Review Issue Mutakhir Keamanan Pangan (Kimia)

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Agenda

Kasus Penolakan Ekspor
Chemicals in Food
Food Additives
Kontaminan
Bahan Kimia Berbahaya
Number of US&EU rejections of food and feed exports from third countries, 2002-2008

Reasons for US&EU rejections of food and feed exports from Indonesia, 2002-2008

Source: UNIDO 2010. Meeting Standards-Winning Markets
FDA Refusals of Imported Food Products by Country and Category, 2005–2013

John Bovay

Table 1
Number of shipments in violation, by year and by industry, 2005-2013

<table>
<thead>
<tr>
<th>Industry</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>Total shipments refused</th>
<th>Total violations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fishery and seafood products</td>
<td>1,871</td>
<td>1,741</td>
<td>1,765</td>
<td>1,745</td>
<td>1,688</td>
<td>2,101</td>
<td>2,857</td>
<td>2,551</td>
<td>1,661</td>
<td>17,980</td>
<td>23,398</td>
</tr>
<tr>
<td>Vegetables and vegetable products</td>
<td>2,296</td>
<td>1,898</td>
<td>1,770</td>
<td>1,221</td>
<td>1,217</td>
<td>1,342</td>
<td>1,447</td>
<td>1,321</td>
<td>1,618</td>
<td>14,130</td>
<td>19,987</td>
</tr>
<tr>
<td>Fruit and fruit products</td>
<td>799</td>
<td>895</td>
<td>985</td>
<td>739</td>
<td>921</td>
<td>1,106</td>
<td>1,498</td>
<td>1,140</td>
<td>1,099</td>
<td>9,182</td>
<td>15,138</td>
</tr>
<tr>
<td>Spices, flavors, and salts</td>
<td>400</td>
<td>521</td>
<td>636</td>
<td>968</td>
<td>631</td>
<td>1,136</td>
<td>933</td>
<td>857</td>
<td>695</td>
<td>6,777</td>
<td>9,160</td>
</tr>
</tbody>
</table>
CHEMICALS IN FOOD

1. Food additives
2. Pesticides
3. Veterinary Drug Residue
4. Contaminants

WHO, 2009
FOOD ADDITIVES

• A food additive may be a single chemical substance, a manufactured chemical mixture or a natural product.
• Those that are added directly to a food to accomplish a technical effect (e.g. a preservative or colour).

PESTICIDES

• Any substance or mixture of substances intended for preventing, destroying or controlling any pest, including vectors of human or animal disease, unwanted species of plants or animals causing harm during or otherwise interfering with the production, processing, storage, transport or marketing of food, agricultural commodities, wood and wood products or animal feedstuffs, or substances which may be administered to animals for the control of insects, arachnids or other pests in or on their bodies.
• The term includes substances intended for use as a plant growth regulator, defoliant, desiccant or agent for thinning fruit or preventing the premature fall of fruit.
• Also used as substances applied to crops either before or after harvest to protect the commodity from deterioration during storage and transport.
Issues of Pesticide

• 2,3,7,8-Tetrakhlorobenzo-p-dioksida (TCDD)- Dioksin
  – Polutan lingkungan, herbisida (2,4,5-T)
  – Masuk ke makanan melalui:
    (1) penyemprotan tanaman dengan 2,4,5-T
    (2) pakan terkontaminasi yang dikonsumsi ternak
    (3) kontaminasi buah dan sayuran yang berdekatan dengan tempat pembakaran

ADI 10 pg = 10^{-11} g/kgBB/hari (WHO)
Veterinary drugs cover a broad range of chemical structures and usually undergo metabolism after administration to an animal.

Modes of administration include injection, implantation, dermal application by spray or pour-on, and inclusion in feed or water, all of which may result in different rates of absorption, with possible differences in the tissue distribution and nature of the residues.
Issues of Veterinary Drug Residue

Antibiotics in Seafood from Southeast Asia-U.S.

