The Secrets of Fish Oil Purity

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HU151HP
England
Intake versus Recommendation
The Gap in Omega-3 LC PUFA

ISSFAL proposal (1999)

Average

0.65 g

0.2 g

Nutritional “gap”

g/d
Therapeutic “Gap”

- ISSFAL recommendation: 0.65 grams/day
- Therapeutic recommendation: 5-15 grams/day
Closing the LC Omega-3 PUFA GAP

1. Oily fish - not liked by all groups

2. Capsules - hide taste, problem of repeating with poorly refined oils

3. A spoonful of cod liver oil - an acquired taste

4. LC Omega-3 oil incorporated into foods - not so easy
History of Fish Oil Production

- 1780  Cod liver oil fermentation
- 1850  Heating of cod livers in vats
- 1980  Use of fish body oil
- 1990  Fish oil concentrates
- 2000  “Weapons-grade” fish oil
Types of Fish Oil

- Fish
  - Contamination with PCBs and Hg

- Crude fish oil
  - Very high contamination with PCBs

- Health food grade
  - Still contaminated with PCBs

- Ultra-refined EPA/DHA Concentrates
  - "Weapons-grade" fish oil
  - Lower levels of PCBs
  - Can be used in high-dose, long-term applications
The Oil refining steps

- **DEGUMMING NEUTRALISATION**
  - PHOSPHOLIPIDS
  - GALACTOLIPIDS
  - FFA, METALS AND COLOR

- **BLEACHING**
  - COLOR
  - OXIDATION PRODUCTS
  - RESIDUAL SOAPS

- **DEODORISATION**
  - OXIDATION PRODUCTS
  - COLOR

Additional refining (Molecular distillation) needed to reduce dioxins, furans and pcbs
Molecular distillation is the answer:

200 C approx and 0.001 mbar high vacuum is needed to refine an oil
What Are PCBs?

- Insulators for electronic transformers
- First production in 1930
- Peaked in 1960
- Banned since 1977
- Neurotoxins, carcinogens, endocrine disruptors
Contamination Pathway

- Contaminated River, lake, sea, or ocean
- Fish or aquatic life
- Food or supplements
- Human consumption
PCBs Increase CHD

- 58% increase in CHD at 286 ng/day compared to 100 ng/day
- Overwhelms protective effects of EPA and DHA on CHD

OmegaRx®

PCB = 0.8 ppb
PCB = 5.3 ppb
Krill Oil

PCB = 7.4 ppb
“High” Quality Chinese Fish Oil

PCB = 25.1 ppb
Resistance to oxidation of many common food oils and fats

**STABLE**
- Cocoa butter, coconut, palm kernel, hydrogenated fats,
- Groundnut, sesame, cottonseed, olive, maize, sunflower, safflower
- Soy, rapeseed
- Butterfat, lard, tallow
- Evening primrose, borage, flax, echium, SDA soy, ARASCO
- Fish, SCO, krill,
- Omega-3 EE concentrates and reconstituted glycerides

**UNSTABLE**
What causes rancidity and off-flavours?

Double bonds are chemically reactive centres from which many taste and smell molecules can be created

<table>
<thead>
<tr>
<th>Fatty acid</th>
<th>No of double bonds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oleic</td>
<td>1</td>
</tr>
<tr>
<td>Linoleic</td>
<td>2</td>
</tr>
<tr>
<td>ALA, GLA</td>
<td>3</td>
</tr>
<tr>
<td>ARA, Stearidonic</td>
<td>4</td>
</tr>
<tr>
<td>EPA, DPA</td>
<td>5</td>
</tr>
<tr>
<td>DHA</td>
<td>6</td>
</tr>
</tbody>
</table>
EPA and DHA oxidize quickly

If a rate of oxidation of 1 were assigned to oleic acid (18:1), then it has been shown that the oxidation rates for

- Linoleic 41
- Linolenic 98
- Arachidonic 195

with even faster rates of autoxidation for EPA and DHA.
Double Bonds React With Oxygen

1 Primary oxidation products are peroxides
2 Peroxides are unstable
3 Many kinds of Secondary oxidation products are formed by breakdown of peroxides
4 These Secondary oxidation products exhibit a wide smell and taste range and damage proteins, lipids and DNA

Nice  Neutral  Nasty
Human nose is very sensitive to fishy off-flavor

Important sensory changes take place here

Sensory saturation

Total concentration of 11 key smell molecules (ppb) Macfarlane AOCS, 2000
USA capsule-grade ethyl ester concentrate SPME headspace
3D of selected zone

Many oxidised lipid molecules:
“Hidden oxidation”
LC Omega-3 concentrates in USA

**Fishy scale**

1= bland, 7= extremely fishy.

