Gain more with
EMPYREAL®

For more information, about EMPYREAL® 75, visit http://www.empyrealgrowth.com
or call 866.369.5498 or 402.533.4282.

Gain more with EMPYREAL® 75

When your farm thrives, you thrive. And only a consistent and naturally nutritional source can give you consistent business results with heavier and healthier harvest.

EMPYREAL® 75 is a pure, clean, highly digestible pure protein source, and high quality feed ingredient for your farm's aqua diet formulation for bigger gains.

Reel in More Value

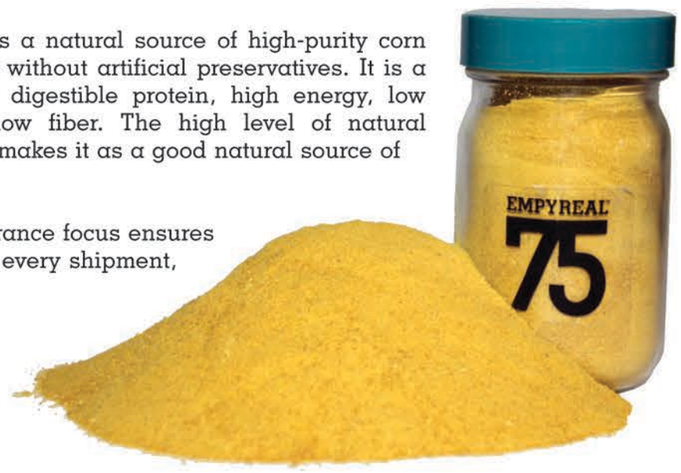
FROM GUARANTEED QUALITY

EMPYREAL® 75

A Naturally Pure Protein Source. Integrity for Every Shipment. Every Time.

EMPYREAL® 75 is a natural source of high-purity corn protein delivered without artificial preservatives. It is a source of highly digestible protein, high energy, low ash, and very low fiber. The high level of natural carotenoids also makes it as a good natural source of antioxidants.

Our quality assurance focus ensures product integrity, every shipment, every time.



Food Safety System Certification 22000

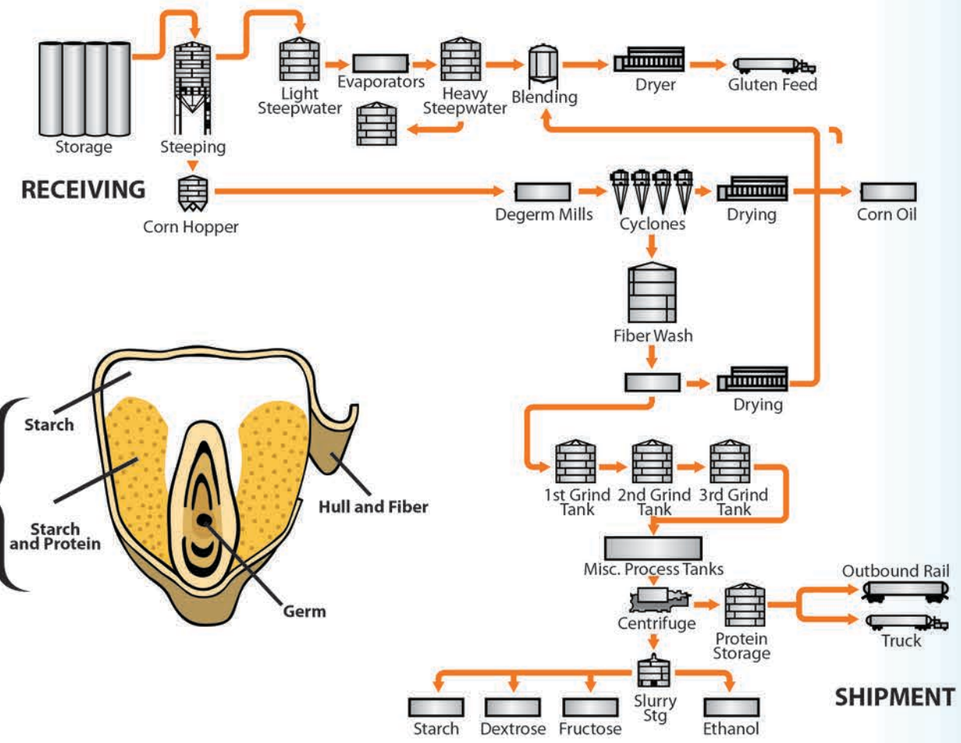
Cargill® is the first animal food facility in the US to get FSSC 22000 certification for the manufacturing process of its EMPYREAL® animal food ingredient product at its Blair, Neb., and Dayton, Ohio facilities as certified by Lloyd's Registry Quality Assurance. The new certification validates that Cargill®'s robust food safety management system meets the safety and quality requirements of major branded feed companies worldwide. In addition to this certification, EMPYREAL® production facilities are Occupational Safety and Health Administration, Voluntary Protection Programs (OSHA VPP) - and International Organization for Standardization (ISO) 22000- certified.

