WORKSHOP 2 - Ethoxyquin in fishmeal – does it have a future?
Ethoxyquin – where to now?

Gretel Bescoby
IFFO
Ethoxyquin – where to now?

• EU re-authorisation
• Safe shipping – IMO regulations
• Antioxidant trials
EU re-authorisation

- Antioxidants Authorisation Consortium (ANTOXIAC) submitted re-authorisation dossier in 2010.
- Awaiting EFSA opinion re safety
- EFSA has since asked for additional information on a number of occasions
EU re-authorisation

• EFSA requested further information in November 2014

• SCoPAFF meeting in December 2014

• Six months for genotoxicity studies

• Results expected in July 2015

• Feeding trials on different animal groups
Safe shipping – IMO regulations

IMDG code requirement

1) At the time of production:
   – between 400 and 1000 mg/kg ethoxyquin, or
   – between 1000 and 4000 mg/kg butylated hydroxy toluene (BHT)

2) At time of shipment:
   – antioxidant content ≥ 100 mg/kg
EU regulations

Current: EC 2316/98

• No specifications specifically for fishmeal
• **Complete feed:** Maximum permitted level = **150 mg/kg** for ethoxyquin as well as BHT

Future approach:

• Possible MPL for food fish?
How are IMO codes developed?

UN Sub Committee of Experts on the Transport of Dangerous Goods (UN-TDG)

UN Model Regulations (packaged/container)

IMDG Code (sea) (packaged/container)

IMSBC Code (sea) (ship hold/bulk cargo)
Amendment to the Model Regulations on the Transport of Dangerous Goods

IFFO submitted proposal for alternative antioxidants

UN-TDG meeting in June 2015

New IMO codes

UN Sub Committee of Experts on the Transport of Dangerous Goods

IMO
ANTIOXIDANT TRIALS

Hooray!! We've got a PLAN!! The plan will save us!!
ANTIOXIDANT TRIALS

Project plan for one year storage of reactive fishmeal:

• 4-6 treatments:
  ➢ 2 concentrations of ethoxyquin:
    a) Normal and b) Low
  ➢ 2 concentrations alternative: 2 levels
  ➢ Possibly a natural antioxidant: 2 levels

• Regular testing (Antioxidant level, PV, FFA, AV, PUFA)
ANTIOXIDANT TRIALS

PLANNED TRIALS:

• CHILE: IFFO/Alimar/Kemin (earliest possible 2015)
  Fish specie: Sardine

• SOUTH AFRICA: Lucky Star/Kemin (earliest 2015)
  Fish specie: Anchovy

• USA: Daybrook/Kemin (Sept/Oct 2015)
  Fish specie: Menhaden
Ethoxyquin – where to now?

To summarise:

• EU re-authorisation
• Safe shipping – IMO regulations
• Antioxidant trials
THANK YOU
Role of Antioxidants, Ethoxyquin Alternatives, and Planned Trials

2015 IFFO Member’s Meeting
Location: Miami, FL
Date: 14 April, 2015
Agenda

- Role of Antioxidants in Fishmeal
- Alternatives to Ethoxyquin
- Planned Trial Overview
Role of Antioxidants

• Primary & Historic Role: Prevention of Self-Combustion reactions
  o Risk mitigation
  o Fishmeal overheating documented back to 1939\(^1\)
  o Antioxidant treatment first noted in mid-1950’s\(^2\)
  o BHT was initially used as antioxidant in fishmeal
  o Ethoxyquin eventually replaced BHT after introduction by Monsanto in 1960’s

2. Meade, T. L., A New Development in Fishmeal Processing, Feedstuffs, May 19, 1956
Role of Antioxidants

- **Additional Role: Maintaining Fish Meal Quality**
  - Maintain nutritional value: Preserve Omega-3 concentration
  - Reduce peroxide value formation
  - Prevent off odors
  - Prevent heating damage to meal
Alternatives to Ethoxyquin

