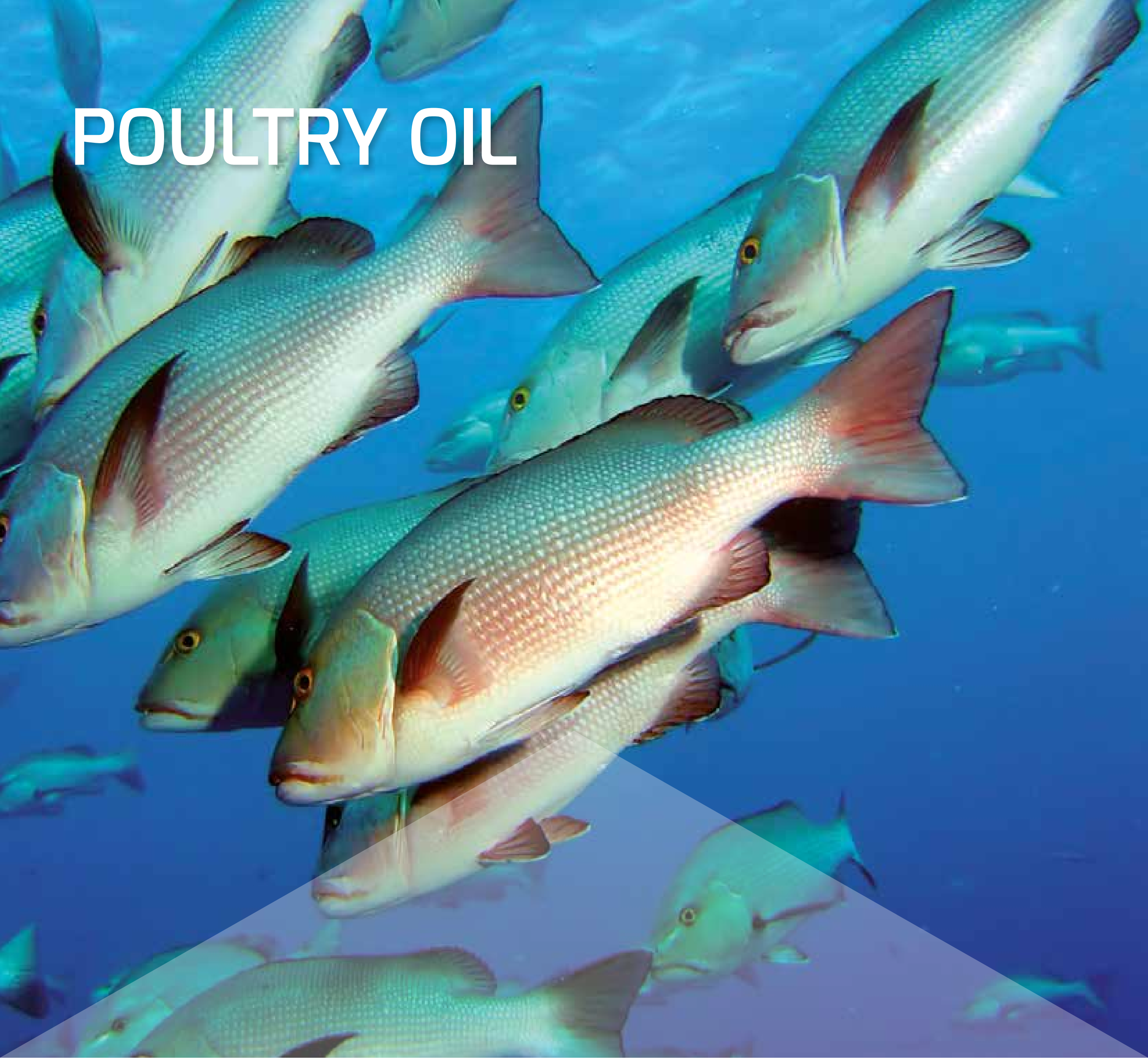
POULTRY OIL



POULTRY OIL

Lipids are a vast class of compounds which are crucial components of fish feeds, mainly to supply sufficient energy for maintenance, growth and reproduction. Lipids, when supplied in sufficient amount, are the main source of digestible energy that is directly related to feed conversion rates for most of the aquaculture species. Fish oil has traditionally been the main lipid source used in aquaculture feeds due to its high PUFA (Poly unsaturated Fatty Acid) content, but market forces have led to significant increase in prices (more than quadrupled in 10 years) and considerable tightening of the supply. Therefore a lot of research has been focused during the last decade on substituting fish oil by vegetable and land animal oils and fats with very good results.