PRODUCTION TECHNOLOGY

EMPYREAL® 75 is produced in Cargill facilities in the United States and meet all applicable U.S. Federal and State regulations for animal food. EMPYREAL® 75 is produced in accordance with current good manufacturing practices for animal HACCP, quality, food safety, and prerequisite programs. Certificates: Kosher, Halal, Food Safety Systems Certification 22000.

Corn Protein Concentrate is the dried proteinaceous fraction of the corn primarily originating from the endosperm after removal of the majority of the non-protein components by enzymatic solubilization of the protein stream obtained from the wet-mill process. This proteinaceous fraction of the corn must contain not less than 80% protein on a moisture-free basis and not more than 1% starch on a moisture-free basis.

Shelf life: up to 18 months from manufactured date. Evaluate for fitness of use after 12 months.



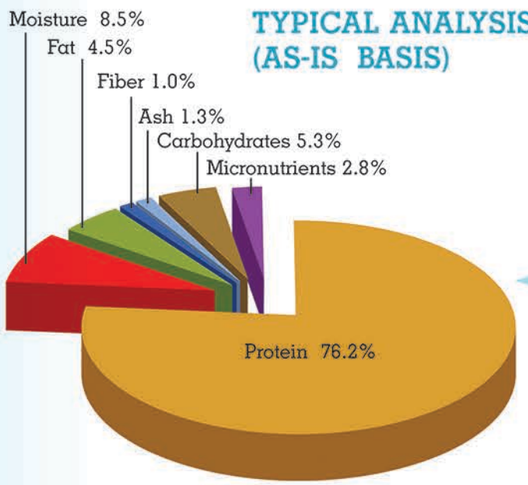
Protein Millstream | Starch Extraction | Heating & Washing | Filtration & Washing | Flash Dry

EMPYREAL® 75

EXCELLENT SOURCE OF CONCENTRATED PROTEIN AQUA DIETS

- Consistent integrity value
- Highly digestible amino acid
- High energy input
- High natural antioxidants
- Low anti-nutrition factors
- Low ash and fiber

Specification



TYPICAL ANALYSIS (AS-IS BASIS)

Protein	76.2%
Fat, Acid hydrolysis	4.5%
Crude fiber	1.0%
TDF	5.0%
Moisture	8.5%
Ash	1.3%
Carbohydrates	5.3%
Density, ib/cu ft	36-39
Omega-6 (Linoleic acid)	2.55%

Nutritional Information

1. Amino Acid Profile

Amino acid	As-is %	% Protein
Alanine	6.17	8.16
Arginine	2.28	3.02
Aspartic acid	4.24	5.62
Cysteine	1.15	1.52
Glutamine (Glutamic acid)	*15.29*	*20.26*
Glycine	1.79	2.37
Histidine	*1.55*	*2.06*
Isoleucine	3.06	4.06
Leucine	12.63	16.73
Lysine	1.08	1.43
Methionine	*1.70*	*2.29*
Phenylalanine	4.65	6.16
Proline	6.68	8.84
Serine	3.47	4.60
Threonine	2.25	2.98
Tryptophan	0.32	0.42
Tyrosine	3.95	5.24
Valine	3.36	4.45

2. Fat and Fatty Acids (average of different samples)

Fat and Fatty Acids	Concentration (%)
Fat	**4.81**
Fatty acids	
16:0 (Palmitic)	0.67
18:0 (Stearic)	0.10
Total 18:1	1.20
Total 18:2	2.61
Total 18:3	0.12
Total saturated fat	0.85
Total monounsaturated fat	1.22
Total polyunsaturated fat	2.73
Fatty acids in total fat (%)	
16:0 (Palmitic)	13.99
18:0 (Stearic)	2.08
Total 18:1	24.86
Total 18:2	54.29
Total saturated fat	17.73
Total monounsaturated fat	25.41
Total polyunsaturated fat	56.72

