PROCESSED ANIMAL PROTEINS FOR FISH FEED

POULTRY MEAL 65 | PORC MEAL 58 | PORC MEAL 65

A HIGH PROTEIN ALTERNATIVE FOR FISH MEAL

As a result of the scarceness of fish meal there is a growing interest to replace fish meal with other protein sources. Vegetable protein sources are widely available but the replacement of fish meal by those vegetable proteins is limited in some aquatic species. Use of high levels of vegetable protein sources is constraint because of an unbalanced amino acid profile, lower digestibility of amino acids, high fiber content, presence of anti-nutritional factors, and low availability of Phosphorus. Processed Animal Proteins (PAPs) are a valuable source of proteins and should be considered as alternative or supplementary protein source in those diets.

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DARLING INGREDIENTS

ANIMAL PROTEIN USE IN THE EU

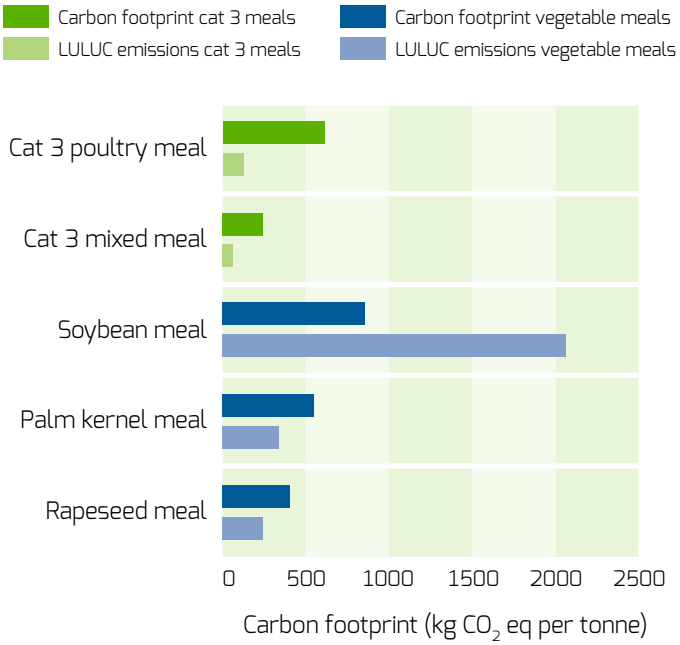
Since the BSE crisis in late 2001 in the EU, Processed Animal Proteins were banned from utilization in feeds for aquaculture and livestock. The re-introduction of PAP into European aqua feeds in 2013, helps the aquaculture in Europa to solve part of the raw material challenges.

SUSTAINABILITY

The use of PAPs considerably reduces the carbon footprint of aqua feeds, since these protein sources are locally available and partially substitutes imported soybean meal from the Americas and fish meal from Peru and Chili.

The carbon footprint of PAP is much lower than vegetable meal's footprints. The emissions related to land use and land use change (LULUC) are higher for the vegetable meals.
The carbon footprint of poultry meal comes mainly from the production of the by-products (based on a distribution according to economic value of meat and by-products), plus energy for transporting the by-products and drying of the material.

Carbon footprints of poultry meal and mixed meal and 3 vegetable meals per tonne of products



Ponsioen & Blonk, 2010

Aquaculture is often criticized for using more fish than producing fish (FIFO>1). The use of PAP lowers the FIFO.

Apart from sustainability, there are the following nutritional reasons why PAPs are the first protein sources to be used to replace fish meal.

HIGH PROTEIN AND AMINO ACID CONTENT

Table of composition of poultry meal and porc meal in comparison with the requirement of gilthead seabream, rainbow trout and salmon

	Content			Requirements	
	Poultry meal 63	**Porc meal 58**	**Porc meal 65**	**Salmo-nids**	**Gilthead Seabream**
Crude protein	63	58	65	35-45	38-46
Amino acids (in % of protein content)					
Arginine	6,7	4,7	7,1	3,3-5,1	5.0
Histidine	1,8	1,9	2	1,6-1,8	-
Isoleucine	3,5	2	3,1	2,0-2.3	-
Leucine	6,3	5,7	6,3	3,6-4.0	-
Valine	4,9	3,3	4,3	2.9-5,3	-
Lysine	5,7	4,1	6	4.0-5,0	5.0
Phenyla-lanine	3,6	2,5	3,5	4,1-5,3	-
Meth+Cyst	3	2,2	2,3	2,4-4,0	4.0
Threonine	3,6	1,9	3,5	1,8-2,2	-
Tryptophan	0,9	-	-	0,5-1.4	0.6

PAPs are rich in most essential amino acids except methionine. They are particularly high in Arginine and other water soluble amino acids (Proline, Glycine, and Glutamic acid), which act as attractant and palatant in aqua feeds.

DIGESTIBLE PROTEINS

Overview of digestibility coefficients observed for rainbow trout and gilthead seabream compared to other protein sources

	Rainbow Trout (in vivo)		Gilthead seabream (in vivo)	
	Average Digestibility Coefficient (ADC)	**Apparent Digestibility of Proteins (ADP)**	**Average Digestibility Coefficient (ADC)**	**Apparent Digestibility of Proteins (ADP)**
LT Fish meal	72,6	90,5	71,8	87,5
Porc meal	55,9-72	83-89	-	35-79
Poultry meal	59,8-77	83-91	-	80-89,9
Soybean meal	29,5-75,3	95,9	-	86-90,9
Soy Protein Concentrate	53,2	90,4	-	-

Digestibility varies a lot between different PAPs and is affected by quality of raw materials before drying and drying method. Good quality PAPs show digestibility levels which are as high as the highest quality fish meals. See next table.

