GLOBAL ORGANIZATION FOR EPA AND DHA OMEGA-3S

Global Organization for EPA and DHA Omega-3s (GOED) - Provision of Information on the Mitigation Approaches used by Fish Oil Refiners.

Name of Submitter: Global Organization for EPA and DHA Omega-3s (GOED)

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Dear Chair of the Electronic Working Group,

We like to thank the CCCF Electronic Working Group (EWG) "3MCPDEs & GEs" for their consideration of our suggestions and making the language of this Code of Practice more broadly applicable to the many types of refined oils destined for global human consumption. Please find below the answers to the Chair's specific additional questions raised about refined fish oils in the current draft Code of Practice for the reduction of 3-monochloropropane-1,2- diol esters (3-MCPDe) and glycidyl esters (GE) in refined oils and food products made with refined oils (at step 5). In general, mitigation approaches developed to date by manufacturers of refined fish oils and related omega-3 oils are still relatively new. We nevertheless hope to provide you here with useful information. In some instances, we refer to our previous report submitted on September 28th, 2018, which contains the specific examples of mitigation approaches practicalized by fish oil producers currently.

GOED represents over 200 companies globally active in the omega-3 business, and among its members (http://www.goedomega3.com/index.php/our-members/list-of-goed-members) are the majority of the producers of refined oils rich in EPA and DHA omega-3 fatty acids, including fish oils, other marine oils, algae oils and terrestrial oils. In addition, our membership includes the largest finished product manufacturers utilizing refined omega-3 oils globally.

Answers to the questions relevant to refined fish oils:

Item 1.
Question: *Is it better to say commodities, or plants and seafood?*

Answer: Commodities is more encompassing in our view. The sentence could read "Edible oils are produced from various commodities, including fruits, seeds, nuts, fish and a variety of single-cell organisms (such as microalgae and protists)."

The word "fish" by Codex encompasses other marine organisms, such as krill, as explained in the next point. The mentioned types of "single-cell organisms" could be left out, we indicated several here to indicate which ones are currently in use for the production of EPA/DHA oils for human consumption, but even others can be used (for example yeasts). Novel terrestrial sources for "fish oils" obtained from GMO crops (currently being tested in field trials) will fall under "seeds".

Question: *Does the term fish oil need to be modified to be more encompassing of krill, crustaceans?*
Answer: CODEX has a fish oil standard, which defines the species used for the production of fish oils. For example, it includes krill as a marine source for "fish oils". The current Code of Practice should refer to the Codex Standard for Fish Oils (CXS 329-2017) for a definition. Here is the link to the standard: http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCODEX%2BSTAN%2B329-2017%252FCXS_329e.pdf

Item 19. *Producing edible fish oils involves several major steps: harvesting the fish, steam cooking, de-watering, and wet reduction (which involves pressing the liquor, separating the oil and water, water washing the oil), and refining.*)

Question: *Fish oil manufacturers, please edit as appropriate. The paragraph is intended to provide a brief discussion of fish oil manufacturing steps to mirror paragraph above on vegetable oils.*
Answer: GOED agrees with the wording of this paragraph.

Items 21-25. Agricultural Practices.
Question: *Can additional information be provided on practices for handling marine oil sources (fish and krill)?*Answer: Yes. Store the fish cold before processing. Although we have no study to support this with data, manufacturers say that <15 Deg C. is current practice.

Item 28. *Avoid recycling residual vegetable oil recovered from solvents or additional extractions, as this oil tends to have higher levels of precursors (e.g. chlorine-containing compounds, DAGs.*

Question: *Does this apply to fish oils?*

Answer: No, this does not apply to fish oils.

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Item 29. *Assess precursors in batches of crude vegetable oils (e.g. DAGs, chlorine-containing compounds) to adjust refining parameters and target appropriate mitigation strategies depending on the type of vegetable oil being processed and processing conditions.*
Question: *Does this apply to fish oil too? If so, can more information be provided?*
Answer: Yes, this applies to fish oils. It is important to take into account that the composition of fish oils (and hence its content of precursors, such as chlorine-containing compounds, as well as mono- and diglycerides) is very much fish species-related, as well as dependent on the local condition and applied processing conditions. There are many possibilities to approach mitigation through this point, although the applications are in their infancy for fish oil producers currently. The Codex Standard for Fish Oils , cited above, will provide you with an idea of the wide variety of types of fish oils (a situation analogous to vegetable oils).

Item 30. *Preferentially refining crude vegetable or fish oil with low concentrations of precursors can produce finished oils with lower levels of 3-MCPDE and GE.*

Question: *Is there additional information on refining of crude fish oils with low concentrations of precursors?*

Answer: Yes, this point is applicable also for fish oils. In our previous information provision, we provided the example of one Norwegian fish oil producer that has already implemented at commercial scale the use of crude fish oils that are low in diglyceride and free fatty acid content (Example 3). Unfortunately, we have no additional results to support this. As pointed out previously, fish oil manufacturers are not eager to share their internal proprietary methodologies and results, since this is a very competitive market.

Item 31. *Use milder and less acidic conditions (e.g. either degumming with a low concentration of phosphoric acid (0.02%) or water degumming) to decrease 3-MCPDE in vegetable oils or fish oils. The concentration of phosphoric acid needed depends on the quality of the crude vegetable oil or fish oil. Care should be taken to remove sufficient concentrations of phospholipids and phosphoric acid to ensure quality.*

Question: *Can additional information on degumming of fish oils be provided?*
Answer: Yes, this point is applicable also for fish oils. Just like for vegetable oils, degumming is used to remove phospholipids from fish oils and could be adapted to be carried out at milder or less acidic conditions. Unfortunately, we have no additional information from fish oil producers beyond the example we provided in the last round of information provision, where we indicated that a major Peruvian fish oil producer has achieved this year at commercial scale the reduction of 3-MCPD and GEs levels when an adaptation of degumming is used in combination with short-path distillation (instead of deodorization). Details are proprietary information for now.