3. Vitamins, Carotenoids and Minerals

Vitamin	mg/kg
Vit A (Retinol)	13.4
Choline	190
Niacin	46.9
Pantothenic acid	1.88
Pyridoxine (B6)	5.45
Riboflavin (B2)	2.73
Thiamine (B1)	0.41
Biotin	0.18
Inositol	1604

Carotenoids/ Antioxidants (ppm)	mg/kg
Cis-Lutein	35-55
Trans-Lutein	90-150
Cis-Zeaxanthin	20-35
Trans-Zeaxanthin	90-120
Alpha-Cryptoxanthin	20-28
Beta-Cryptoxanthin	10-16
Alpha-Carotenoids	2-4
Beta-Carotenoids	15-25

Minerals	Concentration
Calcium	0.05 %
Potassium	0.15 %
Phosphorus	0.24 %
Magnesium	0.05 %
Chloride	0.29 %
Sulfur	0.95 %
Sodium	0.25 %
Iron	73.6 ppm
Zinc	47.9 ppm
Manganese	4.3 ppm
Copper	11.1 ppm
Chromium	0.00 ppm
Molybdenum	0.74 ppm
Selenium	1.97 ppm
Iodine	< 5 ppm

4. Antioxidants and Mycotoxins

Carotenoids

- Are positively nutritional factors.
- Provide antioxidant stability to polyunsaturated fats.

Antioxidant	Concentration
Vit E	28.3 UI/kg
Xanthophyllis	287 ppm
Lutein	130 ppm
Beta-Carotene	36.7 ppm

Carotenoid	U/100mg
Total Beta-Carotene	4680
Total Carotenes	5235
Alpha-Carotene	354
Trans-Beta-Carotene	3485
Cis-Beta-Carotene	1196

Mycotoxins

- Not concentrated in EMPYREAL® 75.
- Technology implemented to significantly reduce aflatoxin, fumonisin and DON levels. Ongoing research to identify and implement technologies to reduce zearalenone.

Values of mycotoxins in the EMPYREAL® 75 are guaranteed and targets as bellows:

Aflatoxin:	Guarantee < 20 ppb	Target < 10 ppb
Fumonisin:	Guarantee < 10 ppm	Target < 5 ppm
Vomitoxin (DON):	Guarantee < 2 ppm	Target: non-detectable
Zearalenone:		Target < 500 ppb
Ochratoxin:		Target: non-detectable
T2:		Target: non-detectable

5. Anti-nutrition factors

The enzymatic solubilization technology is applied during the production of EMPYREAL® 75 to wash out majority of non-protein components that also wash out majority of anti-nutrition factors. The anti-nutrition factors that have been concerned in aqua animals are in the following list:

1. Oilseed anti-nutritionfactors
2. Dietary fiber components
3. Phytic acids.
4. Fungal/microbial metabolites

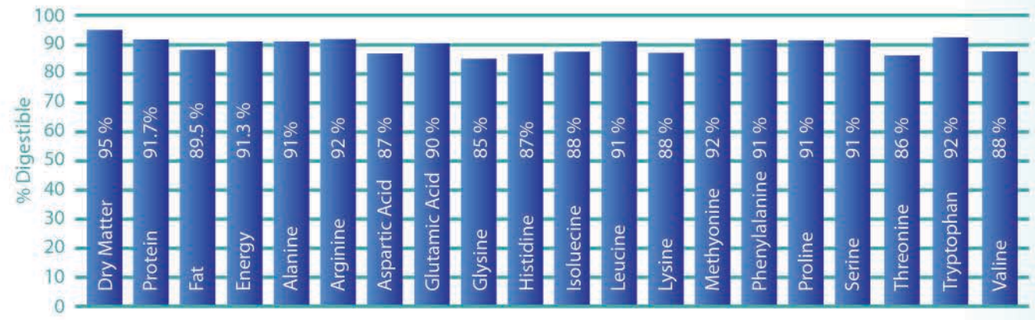
Lignin, lectins, Glycinin, Beta-Conglycinin (the fiber components) and phytic acid are the most concerned anti-nutrition factors in the aqua and livestock feeds.