Macfarlane AOCS 2008, 2012

Some companies use large amounts of citrus flavor to mask “fishy”.

Citrus flavor is rich in aldehydes, geranial, neral and C7-C13 aldehydes and adding up to 5% citrus flavor will cause p-anisidine and TOTOX values to rise significantly and exceed GOED recommendations.

With proper refining and stabilisation there is no need to exceed GOED p-anisidine and TOTOX values by adding large amounts of citrus flavor.
Fish-oil pills vs. claims

January 2012

Ratings
In cost order, within groups.

<table>
<thead>
<tr>
<th>Product</th>
<th>Count</th>
<th>Coated</th>
<th>Cost Day</th>
<th>Cost Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>MET QUALITY STANDARDS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring Valley (Walmart)</td>
<td>200</td>
<td>17g</td>
<td>$60</td>
<td></td>
</tr>
<tr>
<td>Finest Natural (Walgreens)</td>
<td>200</td>
<td>23</td>
<td>82</td>
<td></td>
</tr>
<tr>
<td>Walgreens Concentrate</td>
<td>60</td>
<td>25</td>
<td>91</td>
<td></td>
</tr>
<tr>
<td>Barlean's Organic Oils EPA-DHA</td>
<td>250</td>
<td>26</td>
<td>96</td>
<td></td>
</tr>
<tr>
<td>Nature Made 1,200 mg</td>
<td>180</td>
<td>28</td>
<td>103</td>
<td></td>
</tr>
<tr>
<td>The Vitamin Shoppe Mega-3 EPA-DHA</td>
<td>100</td>
<td>32</td>
<td>117</td>
<td></td>
</tr>
<tr>
<td>Carlson Super Omega-3 Gems</td>
<td>100</td>
<td>46</td>
<td>168</td>
<td></td>
</tr>
<tr>
<td>Norwegian Gold Ultimate Critical Omega</td>
<td>60</td>
<td>-</td>
<td>47</td>
<td>170</td>
</tr>
<tr>
<td>Nature's Way Fisol</td>
<td>180</td>
<td>-</td>
<td>64</td>
<td>235</td>
</tr>
<tr>
<td>DIDN'T MEET ENTERIC-COATING CLAIM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kirkland Signature Enteric 1200 (Costco)</td>
<td>180</td>
<td>-</td>
<td>9</td>
<td>31</td>
</tr>
<tr>
<td>SPOILAGE INDICATED</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nordic Naturals Ultimate Omega</td>
<td>180</td>
<td>-</td>
<td>67</td>
<td>243</td>
</tr>
<tr>
<td>1 OR 2 SAMPLES ABOVE CALIF. TOTAL PCB LIMIT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CVS Natural</td>
<td>250</td>
<td>-</td>
<td>19</td>
<td>70</td>
</tr>
<tr>
<td>Sundown Naturals</td>
<td>200</td>
<td>-</td>
<td>29</td>
<td>104</td>
</tr>
<tr>
<td>Nature's Bounty Odorless</td>
<td>100</td>
<td>-</td>
<td>36</td>
<td>131</td>
</tr>
<tr>
<td>GNC Triple Organic</td>
<td>60</td>
<td>-</td>
<td>37</td>
<td>134</td>
</tr>
</tbody>
</table>

1,000 mg of fish oil unless otherwise noted. Based on 1,000 mg of omega-3 (usually two or three capsules). Reformulated after our tests.
Fish Oil Buyers Beware

- *Consumers Report* (January 2012)

- High in PCBs (1 or 2 capsules > 90 ng)
  - CVS
  - Sundown
  - Nature’s Bounty
  - GNC