Item 34. *Use of greater amounts of bleaching clay may reduce formation of 3-MCPDE and GE in all vegetable oils and fish oils. However, bleaching clays that contain significant amounts of chlorine-containing compounds should be avoided.*

Question: *Can additional information be provided on use of bleaching clay on fish oils?*

Answer: In general, higher relative amounts of bleaching clay are used for fish oil refining than for vegetable oil refining. This is related to factors such as the use of less efficient process equipments, a lower financial impact, and that fish oils can be more difficult to bleach. However, we have not seen a positive impact of using even more bleaching clay by itself to specifically reduce 3-MCPD/GE levels in fish oils. Rather, the type and quality of the bleaching clay is important, and one critical point is indeed what is already stated in the CoP draft, *"However, bleaching clays that contain significant amounts of chlorine-containing compounds should be avoided."*
In our previous round of information, we indicated in Example 1 that a Norwegian fish oil producer who now uses a bleaching-clay low in chlorine-containing compounds has been able to markedly reduce the levels of 2-MCPD, 3-MCPD and glydicyl-esters.
Also, one fish oil producer has reported the use of activated carbon in combination with higher amounts of bleaching clay to achieve process contaminant mitigation (see Example 2 in our previous report). It may be interesting to note here that the use of blends of bleaching earth and activated carbon is already practicalized by many fish oil producers for the removal of persistant organic pollutants from oils. It is well possible that this application is also useful for the removal of 3-MCPD and GE as well, but this possibility has not been evaluated in general.

Item 37. *As an alternative to traditional deodorization, conduct dual deodorization of vegetable oils and fish oils (2-stage deodorization) to reduce thermal load in oil. This includes both a shorter (e.g. 5 minutes at 250°C) and a longer (e.g. 120 minutes at 200°C) deodorization period. Consideration needs to be given to parameters such as temperature, vacuum pressure, and time, and variations in equipment design and capability. Also, additional post processing may be required to reduce levels of GE.*

Question: *Has the fish oil industry utilized dual deodorization as an alternative to traditional deodorization? And if so, is the second sentence in the paragraph applicable to fish oils? Additional information on dual deodorization of fish oils would be helpful*

Answer: Overall theory is the same for fish oils as for vegetable oils, but fish oil manufacturers rather do lower temperature deodorization than dual-temperature deodorization, and stay below 190 deg C. (see CoP Item 36.). It is also considered expensive to invest in this second stage deodorization equipment. This does not mean that dual temperature deodorization is not an option for fish oil deodorization, and in our previous round of information we highlighted one fish oil producer that has implemented a dual-deodorization approach to reduce these process contaminants (see Example 2). The details in the second sentence "*This includes both a shorter (e.g. 5 minutes at 250°C) and a longer (e.g. 120 minutes at 200°C) deodorization period.* " thus appears to be rather too specifically worded when viewed in relation to the deodorization approaches available to treat fish oils. However, the third sentence is applicable: "*Consideration needs to be given to parameters such as temperature, vacuum pressure, and time, and variations in equipment design and capability.* ".

In addition, we like to indicate for your consideration our view on residence time, see at the end of this document.

Item 38. *Use of a stronger vacuum facilitates evaporation of volatile compounds due to the increased steam volume and rate of stripping, contributing to decreased deodorization temperatures and reduced formation of GE, and to a lesser extent 3-MCPDE, in vegetable and fish oils.*

Question: *Is this worded correctly to reflect industry practice with regards to deodorization of fish oils? Can additional information on the use of a stronger vacuum on fish oils be provided?*
Answer: Yes, fully right. Unfortunately, we cannot provide additional industry data to support this beyond the one example of a producer that has implemented this approach as indicated in the last round of information provision (Example 3).

Item 41. *Application of activated bleaching earth during post refining has been shown on an industrial scale to reduce GE in refined vegetable oils and refined fish oils*

Question: *Is there additional information on the use of activated bleaching earth on refined fish oils to reduce GE?*
Answer: Currently, we have no support for post-refining bleaching as being useful in the mitigation of GE (or 3-MCPD) in fish oils. It does not mean it may not, nobody has yet looked at this.

Item 42.
Question: *Is this addition of fish oils correct within the context of the rest of the statement? ("Use of short-path distillation (pressure: <1 mbar and temperature: 120 to 270°C) on bleached and deodorized vegetable and fish oils can reduce acylglycerol components and levels of 3-MCPDE and GE. ").*
Answer: Yes, in theory. Short-path distillation (molecular distillation) is used extensively for the removal of persistant organic pollutant and other unwanted substances from fish oils, as an alternative or complementary technology to traditional refining steps. It is also used for the further concentration of omega-3 fatty acid esters obtained from fish oils. Unfortunately, we have no industry examples yet to support its use for the removal of MCPD and GE, although we expect that it is a matter of time before its use in process contaminant mitigation will be shown.

We like to offer an additional comment on **Item 36:**
Mitigation through adequate use of temperature during deodorization is also a residence time issue. So optimal temperature is heavily depending also on residence time on this elevated temperature. 190degC for fish oil can be 210 Deg C for instance if you decrease residence time. Item 36 could read additionally "Consider conducting deodorization of fish oils at reduced residence time to decrease formation of process contaminants".

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Thank you for your consideration of these answers and information.

Sincerely,

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