Antigens	EMPYREAL® 75	SBM	Fermented SBM
Glycinin (ppm)	Non-detectable	+	2000-30000
Beta-Conglycinin (ppm)	Non-detectable	+	20-3000
Lectin (ppm)	Non-detectable	+	4-25

6. Digestible energy and digestible amino acids for aquatic species

The aquatic species (fish and shrimp) could apply the following digestible energy values depending on the species (carnivorous or omnivorous species).

Digestible energy and digestible amino acids for aquatic species



AMINO ACIDS

Digestible Energy (DE) for omnivorous fish: 4,324 Kcal/kg
Digestible Energy (DE) for carnivorous fish/shrimp: 4,678 Kcal/kg

TARGET SPECIES AND RECOMMENDED INCLUSION

As highly concentrated protein, the Empyreal 75 is targeted to carnivorous species for high inclusions with purpose of reduction of fishmeal. However, for omnivorous species, the addition of Empyreal 75 in their diet to reduce SBM or replace corn gluten meal would bring more value in term of FCR reduction and better ADG.

Trout:	Un-pigment up to 8% or Pigment up to 12%
Salmon:	Up to 20%
Shrimp:	Up to 15%
Seabass/Barramundi:	10% - 20%.
Snakehead:	5% - 9%.
Tilapia/Milk fish:	3% - 5%.
Pangasius fingerling:	3% - 5%
Clarias catfish:	10% - 15%

Harvest the Advantage

of Pure Protein

EMPYREAL® 75 - AAFCO 48.49 Corn Protein Concentrate
Corn Protein Concentrate is the dried proteinaceous fraction of the corn primarily originating from the endosperm after removal of the majority of the non-protein components.

This proteinaceous fraction of the corn must contain not less than 80% protein on a moisture-free basis and not more than 1% starch on a moisture-free basis.

PHYSICAL ADVANTAGES

1. Fine particle size

Majority of the EMPYREAL® 75's particle size (mostly 85%) are passing the 80 mesh (250 μm). EMPYREAL® 75 has superior extrusion functionality over high protein corn ingredients with finer and more uniform cell structure at comparable extruder setup and specific mechanical energy. Better incorporating and intermixing with other ingredients leads to less fines loss due to non-incorporated particles. The fine particles are not only improves the mixing efficiency, reduce fines of the pellets but also improve the digestibility and water stability of the pellets.

Typical Particle Size Distribution

	Retained on US Standard Sieve							
Sieve Size	12	16	20	35	60	80	170	170 throughs
Typical % Overs	0.9	2.6	5.1	13	23.6	15.7	26.6	12.3

2. High oil binding capability

Its oil binding and adsorption make it a very desirable ingredient for any diet in which high amount of fat/oil are required (e.g. marine fish diets) and/or in those pelletized feeds requires adding oil in the mixer (e.g. shrimp feeds) will be benefitial for better mixing and less fines in the final products.

Percentage of corn oil bound (OBI) and absorbed (OAI) by the CPC

OBI (%)	OAI (%)
236	103

3. Low water solubility

Water solubility is only 2% at 25°C that indicates EMPYREAL® 75 is very good water stability ingredient that reduce nutrient leaching from the pellet when adding EMPYREAL® 75 to the diets.

NUTRIENT ADVANTAGES

1. High digestible amino acids, especially Methionine and Glutamine

High Methionine and high Methionine + Cysteine makes EMPYREAL® 75 as an excellent source of amino acid balance as the other ingredients are naturally high in lysine but low in Methionine.

Comparison of the EMPYREAL® 75 to the key vegetable protein raw materials and white fishmeal

Nutrients	EMPYREAL® 75	Soybean meal, solven	Soy Protein Concentrates	Corn DDGS	Fishmeal (general)
Crude Protein (%)	76.2	44	63.0	27	62
Crude Fat (%)	4.5	1.5	0.5	9.3	7.8
Crude Fiber (%)	1.0	7.3	4.5	9.1	0.8
Ash (%)	1.3	6.3	-	6.4	21.3
Essential amino acid (%)					
Lysine	1.08	2.24	3.93	0.90	4.35
Methionine	1.70	0.70	0.81	0.51	1.68
Threonine	2.25	2.00	2.47	0.92	
Leucine	12.63	3.80	4.92	2.80	4.36
Isoleucine	3.06	2.60	2.94	1.0	2.72
Phenylalanine	4.65	2.70	3.28	1.20	2.28
Tryptophan	0.32	0.70	0.84	0.20	0.67
Valine	3.36	2.70	3.06	1.33	3.02
Histidine	1.55	1.30	1.58	0.65	1.34
Arginine	2.28	3.60	4.64	1.10	4.02
Methionine + Cysteine	2.85	1.41	1.70	0.82	2.43
Glutamine/Glutamic acid	15.29	-	-	-	-

High glutamine and leucine bring health benefits as glutamine and leucine involve in several health functions (antioxidant defense, ammonia detoxification, cell signaling, gut development, immunity, and stress responses) and also the palatability (glutamine/glutamic acid).

