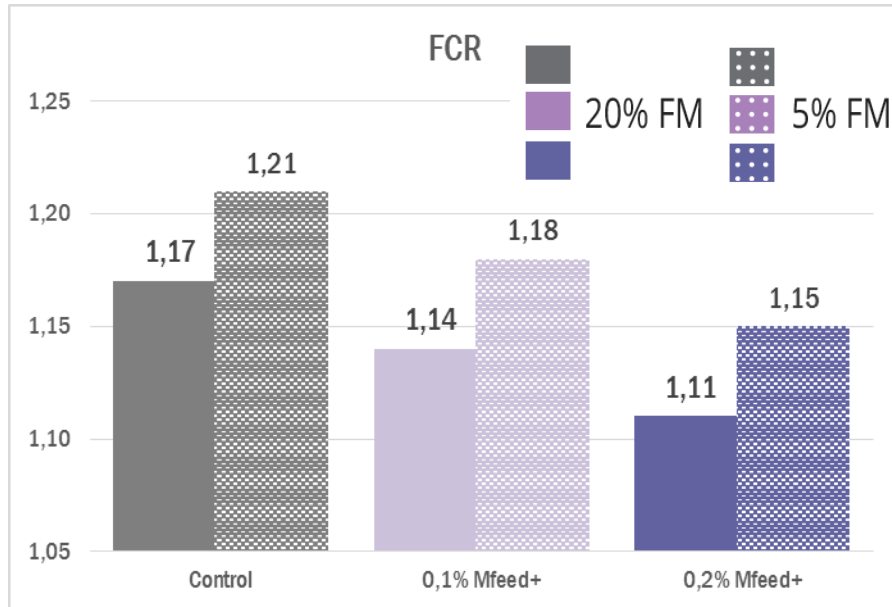
## FIELD RESULT MFEED+ GROWTH PERFORMANCE



Better performance reach with 5%FM + MFeed+ 0,2% compare to 20%FM diet ( $P < 0,001$ )



## FIELD RESULT MFEED+ HEALTH PERFORMANCE

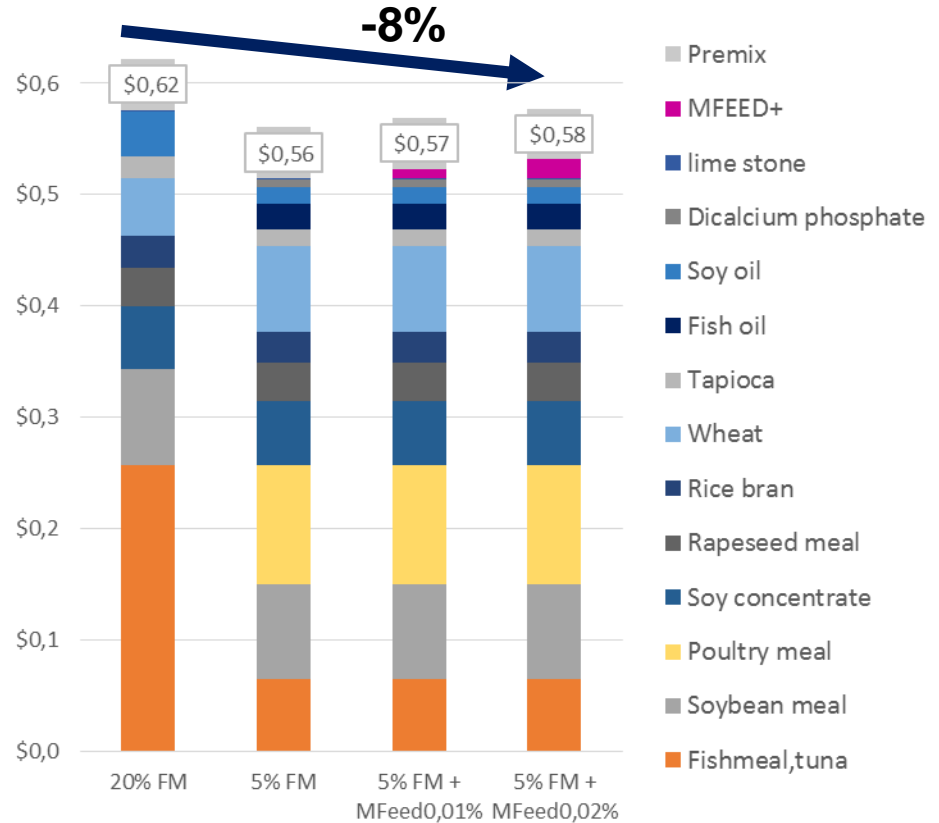


- Equal or better feed efficiency
- Using MFeed+, the survival rate for 5% or 20% FM is almost equal!

# ECONOMIC PERFORMANCES

## ECONOMIC PERFORMANCE

- Lower FM content  
→ lower formula cost
- 5% FM+ MFeed+ 0,2%  
even better performances  
than 20% FM diet!