Poultry oil is derived from poultry by-products. It is the most unsaturated terrestrial animal fat and with a high oleic acid content. Therefore a large number of studies over the past decade have been carried out and are indicating its high nutritional value for many fish species.

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FATTY ACID PROFILE

The type and quantity of dietary lipids can have great impact on the cost of the finished feed, the growth and health of organisms, and the quality of the final products.

Poultry oil is an interesting alternative for fish oil due to its low content of saturated fatty acids, it is even slightly lower than a standard anchovy oil. Poultry oil is a high oleic acid source and low in linoleic acid compared to soybean oil, but, the same as for all vegetable oils, lacking EPA and DHA.

The needs for EPA and DHA depend on the fish species and it is well studied that marine fish have higher needs for these highly unsaturated fatty acids than fresh water fish due to their incapacity to synthesize them. Besides the real needs for the fish, also the final quality of the fish products is important considering human health. Therefore, a lot of research effort has been done on restoring the fatty acid profile to a high PUFA profile in the last phase of fish production as if they were cultured the whole cycle only on fish oil.

More than focusing on the use of specific raw materials, a balance of fatty acids must be achieved by mixing several oils and fats and therefore formulating with minimum and maximum nutrients according to fish species and size. In addition, contrary to what is commonly assumed, the fatty acid composition of various fish oils is highly variable and depends on numerous factors, such as fish species, raw material type (whole fish vs.processing by-product), season, etc.

For this reason the value of alternative oils changes with the fish oil that is used.

The apparent digestibility (ADC) of dietary lipid can be primarily explained by the ratio of saturated fatty acids (SFAs) to total fatty acids and can be incorporated in diets at levels below 23% (±1%) without negatively affecting lipid digestibility (* Hua and Bureau, 2009) for a wide variety of fish species. Additionally, the ADC of SFAs is found to be significantly affected by water temperature. Based on present knowledge, the use of high oleic acid oils, such as poultry and rapeseed oil, is recommended rather than a soybean type because they provide oleic acid rather than linoleic. With oleic acid being one of the predominant fatty acids in olive oil which itself is recognized as an important component of the Mediterranean diet, this could actually be regarded as a positive trait for consumers since it is related to positive effects on coronary heart diseases. Besides, the relatively low content of linoleic acid in poultry oil will limit the effects on the n-6/n-3 maximum ratio, an important limiting factor within fish feed formulation.

Fatty acid		**Poultry oil**	**Capelin oil**	**Anchovy oil**	**Soybean oil**	**Rapeseed oil**
C14:0	Myristic acid	1,2	5,8	7,3	0,0	0,1
C16:0	Palmitic acid	19,0	11,3	17,5	10,0	4,2
C18:0	Stearic acid	6,9	1,1	3,8	3,3	1,6
C18:1n-9	Oleic acid	33,0	10,5	10,3	21,3	56,8
C18:2 n-6	Linoleic acid	22,0	1,2	1,1	54,3	19,9
C18:3 n-3	Linolenic acid	1,9	0,7	0,7	7,1	10,2
C20:4 n-6	Arachidonic acid (AA)	0,5	0,2	1,0	<0,1	<0,1
C20:5 n-3	Eicosapentanoic acid (EPA)	<0,1	7,4	15,4	<0,1	<0,1
C22:6 n-3	Docosahexanoic acid (DHA)	<0,1	5,1	11,3	<0,1	<0,1
Sum saturated FA		27,5	18,8	29,7	13,9	6,9
Sum n-6 FA		22,7	2,5	4,0	54,3	20,0
Sum n-3 FA		2,0	17,9	33,2	7,2	10,5
n-6/n-3		11,4	0,1	0,1	7,9	1,9

Fatty acid composition of Sonac poultry oil compared to two fish oils, capelin oil (North-European), anchovy oil (South-American) and two vegetable oils: soybean oil and rapeseed oil.