2. High energy protein source

DE for omnivorous fish: 4,324 Kcal/kg.
DE for carnivorous fish/shrimp: 4,678 Kcal/kg.

3. Less anti-nutrition factors

With the enzyme technology to wash out majority of non-protein components (fiber and starch) that also wash out majority of the anti-nutrition factors before the natural and pure protein from corn is concentrated as in EMPYREAL® 75.

Catch More Benefits

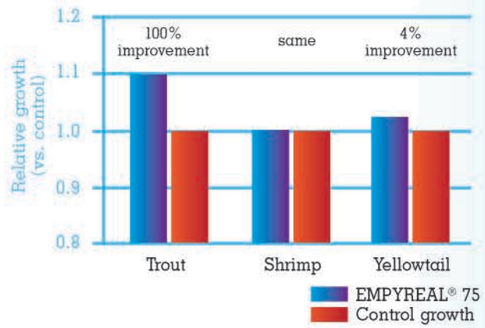
of using EMPYREAL® 75 in the feed formula

Pure and natural protein concentrate	Excellent protein for fishmeal replacement
Digestible amino acids & high energy	Better animal growth & lower FCR
High methionine	Good source for balancing amino acids with other ingredients
High glutamine and leucine	Palatability and health improvements
High natural antioxidants	Protect fatty acids in diets and enhance animal stress resistance
Less anti-nutrition factors	Reduce negative impact on animal health and growth
Low fiber and ash	Better digestibility
High oil binding & fine particle size	Better pellet quality: less fines & better water stability

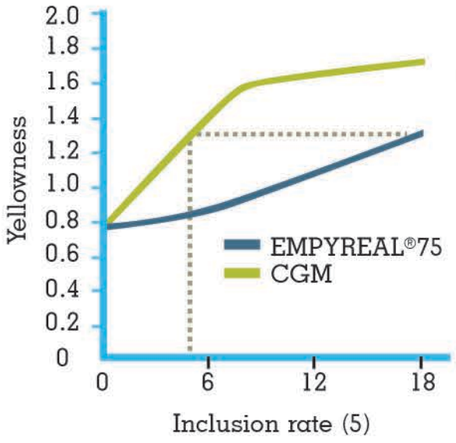
Research Findings and Trials on Aqua Species

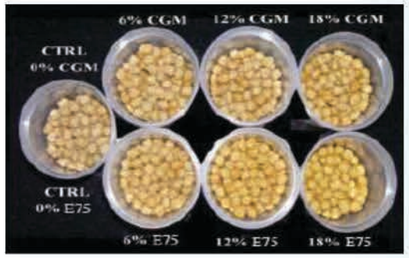
Method:
- Replace fishmeal up to 55% in target species diets.
- Evaluation of growth and pigment impact.

Results:
- Similar to better result when compared to control diets.
- Pigment impact on flesh is lower than Corn Gluten meal (in Tilapia).
- We have not seen any pigment impact on flesh in marine species (yellow tail, cobia).
- Empyreal® 75 is effective replacement for significant amount of fishmeal in the diets.



TILAPIA





Ealuation of the pigment impact on Tilapia flesh for IMPERIAL® 75 and CGM

Atlantic Salmon *(Salmo salar)*

EMPYREAL® 75 & LYSTO™ evaluation on Atlantic Salmon (Salmo salar). Growth digestibility trials*
Composition of Reference Diet for Growth and Digestibility Studies, in percentage.