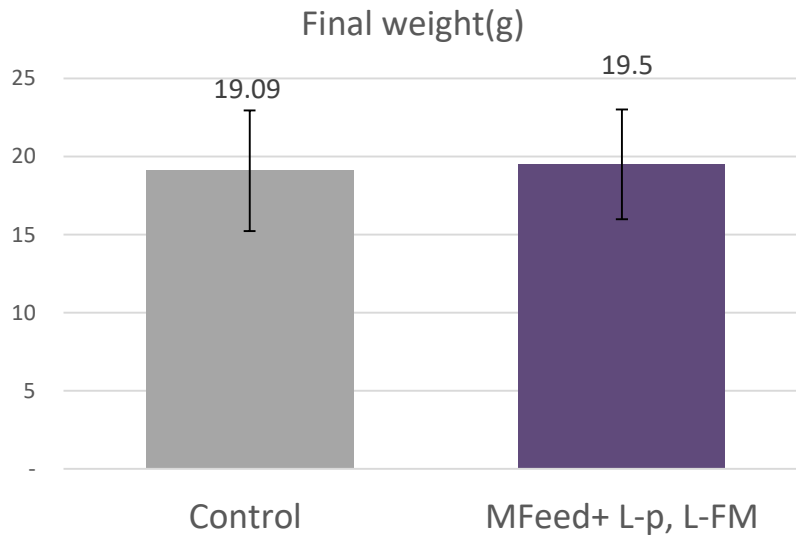
## COMMERCIAL FEEDMILL VIETNAM

**Support low energy or protein diet**  
Protein (-1%) and Low FM (-5%) in shrimp

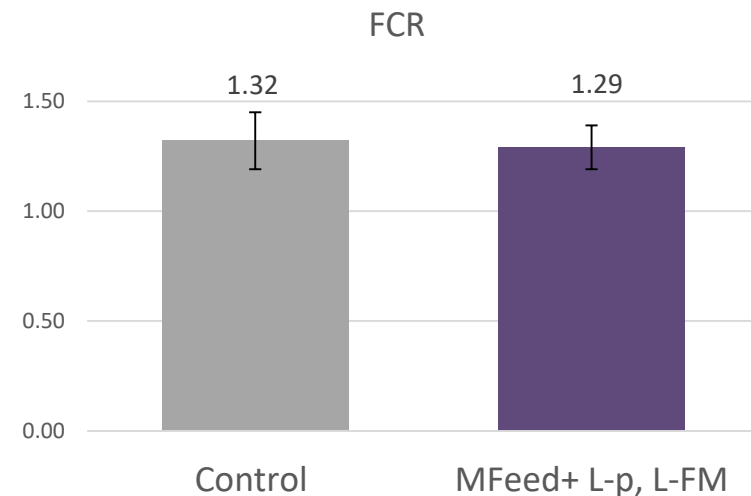
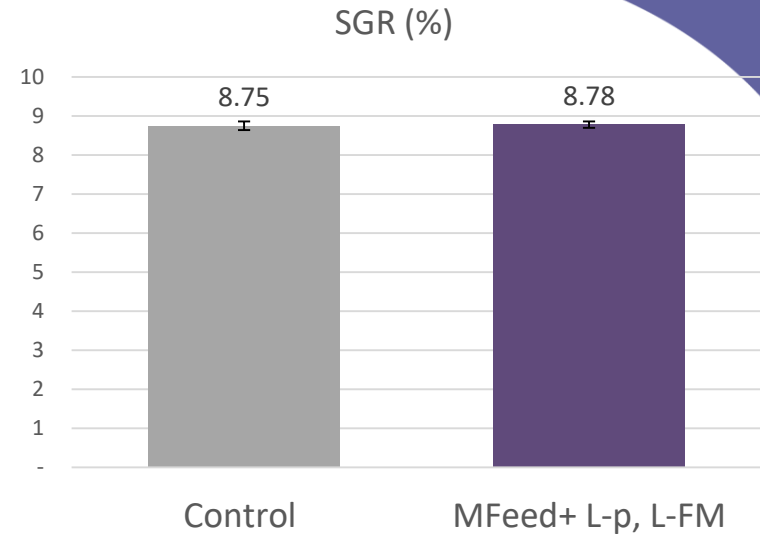


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## FIELD RESULTS MFEED+ ZOOTECNICAL PERFORMANCE



- MFeed+ diet provide same, if not better performance
- Low protein and low FM content are well balance by the use of MFeed+



## FIELD RESULT MFEED+

### CONCLUSION

- MFeed+ help to maintained same feed performance with low FM and protein content (-5%; -1%) and in case of high digestible challenge
- MFeed+ as a key additive to improve feed performance level with optimum cost effectiveness of the feed
  - ROI of 1:1,4 & -1 261 and -1 144VND/kg for shrimp
  - -8% in tilapia formulation cost

**➔ MFeed+ boosted enzymes, improved performance!**

## DOSAGE & SPECIFICATIONS

- Not pH or T°C dependent
- Heat resistant (extrusion)
- Not specific to single substrate
- Easy to use



- **Fish**
  - Grow out stages: 1-2kg/T



- **Shrimp**
  - Grow out stages: 1-2kg/T



**THANKS FOR  
YOUR  
ATTENTION**

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