

## Information and Bio Suisse' position on residues of synthetic antioxidants in fish and fish feed

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**Despite the prohibition on synthetic antioxidants in fish feed, traces of these substances have occasionally been detected in organic fish. This position paper names potential sources of contamination and suggests measures to minimize the occurrence of such residues in the future. Bio Suisse has also set benchmark values for fish feed and fish muscle tissue.**

### Background information

Synthetic antioxidants such as the additives ethoxyquin E324, butylated hydroxytoluene E321 and butylated hydroxyanisole E320 are widely used to preserve fish feed for aquaculture for the following reasons:

- They stabilize fat-soluble vitamins, which are essential components of the feed.
- They protect fish meal against lipid peroxidation, which could otherwise cause a fire if an accumulation of heat led to a chain reaction.
- They prevent fish oil from becoming rancid.

Due to their presence in feed, traces of synthetic antioxidants also appear in fish.

### The case of ethoxyquin

Ethoxyquin has a relatively short half-life (2.4 days). However, ethoxyquin dimer, a metabolite of ethoxyquin, is more persistent and is only excreted in trace amounts (half-life > 14 days). Studies have shown that corresponding amounts of ethoxyquin and ethoxyquin dimer are detected in fish: The average value of ethoxyquin found in non-organic farmed salmon was 0.055 mg/kg (with a maximum value of 0.167 mg/kg), while the average value of ethoxyquin dimer was 0.73 mg/kg (with a maximum value of 1.45 mg/kg).[1]

Residues can occur in any kind of fish that is fed with feed containing fish meal. However, residues are more likely to occur in predatory fish such as salmon due to the greater percentage of fish meal in their feed as well as their relatively long growth phase.

In the EU synthetic antioxidants such as ethoxyquin (EMQ), including in combination with other synthetic antioxidants (e.g., butylated hydroxytoluene [BHT] and butylated hydroxyanisole [BHA]), are permitted in non-organic animal feed in concentrations of up to 150mg/kg (100mg/kg in dog food) (Directive 70/524/EEC). The direct addition of ethoxyquin to food (with the exception of dried chillies/peppers) is no longer permitted in the EU. In the EU there is no maximum residue limit for ethoxyquin that occurs in food via its use as an antioxidant in feed. Japan has set a maximum residue limit of 1 mg/kg of ethoxyquin in fish. Ethoxyquin is also used as a plant protection product, but this has been prohibited in the EU since 2011.

The toxicity of ethoxyquin (plus ethoxyquin dimer and the impurity p-phenetidine) was analysed at the behest of the EFSA (European Food Safety Authority) in 2015 in the framework of a re-evaluation procedure for all feed additives, but the analysis was inconclusive due to a lack of data. In consequence, the decision was made to gradually withdraw approval of ethoxyquin during a transition period from June 2018 – June 2020 and to commission a complete risk assessment. According to current estimates, the risk assessment will not be completed before the end of 2019.

If the risk assessment comes to the conclusion based on the position of the EFSA that tolerance thresholds must be set for ethoxyquin as an additive to animal feed, then the Swiss Federal Food Safety and Veterinary Office (FSVO) will amend the FDHA Ordinance on the Maximum Residue Levels for Pesticides in or on Products of Plant and Animal Origin (SR 817.021.23) accordingly, with due consideration of EU requirements.

### The situation for 'Bud'/organic operations

Under EU organic regulations (Council Regulations [EC] 834/2007 and [EC] 889/2008) and Naturland standards, the use of synthetic antioxidants in fish meal and fish feed is prohibited in organic aquaculture. In addition, fish meal/oil must be sourced from verifiably sustainable, wild-caught seafood (generally scraps left over from food fish processing), where no feeding takes place and therefore no synthetic antioxidant residues are to be expected.

By-products from non-organic food fish processing are prohibited. Bio Suisse also prohibits the use of synthetic antioxidants in fish meal and fish feed.

Despite prohibitions against synthetic antioxidants in organic fish feed, traces of ethoxyquin residues have repeatedly been detected in organic fish, particularly in organic salmon. The levels detected indicate contamination rather than added ethoxyquin in feed.

Possible sources of synthetic antioxidant residues are:

- Certain vitamins (mainly vitamins A and D) which are stabilized with synthetic antioxidants. Manufacturers of multi-vitamin supplements, who also deliver to organic feed producers, are dependent on just a few suppliers of these vitamins worldwide. Even if manufacturers of multi-vitamin supplements do not add synthetic antioxidants themselves, traces may still occur in their products. From a nutritional point of view, multi-vitamin supplements are indispensable in feed. IFFO (the Marine Ingredients Organisation, <http://www.iffonet/>) is currently conducting experiments in relation to this issue. Their results indicate that fish meal can be effectively protected using lower amounts of synthetic antioxidants or using alternative antioxidants.
- Cross-contamination can occur in organic feed, fish meal or fish oil if feed mills produce in both organic and non-organic quality. This means that they produce both organic and non-organic products in parallel (as do many other processing operations in the food industry). Organic and non-organic products are kept segregated via temporal separation and appropriate cleaning procedures, purge batches, etc. Despite such segregation measures, undesired contamination can still occur.

Measures to minimize synthetic antioxidant contamination in fish are as follows:

- Transport fish meal in airtight containers; then no added synthetic antioxidants are necessary (or less effective natural antioxidants could be added instead).
- Replace synthetic antioxidants with natural substances in fish meal and multi-vitamin supplements.
- Keep the production and storage of organic fish feed, organic fish meal and organic fish oil segregated and optimize quality assurance (in cleaning and storage).

### The position taken by Bio Suisse

For the reasons given above, both Bio Suisse and Naturland have occasionally found traces of ethoxyquin residues in organically certified fish feed, ranging from 1-3 mg/kg. (For the sake of comparison, ethoxyquin added directly to fish meal/oil produces concentrations in feed of around 75 mg/kg, going up to 150 mg/kg if added directly to feed).

In order to offer operations greater planning security and help them determine whether a feed still conforms to the standards, Bio Suisse has set the following benchmark values:

In test reports from feed and fish meal producers, the benchmark value for all synthetic antioxidants, whether alone or in combination, is 3 mg/kg in feed and 3 mg/kg in fish meal and fish oil, with a detection limit of 1 mg/kg. Benchmark values for fish muscle tissue in particular have been set at 0.01 mg/kg for synthetic antioxidants and 0.02 mg/kg for ethoxyquin dimer to aid decision-making.

Consult the '[Bio Suisse decision chart for assessing pesticide residues in "Bud" products](#)' for further guidance.

Any incident of residues detected in feed or fish muscle tissue must be reported to Bio Suisse and your certification body (according to contract). Sources of contamination must be identified, and appropriate measures for improvement must be taken.

## Reference

- [1] A.-K. Lundebye, H. Hove, A. Måge, V.J.B. Bohne & K. Hamre (2010) Levels of synthetic antioxidants (ethoxyquin, butylated hydroxytoluene and butylated hydroxyanisole) in fish feed and commercially farmed fish, *Food Additives & Contaminants: Part A*, 27:12, 1652-1657