• Regulated under IMDG code UN 2216 Class 9 Dangerous Substance

• Regulation allows:
  - Between 400 and 1000ppm Ethoxyquin
  - Between 400 and 1000ppm Liquid BHT
  - Between 1000 and 4000ppm powdered BHT
  - Minimum 1000ppm Tocopherol based antioxidant

  - Must contain minimum 100ppm Ethoxyquin / BHT at shipment
  - Must contain minimum 250ppm Tocopherol based antioxidant
History for Naturally Stabilized Fishmeal - an Ethoxyquin Alternate

- USCG Special Permit 14-95 required 1000ppm min. NATUROX™ Liquid dosage when produced.
  - Icelandic meal addendum allowing 500ppm NATUROX™ Liquid dosage when produced with 125ppm residual at shipping.
- Shipped within 6 months of production.
- IFOP, Chilean Navy adopted USCG provisions as well as the Australian Maritime Safety Authority, Germany, and Belgium
- Codified under UN2216 in 2010
Protocol

- Wild Salmon meal treated with one of following:
  - 500ppm Ethoxyquin
  - 2000ppm Naturox™
  - 2000ppm Naturox™ R30

- Test at 0, 1, 3, 6, 9, & 12 months
  - Test for PV, Antioxidant, Oxygen Bomb, & Fatty Acid Profile
  - Also test for % Fat at 0, 3, 6, and 12 months
## Peroxide Value Data

### Peroxide Value (meq/kg fat) of Salmon Meal

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Storage Time</th>
<th>0 month</th>
<th>1 month</th>
<th>3 month</th>
<th>6 month</th>
<th>9 month</th>
<th>12 month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td></td>
<td>8.6</td>
<td>19.2</td>
<td>50.7</td>
<td>14.1</td>
<td>2.9</td>
<td>2.7</td>
</tr>
<tr>
<td>1 lb/ton Ethoxyquin</td>
<td></td>
<td>1.1</td>
<td>1.9</td>
<td>0.0</td>
<td>1.2</td>
<td>0.5</td>
<td>0.0</td>
</tr>
<tr>
<td>4lb/ton Naturox™</td>
<td></td>
<td>1.5</td>
<td>8.0</td>
<td>1.7</td>
<td>5.7</td>
<td>4.4</td>
<td>4.2</td>
</tr>
<tr>
<td>4 lb/ton Naturox™ R30</td>
<td></td>
<td>0.0</td>
<td>1.8</td>
<td>0.9</td>
<td>3.6</td>
<td>3.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

### Peroxide Value of Salmon Meal

The graph shows the peroxide value (PV) of salmon meal over different storage times and treatments. The PV (meq/kg fat) is represented for each treatment at 0 month, 1 month, 3 months, 6 months, 9 months, and 12 months. The treatments include Untreated, 1 lb/ton Ethoxyquin, 4lb/ton Naturox™, and 4 lb/ton Naturox™ R30. The PV values are indicated by different colors for each storage period.
# Omega-3 Content (Relative %)

## Omega-3 Content (Relative %) of Salmon Meal

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Storage Time</th>
<th>0 month</th>
<th>1 month</th>
<th>3 month</th>
<th>6 month</th>
<th>12 month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td></td>
<td>27.8</td>
<td>25.2</td>
<td>16.9</td>
<td>9.1</td>
<td>7.0</td>
</tr>
<tr>
<td>1 lb/ton Ethoxyquin</td>
<td></td>
<td>26.6</td>
<td>29.2</td>
<td>31.1</td>
<td>25.5</td>
<td>27.2</td>
</tr>
<tr>
<td>4 lb/ton Naturox™</td>
<td></td>
<td>25.1</td>
<td>26.5</td>
<td>26.2</td>
<td>22.5</td>
<td>23.3</td>
</tr>
<tr>
<td>4 lb/ton Naturox™ R30</td>
<td></td>
<td>24.5</td>
<td>27.7</td>
<td>26.8</td>
<td>21.5</td>
<td>24.4</td>
</tr>
</tbody>
</table>

