DAESANG

Protam

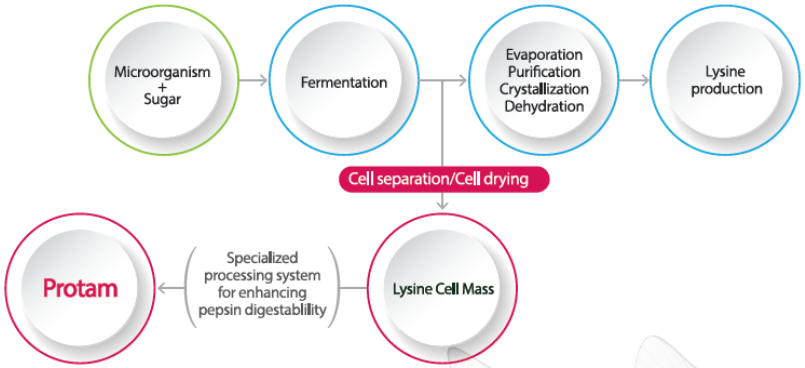
Bacterial cell mass for protein source

DAESANG Corp. Ingredient Business Unit

Bio Solution 2 Team (Feed Business)

❖ Introduction of Protam

What is Protam?



Bacterial cell mass from lysine fermentation has the great potential to be used as an alternative high protein source one of the most expensive ingredients in aqua feed.
SEWON Protam is mainly composed of dried bacterial cell mass that is produced during the manufacturing process of lysine. The availability of Protam is more efficient than lysine cell mass in terms of nutrient digestibility for aquaculture.

Applications & Functions

Aquaculture

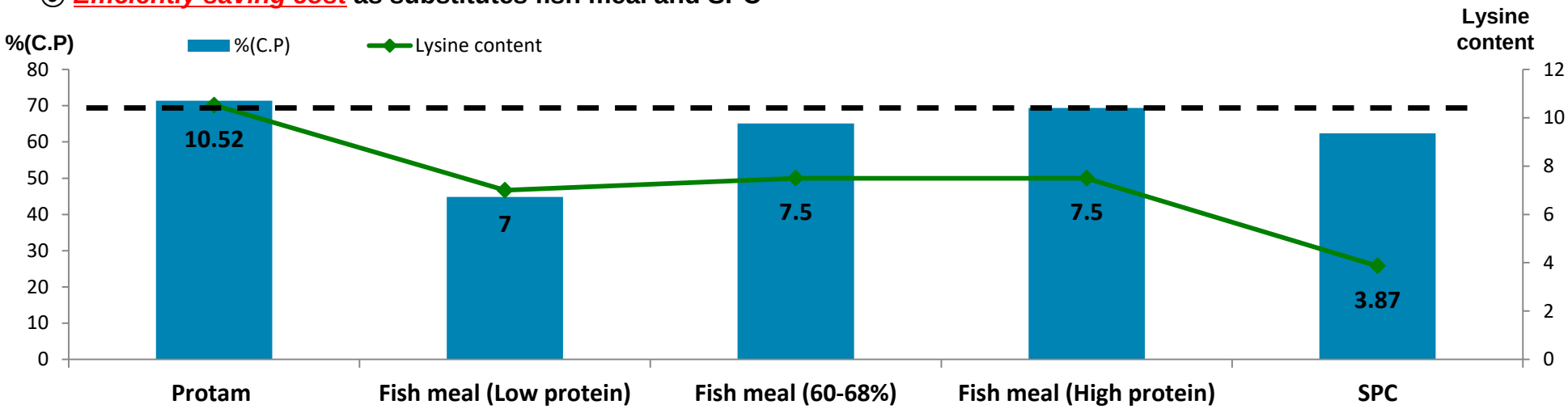
- **Alternative protein sources**: Complete or partial replacement of fish meal, Soy protein concentrate, protein source in aqua feed
- **High level protein and excellent amino acid composition** (Lysine, Methionine)
- **Applicable fish species**: Salmon, Rainbow trout, shrimp, Carp, Tilapia, Catfish, etc. fish species

Product profile

Source	*Corynebacterium glutamicum*
Country of origin	Republic of Korea
Crude protein	Min. 68.0 %
Moisture	Max. 10.0 %
Appearance	Granule type
Storage	Packaging in a cool, dry and dark area at room temperature
Shelf life	2 year from date of manufacture
Packaging	1 mt net in a bulk bag, 25kg paper bag

❖ Protam VS. Fish meal, SPC

- **Protam's Advantages**
  - ① ***High level protein & excellent amino acid composition*** **similar to high protein grade fish meal**
  - ② ***High Lysine content*** **compared to fish meal and SPC ingredient, Low ash content**
  - ③ ***Efficiently saving cost*** **as substitutes fish meal and SPC**