Ingredients	Control	E75 1	E75 2	Lysto
Poultry meal, IDF	27.5	17.7	17.7	17.7
Fish oil, Menhaden	21.0	22.0	22.0	22.0
Fishmeal, Menhaden	20.0	20.0	20.0	20.0
Wheat flour	15.0	15.0	15.0	15.0
Corn protein concentrate	0	15.0	15.0	0
CPC Lysto	0	0	0	15.0
Soy protein concentrate	9.4	4.3	4.3	5.0
Wheat protein meal	5.0	3.2	3.2	3.2
Vitamin premix ARS 720	1.0	1.0	1.0	1.0
Lysine-HCI	0	0.7	0.7	0
Choline chloride	0.6	0.6	0.6	0.6
Vitamin C (Stay-C)	0.2	0.2	0.2	0.2
Trace mineral premix	0.1	0.1	0.1	0.1
Astaxanthin	0.1	0.1	0.1	0.1
Yttrium oxide	0.1	0.1	0.1	0.1
Analysis, calculated	-	-	-	-
Crude protein	45.6	45.3	45.3	45.6
Crude lipid	28.2	27.6	27.6	27.9

*USDA ARS National Cold Water Marine Aquaculture Center, Franklin, ME

Results from growth trial: average final weight (g), average weight gain (g), percent increase in weight, average specific growth rate (SGR), average feed conversion ratio (FCR) and average final number of fish (no significant statistical differences found).

Diet	Ave Final weight (g)	Ave Final gain (g)	Percent increase	Avg SGR	Avg FCR	Avg No. of fish
Reference	610.50	401.87	192.63	0.89	1.04	18.0
E75 1	617.29	409.03	196.38	0.90	1.01	18.0
E75 2	591.81	382.68	182.99	0.86	1.07	18.0
LYSTO	605.86	397.70	191.06	0.88	1.08	17.25
Grand Total	604.00	395.44	189.23	0.88	1.06	17.78
P-value	0.8235	0.8127	0.7373	0.7852	0.4059	-

Diet Digestibility in Salmon

Diet	Organic matter	Dry matter	Protein	Energy	Lipid
Reference	86.95	77.29	91.70	87.71	94.97
E75 1	86.40	76.79	91.35	86.25	94.98
E75 2	86.59	76.26	91.15	86.98	95.96
LYSTO	87.12	78.26	91.45	87.60	96.18
P-value	0.94	0.78	0.82	0.58	0.79

Shrimp *(Penaeus vannamei)*

At inclusion of Empyreal® 75 of 0, 4, 8, 12%

Ingredients composition (g 100g^{1} of feed) of commercially produced open feed formulations and proximate analysis. Diets were using L. vannamei growing with initial weight of 0.023 g, stocked in production ponds (0.1ha) at the rate of 38 shrimp m^{-2}. Using standard production practices as described by (Amaya et al. 2007a).

Ingredients	E75 0	E75 4	E75 8	E75 12
Soybean meal	46.69	46.63	46.48	46.32
Milo	26.20	26.31	26.48	26.67
Menhaden fish meal	15.00	9.99	5.00	-
EMPYREAL®75	-	4.00	8.00	12.00
Squid meal	2.00	2.00	2.00	2.00
Menhaden fish oil (sprayed)	4.58	4.86	5.15	5.45
Soy lecithin	1.00	1.00	1.00	1.00
Vitamin premix	0.33	0.33	0.33	0.33
Trace mineral premix	0.52	0.52	0.52	0.52
Stay C 350 mg/kg (35%)	0.02	0.02	0.02	0.02
Calcium Phosphate Dibasic	2.00	2.68	3.36	4.03
Copper Sulfate	0.01	0.01	0.01	0.01
Bentonite	1.50	1.50	1.50	1.50
Mold Inhibitor	0.15	0.15	0.15	0.15
Crude Protein	36.38	36.61	36.48	37.68
Crude Fat	10.28	10.47	13.52	12.91
Moisture	7.62	7.89	5.15	3.79
Crude Fiber	2.22	2.18	2.03	2.17
Ash	10.76	9.60	8.95	8.83

Growth performance of Pacific white shrimp cultured after 16 weeks, with an average initial weight of 0.023 ± 0.002g.