- Approximately 80% of the seafood bought in the U.S. is imported. Most of the imported shrimp comes from places such as Thailand, China, the Gulf of Mexico and other Asian countries.
- Chloramphenicol was found in imported Thailand, Vietnam and Chinese shrimp and crawfish (2002).
- Indonesia’s shrimps were found to be infected by viruses and contaminated by chloramphenicol (2004).
- Chloramphenicol is routinely found in imported shrimp (2004).
- Among 2% of imports tested by FDA, 10% of the samples have been tainted with Chloramphenicol (2007).
- FDA detected malachite green in seafood from China (2006).
- FDA blocked the importation of several varieties of seafood due to continued malachite green contamination (2007).

Antibiotics in Seafood from Southeast Asia-International

- EU food authorities detected unacceptable levels of chloramphenicol in imported shrimp from China, Vietnam, Indonesia, Thailand and India (2001).
- EU continues to prohibit Cambodian seafood exports from entering Europe (2005).
- EU decertified all shrimp from Pakistan (2007).
- Canada imposed a 100 percent inspection policy on seafood exports from Vietnam after Vietnamese seafood products repeatedly tested positive for chloramphenicol (from 2003 to 2005). Japan did it in 2006 and Russia in 2007.
Contaminants in the diet may include:

- environmental pollutants, such as heavy metals and industrial chemicals,
- mycotoxins,
- migrants from packaging materials,
- other substances not authorized for use in food.

Chemical Contaminants

- Heavy metal:
  - Hg (MeHg) in fish
  - Arsenic in rice
- Benzena
- Acrylamide
- 3-MCPD and 3-MCPD ester
- Other substances not authorized for use in food

Emerging chemical food safety
Trace Element and Heavy Metal

- **Trace element**: is an element in a sample that has an average concentration of less than 100 ppm measured in atomic count or less than 100 micrograms per gram.
- V, Cr, Mn, Co, Cu, Zn, Se, Rb, Sr, Mo, Ag, Cd, Sn, Sb, Cs, Ba, Hg, Tl, Pb and Bi

What is a heavy metal?

- The term **heavy metal** refers to any metallic chemical element that has a relatively high density and is toxic or poisonous at low concentrations.
- Heavy metals are conventionally defined as elements with metallic properties and an atomic number >20.
- The most common heavy metal contaminants are Cd, Cr, Cu, Hg, Pb, and Zn.
### Arsenic in Rice

#### Arsenic specification

There are a lot of different arsenic compounds in the environment.

<table>
<thead>
<tr>
<th>Inorganic</th>
<th>Organic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic bonded to oxygen and/or sulfur or hydrogen.</td>
<td>Arsenic bonded to carbon and/or oxygen or hydrogen</td>
</tr>
<tr>
<td>( \text{As}_2\text{O}_5 )</td>
<td>( \text{H}_3\text{AsO}_4 ) arsenate</td>
</tr>
<tr>
<td>( \text{As}_2\text{O}_3 )</td>
<td>( \text{H}_3\text{AsO}_3 ) arsenite</td>
</tr>
<tr>
<td>( \text{AsH}_3 )</td>
<td>arsine</td>
</tr>
</tbody>
</table>


*Heitkemper and colleagues at USFDA Cincinnati*

The average total content was 210 µg kg\(^{-1}\).

Regardless of total content, inorganic arsenic rarely exceeded 150 µg kg\(^{-1}\).

Arsenic content in US rice has been relatively constant over the past 30 years.
What do other researchers find about arsenic in rice?