Table 3: different sources of poultry by-product meal can vary in digestibility

	Digestibility (in vivo)		PH stat trout (DH%)		Digestibility Mink (in vivo)
	Boisen (%)	**Pepsin (%)**	**stomach enzymes**	**intestine enzymes**	**Protein digestibility**
Sonac High Quality (HQ)	92	93	8,16	6,85	80
Sonac Standard Quality (SQ)	89	88	6,97	5,48	70
German poultry by-product meal	82	88	3,48	5,21	75
French poultry by-product meal	87	88	5	5,65	73

PARTIALLY SOLUBLE PROTEINS

Both fish meal and PAPs contain important amounts of water soluble proteins, in the form of peptides or longer chains. These water soluble proteins are highly digestible, but also will improve the attractability and palatability of aqua feeds. Highly digestible protein sources are essential in formulating larval and starter diets for fish. Palatability of diets becomes increasingly important when vegetable proteins replace fish meal.

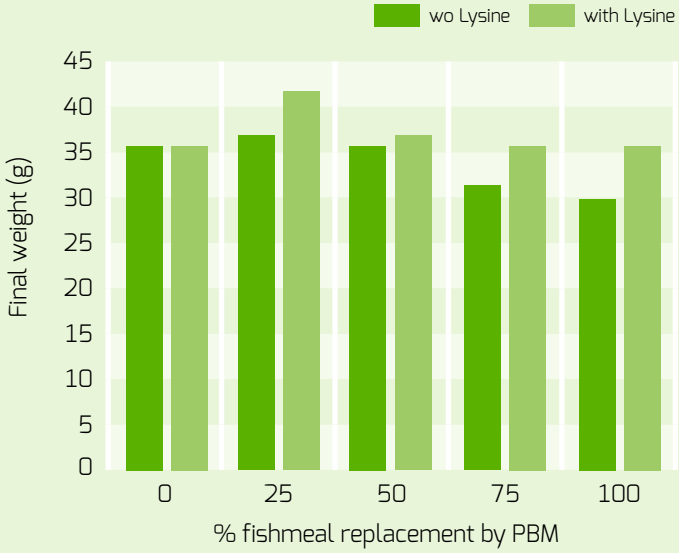
PRESENCE OF DIGESTIBLE P AND CA (BETTER AVAILABILITY OF P REDUCES POLLUTION IN SEA CAGES)

Phosphorus digestibility is a major challenge in aqua feed formulation. The Phosphorus present in vegetable proteins is mostly trapped in Phytin and is not available for the fish. The Phosphorus present in porc and poultry meal has a higher availability. As a consequence, the faeces of fish feed more animal proteins will contain less phosphorus , so less phosphorus will find its way into the environment and causes eutrophication.
This is particularly important for cage farming and trout farming in flow through ponds.

LOW FIBER CONTENT

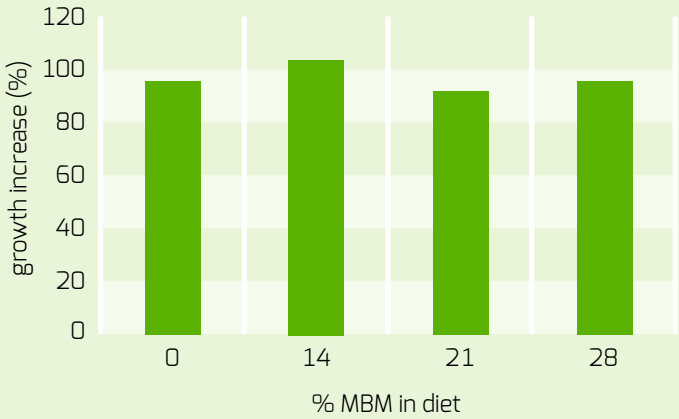
Most commercial fish species that are cultured in Europe for human consumption are carnivorous species. Their ability to digest fibers is limited. Animal proteins contain very little amounts of fibers in contrast to most vegetable protein sources.

Growth of Rainbow trout



Cheng et al (2002) showed a growth improvement when fish meal was replaced by Poultry By-product meal (PBM) at a low level. At a higher replacement level, addition of Lysine to balance the amino acids resulted in similar growth.

Growth of Gilthead Seabream with varying of MBM in the diet



Robiana et al (1997) could replace 40 % of the fish meal in diets for Gilthead Seabream without growth loss.

PRESENCE OF SOME NUTRIENTS

Due to the high price and scarcity of fish meal there is a continuous search to replace fish meal. Replacement is possible up to a certain level, but total replacement often results in growth loss, even while diets are formulated to contain the same amounts of essential nutrients for which the requirements are known.

Replacing fish meal by PAPs generally results in better results than replacing fish meal by vegetable proteins. Hydroxyproline, taurine and nucleic acids are some of the nutrients that have attracted attention, but their role still needs further elucidation.

CONCLUSION

PAPs are high quality protein sources, which have a good market availability. Their use in aquafeeds facilitates the formulation of high proteins fish feeds. This use of by-product meals helps the strive towards more sustainable aquaculture. PAPs contain a lot of interesting nutrients and are the best alternative to replace fish meal.

Sonac is a leading manufacturer of reliable ingredients of animal origin. With an active R&D program, reliable processes and sustainable end products Sonac continuously adjusts to market needs. A good geographical spread of locations and a broad portfolio of fats, proteins, minerals and specialties make Sonac a trusted partner for many international producers in food, pet food, feed and fertilizers, worldwide. Sonac is part of Darling Ingredients.

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