TRIAL RESULTS

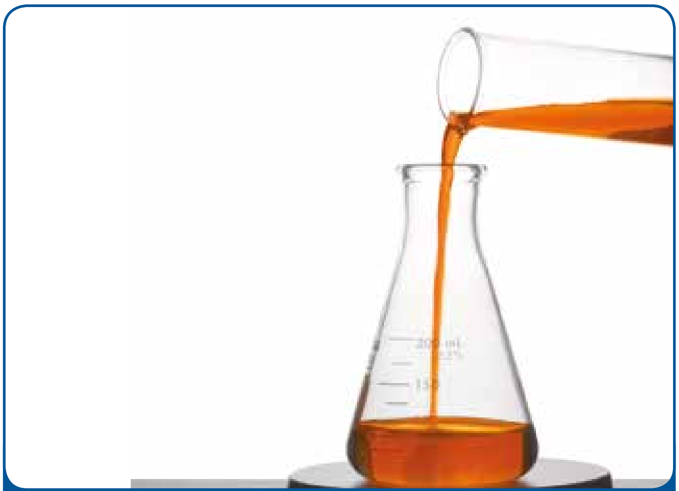
Performance in Rainbow trout

The replacement of fish oil by 5% of Sonac poultry oil, did not affect growth performance of 35 grams trout after feeding 45/21 (protein/fat) diets during 56 days at 16ºC. Although the specific growth rates and feed conversion rates were similar, the fatty acid profile was modified, as expected, and somewhat lower in EPA and DHA levels and higher oleic and linoleic acid levels compared to trout fed exclusively on fish oil. A wash out period of 28 days at 16ºC was not sufficient to restore the EPA and DHA levels. However the total level of saturated fatty acids was not really changed. Further, organoleptic tests indicated that there were no differences in the organoleptic properties of the trout fed exclusively on fish oil compared to trout fed on 5% of poultry oil. All diets had a 34% of fish meal and 17% (control) and 12% (5% poultry oil diet) of fish oil inclusion. (A.H.M. Terpstra et al (Coppens Research Center), 2008, non-published data).

Feeding 50 grams trout for 58 days at 16ºC, replacing 9% of rapeseed oil in a 44/20 (protein/fat) trout diet by 9% crude Sonac poultry oil resulted in similar feed conversions and specific growth rates. All diets had a 32% of fish meal and 8% of fish oil inclusion. (A.H.M. Terpstra et al (Coppens Research Center), 2009, non-published data).

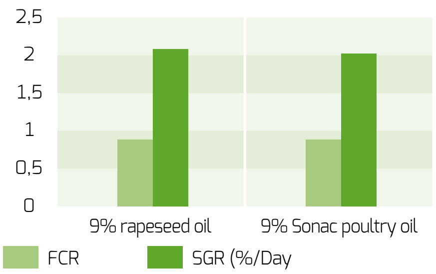
Specific growth rate (SGR) was calculated as:
· SGR=(ln W1-ln W0)/number of days on trial diet

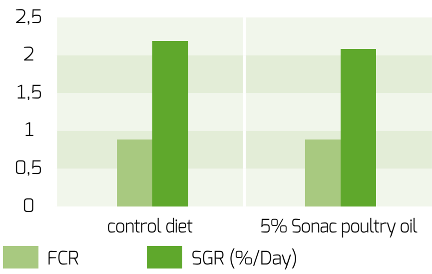
Feed conversion rate (FCR) was calculated as:
· FCR= amount of feed (kg) needed to obtain an increase in body weight of 1kg

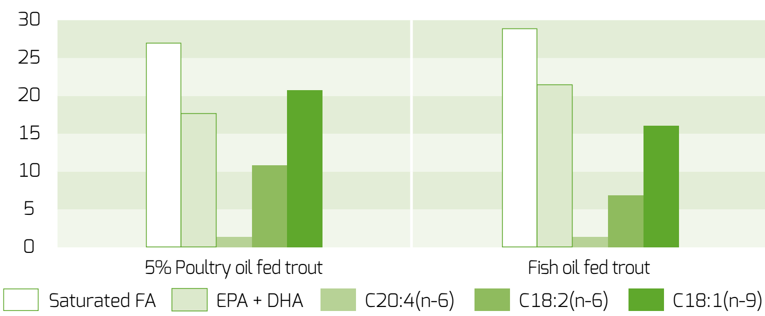


BENEFITS

- Cost beneficial
- Reasonable availability
- High digestible energy content
- Low in saturated fatty acids compared to other animal oils and fats and certain vegetable fats like for example palm oil
- High oleic acid content and relatively low in linoleic acid
- Contains n-3 linolenic acid
- High and stable quality (low in FFA, moisture, impurities and peroxide value)
- Low levels of undesirable substances