Geographical Variation in Total and Inorganic Arsenic Content of Polished (White) Rice

Meharg and colleagues at the University of Aberdeen

TABLE 1: Descriptive Statistics of Total Arsenic and Inorganic Arsenic Contents in White Rice Produced in Different Countries

<table>
<thead>
<tr>
<th>Location</th>
<th>Average Total</th>
<th>Max total</th>
<th>Average inorganic</th>
<th>Max inorganic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>130</td>
<td>330</td>
<td>80</td>
<td>210</td>
</tr>
<tr>
<td>China</td>
<td>140</td>
<td>460</td>
<td>160</td>
<td>380</td>
</tr>
<tr>
<td>Egypt</td>
<td>50</td>
<td>580</td>
<td>No data</td>
<td>No data</td>
</tr>
<tr>
<td>France</td>
<td>280</td>
<td>560</td>
<td>No data</td>
<td>No data</td>
</tr>
<tr>
<td>India</td>
<td>70</td>
<td>180</td>
<td>30</td>
<td>70</td>
</tr>
<tr>
<td>Italy</td>
<td>150</td>
<td>330</td>
<td>110</td>
<td>160</td>
</tr>
<tr>
<td>Japan</td>
<td>190</td>
<td>420</td>
<td>No data</td>
<td>No data</td>
</tr>
<tr>
<td>Spain</td>
<td>200</td>
<td>820</td>
<td>No data</td>
<td>No data</td>
</tr>
<tr>
<td>Thailand</td>
<td>140</td>
<td>390</td>
<td>No data</td>
<td>No data</td>
</tr>
<tr>
<td>USA</td>
<td>250</td>
<td>660</td>
<td>100</td>
<td>150</td>
</tr>
</tbody>
</table>
How much arsenic is considered safe?
How much inorganic arsenic is considered safe?

Food: No US guideline value.
Drinking water: US EPA 10 µg L\(^{-1}\) (ppb)

Joint FAO/WHO expert committee on food additives, seventy-second meeting, Rome, 16–25 February 2010, summary and conclusions Issued 16th March 2010
http://www.who.int/foodsafety/chem/summary72_rev.pdf

The limit for dietary inorganic arsenic exposure is:

3.0 µg per kg body weight per day

Mercury Hotspots in Indonesia
The Mercury Cycle

Mercury (Hg) cycles from Earth to atmosphere to oceans and back to Earth. In the ocean, mercury is converted to monomethyl mercury (MMHg), a neurotoxin that moves up the food chain and becomes highly concentrated in tuna, swordfish, and other fish that people eat.

How mercury enters the air

Air-See Interaction

Dental amalgams

Thermometers, Barometers, etc

- Mining
- Fossil fuel combustion
- Waste incineration
- Industrial processes

Mercury in food

Mercury in air

Mercury in water

Transformation by microorganisms and bioaccumulation in aquatic species

Humans

Figure 1. The main pathways of exposure to mercury
Formalin

Water solution with 40% formaldehyde by volume or 37% by mass is called “100% Formalin”
Naturally Occurring Formaldehyde

- Normal physiological substance
  - Endogenous formaldehyde 3-12ng/g tissue
  - Liver 22mg/min
- Essential for protein synthesis
- Normal part of Lipid Metabolism
## Formaldehyde

- Sunlight and bacteria in the environment break down formaldehyde
- The human body quickly metabolizes formaldehyde converting it into formic acid
- Formic acid in large amounts and concentrations can be harmful
- Ant bites contain formic acid

\[
\text{HCO}_2\text{H}
\]

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### Foods Known to Contain Naturally Occurring Formaldehyde