Content	Protam	Fish meal (Low protein)	Fish meal (60-68% protein as fed)	Fish meal (High protein)	*SPC
Application purpose (Aqua feed- protein source)	Replacement of Fish meal and SPC	Carp, Catfish feed	Whiteleg shrimp, Tilapia, Rainbow trout feed	Atlantic salmon, Rainbow trout feed	Atlantic salmon, Whiteleg shrimp, Rainbow trout feed
%(C.P)	**71.36**	44.8	65.1	69.4	62.4
CP digestibility (%) (Marine fish)	**80	***82	***87.7	***90.7	90
Apply digestion rate, %(C.P)	**57.1**	36.7	57.1	62.9	56.2
Lys contents	**10.52**	7.0	7.5	7.5	3.87
%,Ash	**3.03**	32.6	17.0	12.5	6.9

**SPC: Soy protein concentrate*

*** Source: CP digestive rate content based on swine. Our fish digestion rate test is in progress.*

**** Source: Feedipedia (Animal resources information system)*

❖ Component analysis profiles

• General analysis

Item of analysis	Unit	Protam	Fish meal (Low protein)	Fish meal (60-68% protein as fed)	Fish meal (High protein)	SPC
Moisture	%	6.07	7.5	7.8	7.9	7.3
Dry matter	%	93.93	92.5	92.2	92.1	92.7
Crude protein	%	**71.36**	44.8	65.09	69.4	62.4
Crude fat (Ether extract)	%	2.25	9.5	9.13	10.1	0.4
Crude Ash	%	3.03	32.6	17.0	12.5	6.9

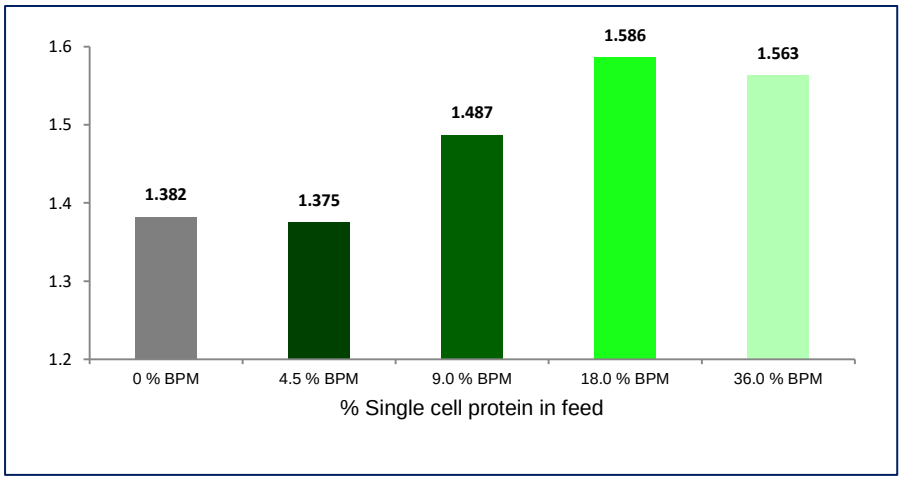
• Amino acid profiles

Amino acids	Unit	Protam	Fish meal (Low protein)	Fish meal (60-68% protein as fed)	Fish meal (High protein)	SPC
Arginine	% protein	3.14	5.2	6.2	5.8	4.59
Histidine	% protein	1.34	2.4	2.4	2.2	1.67
Lysine	% protein	**10.52**	7.0	7.5	7.5	3.87
Methionine	% protein	1.00	2.6	2.7	2.8	0.85
Threonine	% protein	2.69	4.0	4.1	4.1	2.47
Tryptophan	% protein	0.52	-	1.0	1.1	0.81
Valine	% protein	2.29	5.2	4.9	4.9	3.01

❖ Application_ Atlantic salmon

- **Fish meal substitution effect of the single cell protein on the growth performance of Atlantic salmon**
  - ➢ Growth performance improved with increasing substitutive single cell protein.

Specific growth rate (*SGR)



Formulation and chemical composition of the experimental diets

Diet *Formulation (g kg^{-1})*	0 % BPM	4.5 % BPM	9.0 % BPM	18.0 % BPM	36.0 % BPM
BioProtein	0	45	90	180	360
Fish meal	650	613	576	502	354
Wheat	142	132	123	105	68
Fish oil	205	206	207	210	215
Y_2O_3	0.1	0.1	0.1	0.1	0.1
Minerals	2.5	2.5	2.5	2.5	2.5
Vitamins	1.0	1.0	1.0	1.0	1.0

Reference :T.S. Aas et al., *Aquaculture*, **2006**, *259*, 365-376.