## Omega-3 Content (% loss) of Salmon Meal

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Storage Time</th>
<th>0 month</th>
<th>3 month</th>
<th>6 month</th>
<th>12 month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td></td>
<td>0.0</td>
<td>44.2</td>
<td>76.5</td>
<td>81.8</td>
</tr>
<tr>
<td>1 lb/ton Ethoxyquin</td>
<td></td>
<td>0.0</td>
<td>-15.2</td>
<td>11.5</td>
<td>7.6</td>
</tr>
<tr>
<td>4 lb/ton Naturox™</td>
<td></td>
<td>0.0</td>
<td>-2.8</td>
<td>18.5</td>
<td>8.7</td>
</tr>
<tr>
<td>4 lb/ton Naturox™ R30</td>
<td></td>
<td>0.0</td>
<td>-8.0</td>
<td>12.3</td>
<td>1.3</td>
</tr>
</tbody>
</table>

![Graph showing Omega-3 Content (%)](image-url)
## Antioxidant Levels

### Antioxidant Level (ppm) of Salmon Meal

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Storage Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 month</td>
</tr>
<tr>
<td>Untreated</td>
<td>0</td>
</tr>
<tr>
<td>1 lb/ton Ethoxyquin</td>
<td>231</td>
</tr>
<tr>
<td>4 lb/ton Naturox™</td>
<td>1886</td>
</tr>
<tr>
<td>4 lb/ton Naturox™ R30</td>
<td>1196</td>
</tr>
</tbody>
</table>

### Antioxidant Level in Salmon Meal

![Antioxidant Level in Salmon Meal](Image)
Proposed Trial Overview

- Why the need for antioxidant trials?
  - Uncertainty of regulatory status of Ethoxyquin in Europe
  - Global market demand for alternatives to Ethoxyquin
  - Growing demand for natural alternatives to synthetics
  - Increased scrutiny on Ethoxyquin residues in human food

- Objectives
  - Can Ethoxyquin levels be effectively reduced?
  - Is there an economically viable synthetic alternative?
  - Validate natural alternative for higher value meals
Antioxidant Criteria

• Effective (self heating and peroxide value control)
• Economical (for synthetic)
• Provide producers with market flexibility
• Broad regulatory approval
• Reactive to potential regulatory changes
• Have clear and concise regulation
Antioxidant Options

- **Current Options**
  - Ethoxyquin (current standard)
  - BHT (approved alternative)
  - Tocopherols (approved Natural alternative)

- **Potential Options**
  - BHA (health concerns)
  - Propyl Gallate (effective on unsaturated oils)
  - TBHQ (lack of broad regulatory approval)
Proposed Trial Overview

• Trial Outline
  o Multiple levels of Ethoxyquin
  o Multiple levels of Ethoxyquin alternative (BHT or BHT/PG blend)
  o Multiple levels of Natural antioxidant
  
  o Test for PV, Anisidine value, FFA, PUFA, antioxidant residuals, and self heating at regular intervals for 12 months
Variables Known to Effect Quality

• Antioxidant Addition
  o Location of addition
  o Method of addition
  o Type of antioxidant

• Fish Variation
  o Seasonal variation
  o Year to Year variation
  o Diet variation
Variable Known to Effect Quality

• Process Conditions
  o Low temp vs High temp production
  o Storage temp
  o Storage method – bulk vs bagged
  o Process changes

• Raw Material
  o Freshness
  o Composition
  o Solubles and/or sludge inclusion
  o Quality – FFA profile and content, Aw content
Summary

- Until recently self-heating characteristics were the primary concern
- Since 1995 Kemin has successfully stabilized nearly 500,000 tons of fishmeal with Naturox™
- Successfully stabilized salmon (wild and farmed), menhaden, capelin, anchovy, herring, sardine, mackerel, and catfish
- Many petfood companies instituted more rigid PV requirements on fishmeal in 2014
- Preliminary research suggests addition botanical extracts can help manage PVs
- Trial should take into consideration global needs from a regulatory and marketing perspective
THANK YOU

Contact Information:
Jim Mann
Kemin Nutrisurance
Jim.Mann@Kemin.com
(515) 240- 0624