1. Fruits and Vegetables
2. Meat and Meat Products
3. Dairy Products
4. Seafood
5. Others
<table>
<thead>
<tr>
<th>Food Type</th>
<th>Level (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple</td>
<td>6.3 - 22.3</td>
</tr>
<tr>
<td>Apricot</td>
<td>9.5</td>
</tr>
<tr>
<td>Banana</td>
<td>16.3</td>
</tr>
<tr>
<td>Beetroot</td>
<td>35</td>
</tr>
<tr>
<td>Bulb vegetables (e.g. onion)</td>
<td>11.0</td>
</tr>
<tr>
<td>Cabbage</td>
<td>5.3</td>
</tr>
<tr>
<td>Carrot</td>
<td>6.7 - 10</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>26.9</td>
</tr>
<tr>
<td>Cucumber</td>
<td>2.3 - 3.7</td>
</tr>
<tr>
<td>Grape</td>
<td>22.4</td>
</tr>
<tr>
<td>Green onion</td>
<td>13.3 - 26.3</td>
</tr>
<tr>
<td>Kohlrabi</td>
<td>31</td>
</tr>
<tr>
<td>Pear</td>
<td>38.7 - 60</td>
</tr>
<tr>
<td>Plum</td>
<td>11.2</td>
</tr>
<tr>
<td>Potato</td>
<td>19.5</td>
</tr>
<tr>
<td>Spinach</td>
<td>3.3 - 7.3</td>
</tr>
<tr>
<td>Tomato</td>
<td>5.7 - 13.3</td>
</tr>
<tr>
<td>Water melon</td>
<td>9.2</td>
</tr>
<tr>
<td>White radish</td>
<td>3.7 - 4.4</td>
</tr>
<tr>
<td>Shiitake mushroom (dried)</td>
<td>100 - 406</td>
</tr>
<tr>
<td>Shiitake mushroom (raw)</td>
<td>6 - 54.4</td>
</tr>
</tbody>
</table>

Assessment of formaldehyde levels in local and imported fresh fish in Ghana: a case study in the Tamale Metropolis of Ghana.

Saba CK1, Atayure SI2, Asiedu P3.

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Abstract

Fish is an important source of protein all over the world, including in Ghana. The fishery sector plays a major role in meeting the domestic need of animal protein and also contributes greatly in foreign exchange earnings. The domestic supply of fish does not meet the demand, so Ghana imports fish and fish products from other countries. Media reports in Ghana have alleged the use of formaldehyde to preserve fish for increased shelf life and to maintain freshness. This research, therefore, sought to establish the levels of formaldehyde in imported and local fresh fish in the Tamale Metropolis by using a ChemSee formaldehyde and formalin detection test kit. Positive and negative controls were performed by using various concentrations of formalin (1, 10, 30, 50, 100, and 300 ppm) and sterile distilled water, respectively. Three times over a 6-month period, different fish species were obtained from five wholesale cold stores (where fish are sold in cartons) and some local sales points (where locally caught fish are sold). A total of 32 samples were taken during three different sampling sessions: 23 imported fish (mackerel, herring, horse mackerel, salmon, and redfish) and 9 local tilapia. The fish were cut, and 50 g was weighed and blended with an equal volume (50 ml) of sterile distilled water. Samples were transferred to test tubes and centrifuged. A test strip was dipped into the supernatant and observed for a color change. A change in color from white to pink or purple indicated the presence of formaldehyde in fish. The study showed that no formaldehyde was present in the imported and local fish obtained. The appropriate regulatory agencies should carry out this study regularly to ensure that fish consumed in Ghana is safe for consumption.
Formaldehyd pada Pangan

1. Pangan positif uji formalin → **aman**, tidak diperlukan tindak lanjut penegakan hukum
   Contoh: pangan hasil fermentasi (tempe, roti, tauco)

2. Pangan positif uji formalin → **diduga pelanggaran**, perlu uji lanjut secara kuantitatif
   Contoh: buahan, sayuran, ikan segar

3. Pangan positif uji formalin → **pelanggaran**, langsung tindak lanjut penegakan hukum
   Contoh: tahu, mie basah matang, otak-otak, bakso dll

*Other substances not authorized for use in food*
A Risk-Based Strategy for Evaluating Mitigation Options for Process-Formed Compounds in Food: Workshop Proceedings

Paul Hanlon¹, Gregory P. Brorby², and Mansi Krishan³
Any other chemicals in food need to be discussed?
terimakasih