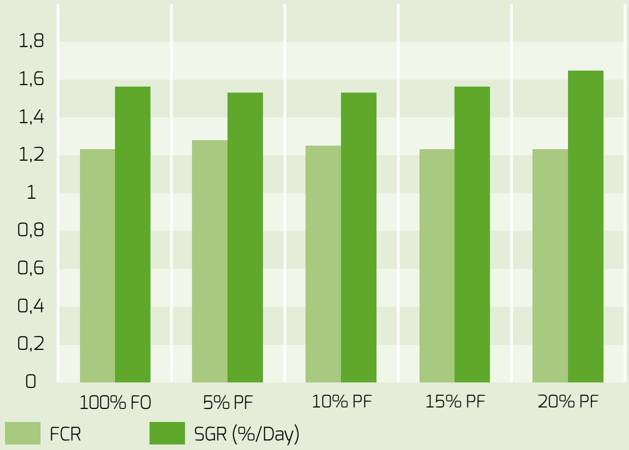


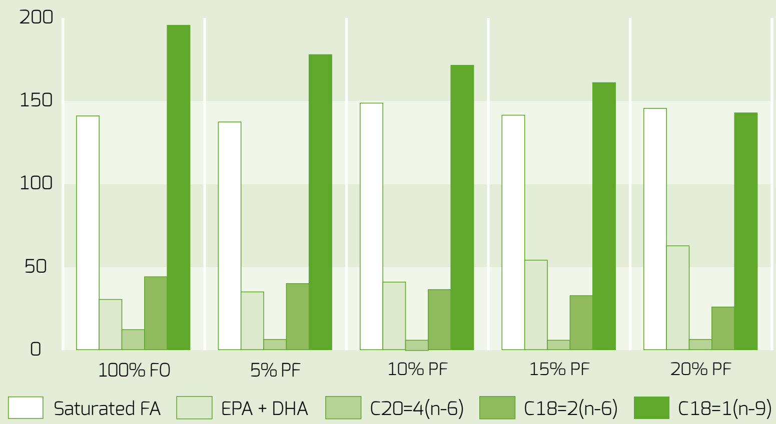


Fatty acid profile of trout at the end of the trial expressed as % of total methyl esters.

PERFORMANCE IN EEL

During 78 days, 22 grams eels were fed with five experimental 39/27 (protein/fat) diets containing increasing amounts of Sonac poultry oil (0, 50, 100, 150 and 200 g/kg) to substitute fish oil. No effect of Sonac poultry oil inclusion was seen on feed intake, specific growth and feed conversion rates. The proximate composition of the eels at the end of the trial was similar for all, but, as seen in other species, the fatty acid profile of the fish reflected the profile of the diet. As for trout, with increasing poultry oil levels in the diet, oleic and linoleic acid levels increased and EPA & DHA levels decreased compared to eel fed exclusively on fish oil.





All diets had a 45% of fish meal inclusion level. Fatty acid profile of eel at the end of the trial expressed as mg fatty acid methyl esters /g dry matter. (Dr.Jansman et al (TNO), 2000, non-published data)

CONCLUSIONS

Poultry oil is a high quality lipid source for many fish species and a very good candidate to (partly) substitute fish oil. The inclusion level depends on numerous factors, such as the fatty acid profile of the alternative lipids used, the fish species and the phase of the production cycle. It has been demonstrated that high replacement of fish oil by poultry oil (for eel up to 100%) has no effect on growth performance. However, high inclusion of vegetable and/or animal oils, can result in a reduction of long-chain n-3 PUFA concentration in the final product, particularly EPA, as demonstrated in numerous studies and many species. However when poultry oil is included, the total saturated fatty acid level keeps stable.

Finally the PUFA values can be restored by supplying a finishing diet based on fish oil during a certain period, dependent on fish size, growth rate, and dietary DHA and EPA contents.

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.

GMP+ Feed Safety Assurance

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ISO 14001
HACCP
BUREAU VERITAS Certification

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