	Final Weight (g)	Yield (kg/ha)	Survival (%)	FCR	Production Value ($)	Feed Cost ($)	Feed $/Kg Shrimp
E75 0	20.51^{a}	5007.8^{a}	64.92^{a}	1.38^{a}	2106.72^{a}	791.41^{a}	1.60^{a}
E75 4	17.48^{a}	519.00^{a}	77.58^{a}	1.34^{a}	1808.40^{a}	715.69^{b}	1.39^{ab}
E75 8	17.17^{a}	5420.5^{a}	83.60^{a}	1.27^{a}	1844.05^{a}	651.31^{c}	1.20^{b}
E75 12	18.71^{a}	5440.1^{a}	75.91^{a}	1.29^{a}	2018.08^{a}	598.16^{d}	1.11^{b}
PSE	0.5289	117.3565	2.3024	0.03487	65.2261	4.0777	0.0369
P-value	0.2112	0.5601	0.1423	0.6898	0.3727	< 0.0001	0.0049

These results demonstrate that the use of alternative feed formulations such as EMPYREAL® 75 results in reduced feed cost but also reduced production costs. Hence, the use of EMPYREAL® 75 is an alternative protein source should be encouraged.

In general, high level of EMPYREAL® 75 inclusions in shrimp feed, with the absence of expensive fish meal, are viable when essential nutrients in the diet are properly balanced to meet nutrient requirement of the shrimp.

Yellow tail (Seriola lalandi)

A 12-week growth trial (December 15, 2010 until March 9, 1011) was run with 4 diets and 100 animal per test diet

Composition of practical diet (As-is Basis)

Ingredients	Diet 1	Diet 2	Diet 3	Diet 4
Fishmeal	60	-	21.5	-
EMPYREAL®75	-	55	-	40
High Pro DDG	-	-	60	40
Soybean meal	28.5	25	-	-
Tapioca Alpha Starch	10	10	10	10
Taurine	-	3	3	3
L-Lysine	-	2.5	1.5	2.5
DL-Methionine	-	0.5	0.5	0.5
Calcium Phosphate	-	2.5	2	2.5
Vitamins	1	1	1	1
Minerals	0.5	0.5	0.5	0.5
Total	100	100	100	100

** Allen Davis, HUBS Sea World, California.*

Product results for the 12-week trial

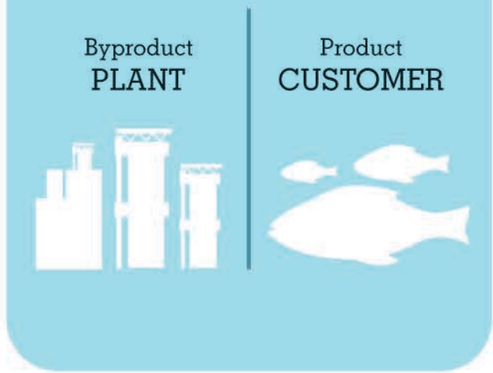
Treatment	Initial Mean Weight (g)	Final Mean Weight (g)	Final Biomass (g)	Mean Weight Gain (g)	Survival (%)	FCR
1	328	451	451	45,100	100	5.7
2	321	421.2	421.2	41,698.8	99	5.5
3	318	378	378	37,800	100	.8
4	320	368.2	368.2	36,450	99	9.9

Fillet pigment deposition comparison in treatments 1 through 4 (top to bottom).

EMPYREAL® 75 is a product, not a commodity.

Customer-focused Innovation

Converting knowledge and insight into new producs and services that create distinctive value and profitable growth for our customers.



Commodities	VS	Products
Manufacturing		
Common/Standard		Unique/Specialized
Few grades/versions		many grades/versions
Low cost critical		Cost-optimized
Customer responsible for quality and availability		Manufacturer responsible for quality and availability
Do what is required		Do what is desired
Supply Chain/Logistics		
Ship when you have		Ship when it's needed
Common carriers		Dedicated carriers
Lowest cost shipment		Cost-optimized shipping
Customer responsible for quality and availability		Manufacturer responsible for quality and availability
Take advantage of "opportunities"		Pass on "opportunities"
Sales/Merchandising		
All same, trade		Require explaining/selling
Swap/buy in		Build to demand
Price, all market will pay		Price function of value
Discounts for problems		Replace, never discount
My turn, I win		Long term, win:win

Consistency

- EMPYREAL® 75 is manufactured utilizing the same technology at all production sites.
- Extreme care is taken to ensure that every lot is the same on every occasion.
- CGM is manufactured in a number of different plants, in a number of different countries, operated by a number of different companies utilizing a variety of different technologies - meaning that product consistency is not typical.
- Nutrient composition, color, particle sizee and other physical characteristics are far more consistent in EMPYREAL® 75 than in CGM.