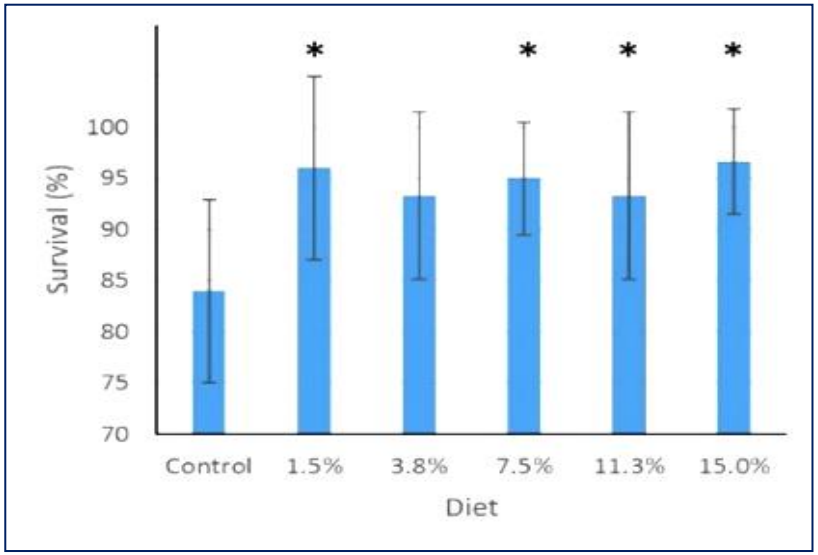
- Diets containing 0, 4.5, 9, 18 or 36 % of a bacterial protein meal (BPM) produced with methane as a carbon source, were fed for 48 days to triplicate groups of Atlantic salmon (initial weight 170 g).
- The specific growth rate in the growth and respiration trial was significantly higher in the 18 and 36% BPM groups than in the 0 % and 4.5 % BPM groups.

* Specific growth rate (SGR): 100 X [ln(Final weight) – ln(Start weight)]/ Days fed.

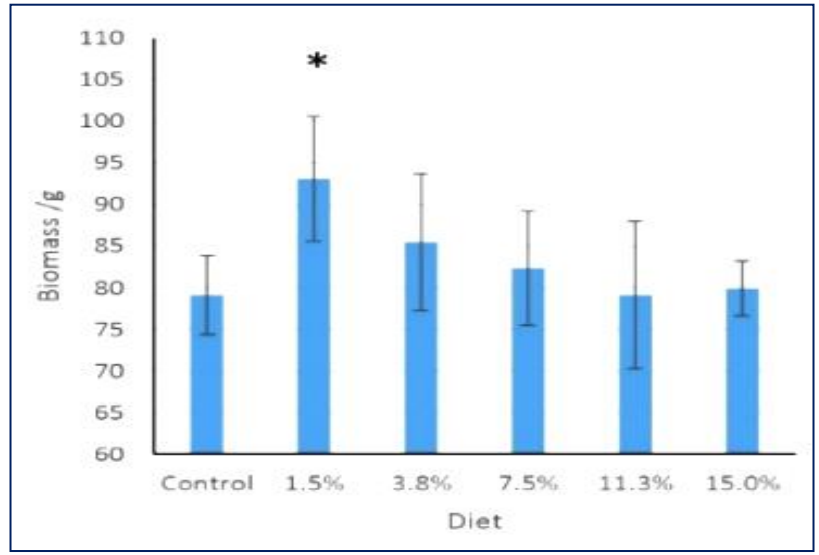
❖ Application_ Whiteleg shrimp

- **Applications of a single cell protein in the culture of Whiteleg shrimp**
  - ➢ Fish meal substitution effect on the *SCP improved survival and growth performance of shrimp

Survival (%)



Average weight gain of shrimps



Reference : January/February **2018** AQUA Culture Asia Pacific Magazine.

- Feeds comprised of control diet of 15% fishmeal and five diet of increasing concentration of SCP to replace fishmeal, at 1.5%, 3.8%, 7.5%, 11.3%, and 15% of total feed.
- Survival rate varied from 84% for the control diet to 97% for the diet with 15% group, except the 3.8% group, showing statistically significant ($p<0.05$) improvement relative to the control.
- SCP inclusion resulted in statically significant increase in aggregate shrimp weight in the 1.5% diet groups.

* SCP: Single cell protein

❖ User's manual

- **Product**: Protam
- **Product type**: *Corynebacterium* sp. based granule type
- **Usage**: Substitution of fish meal, SPC, and protein sources in aqua feed
- **Applicable fish species**: Salmon, Rainbow trout, Shrimp, Carp, Tilapia, Catfish, etc. fish species
- **Recommended amount of aqua feed**

Salmon, Trout

Stage	CP content (Feed)	Recommended dosage
Fry	56 – 60 %	2 – 10 %
Post-smolt	52 – 57 %	
Grower	50 – 55 %	
Broodstock	50 – 58 %	

Shrimp

Stage	CP content (Feed)	Recommended dosage
Larvae, Post larvae	38 – 40 %	2 – 5 %
Juvenile	35 – 38 %	2 – 4 %
Grower	32 – 36%	2 – 4 %
Broodstock	34 – 38 %	2 – 4 %

- **Advantage**

1. ***High level protein & excellent amino acid composition***
2. ***High Lysine content***
3. ***Cost saving effect***
4. ***Continuous availability***, ***Constant product specification***
5. ***Salmon***: Applicable up to 36% in feed, Growth improvement
6. ***Shrimp:*** Applicable up to 15% in feed, Improved survival rate

- ***Nutrition profile**

Nutrients	Contents
Crude protein (%)	71.36
Crude Fat (%)	2.25
Crude Ash (%)	3.03
Crude Fiber (%)	0.04
Moisture (%)	6.07
Non-protein nitrogen (%)	0.83
L-Lysine	10.52

***Nutrition profile: Protam analysis result**