- Spoilage (Totox >26)
  - Nordic Naturals
The importance of independent certification of product quality

- There are a number of instances of fish oil product recalls because of misleading label claims.
- Areas of error include low potency (low EPA and DHA).
- Higher levels of dioxins, furans and PCBs than WHO maxima.
- Levels of peroxide, anisidine and TOTOX higher than GOED recommendations.
- ZoneLabs has each product lot tested at IFOS, an internationally recognized independent center of excellence for Omega-3 testing and all results are published on the Internet.
Standards Should Be Higher

<table>
<thead>
<tr>
<th>PRODUCT NAME</th>
<th>PRODUCT DESCRIPTION</th>
<th>LOT #</th>
<th>EXP. DATE</th>
<th>ALL TEST RESULTS ARE POST PRODUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>OmegaRx 1000mg</td>
<td>Softgel Caps</td>
<td>SB001302</td>
<td>5/31/2015</td>
<td></td>
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</tbody>
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**CONCENTRATION (1a)**

<table>
<thead>
<tr>
<th>LABEL CLAIM</th>
<th>BATCH RESULTS</th>
<th>DR. SEARS APPROVED</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPA (C20:5) 400 mg/1000mg</td>
<td>440 mg/1000mg</td>
<td>PASS</td>
</tr>
<tr>
<td>DHA (C22:6) 200 mg/1000mg</td>
<td>220 mg/1000mg</td>
<td>PASS</td>
</tr>
</tbody>
</table>

**PURITY, SAFETY (2b)**

<table>
<thead>
<tr>
<th>GOED STANDARD (d)</th>
<th>IFOS STANDARD (e)</th>
<th>DR. SEARS’ STANDARD</th>
<th>BATCH RESULTS</th>
<th>DR. SEARS APPROVED</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCB - 209 Congeners &lt;90 ppb</td>
<td>&lt;45 ppb</td>
<td>&lt;5 ppb</td>
<td>1 ppb</td>
<td>PASS</td>
</tr>
</tbody>
</table>

**STABILITY (3c)**

<table>
<thead>
<tr>
<th>CRN/GOED STANDARD</th>
<th>IFOS STANDARD</th>
<th>DR. SEARS’ STANDARD</th>
<th>BATCH RESULTS</th>
<th>DR. SEARS APPROVED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peroxide</td>
<td>&lt;5 meg/kg</td>
<td>&lt;5 meg/kg</td>
<td>1.5 meg/kg</td>
<td>PASS</td>
</tr>
<tr>
<td>Anisidine</td>
<td>&lt;20</td>
<td>&lt;20</td>
<td>3</td>
<td>PASS</td>
</tr>
<tr>
<td>TOTOX</td>
<td>&lt;26</td>
<td>&lt;19.5</td>
<td>6</td>
<td>PASS</td>
</tr>
</tbody>
</table>

**DATA SOURCES**

All Test Results are Post Production.

Testing Laboratories 1) EurofinsScientific Inc. 2) Pace Analytical, 3) Eurofins Scientific Inc.

a) Dr. Sears’ Concentration Standard on a mg/1000mg basis.
b) Dr. Sears’ PCB Standard based upon 209 PCB Congeners - GOED Standard Based upon 7 PCB Congeners until December 2012.
c) Dr. Sears <19.5 Totox Standard Based Upon Post Production Totox Values. GOED / IFOS Standard Based Upon Pre-Production Totox Values.
e) IFOS - International Fish Oil 5 Star Standards. For more information: www.ifosprogram.com.
Thank You for your attention

If you trudge around the Everglades and become aware of a “fishy smell” close by ..... 

LOOK OUT FOR ALLIGATORS

The worse the smell the larger your problem for big alligators that eat fish produce a lot more cis-4 heptenal than little alligators (11% DHA and 4% EPA in fat). Cis-4 heptenal is very fishy (Macfarlane AOCS, 2000).

Alligators that don’t eat fish are even more dangerous for they don’t smell at all!!!!!!!

OmegaRx is potent, pure, safe, stable against oxidation and not fishy. I do not think we should feed it to alligators. Do you?