

Thailand

Jariya Pucharoen

Food technologist

Samutsakorn Fish Inspection and Research Center

Fish Inspection and Quality Control Division

Department of Fisheries

Ministry of Agriculture and Cooperatives

e-mail : jpucharoen1@yahoo.com

1. Introduction

Heavy metals are individual metals and metal compounds that negatively affect people's health. In very small amounts, many of these metals are necessary to support life. However, in larger amounts, they become toxic. They may build up in biological systems and become a significant health hazard. Therefore the maximum levels for some heavy metals such as Cadmium, Lead and Mercury in food products are set in many countries. To manage the safety of food products, the science-based knowledge of these heavy metals should be known.

2. Objectives And Goals

To obtain an understanding of the level of heavy metals (Cadmium, Lead and total Mercury) in fish and fish products.

3. Survey Methodologies

a. Sampling Method, Location, Species, Number of Samples and Sampling Size

Frozen cuttlefish (*Sepia* spp.), frozen baby octopus (*Octopus* spp.), frozen squid (*Loligo* spp.), canned skipjack (*Katsuwonus pelamis*), canned albacore (*Thunnus alalunga*), canned yellowfin (*Thunnus albacares*), frozen vannamei shrimp (*Penaeus vannamei*), frozen nile tilapia (*Tilapia nilotica*), canned sardinella (*Sardinella gibbosa*), frozen baby clam (*Paphia undulata*), frozen green mussel (*Perna viridis*), frozen salmon (*Salmon*

oncorhynchusketa), frozen ribbon fish (*Trichiurus affinis*) and frozen imitation crabmeat (*Nemipterus* spp.) were collected from the factories in Samutsakorn province. After sampling, frozen samples were packed in plastic bags and sent to the laboratory. Samples were kept at -18°C if they were not analyzed immediately.

b. Method of Analysis

The samples were analyzed for Cadmium, Lead and total Mercury at the Samutsakorn Fish Inspection and Research Center. About 300g of the edible part of sample was blended and analyzed according to the method as in Appendix 1. Graphite furnace AAS (Brand: Perkin Elmer) was used for Cadmium and Lead while the cold vapor mercury analyzer (Brand: Perkin Elmer) was used for total Mercury.

c. Limit of Detection and Limit of Quantification

Limit of Detection of method is 0.01 ppm for Cadmium, Lead and total Mercury.

Limit of Quantification of method is 0.04 ppm for Cadmium and 0.05 ppm for Lead and total Mercury.

d. National Regulatory Limits

The regulatory limit of each contaminant is dependent on the type of product and the importing country. Information is available at the website: www.fisheries.go.th.

4. Results And Discussion

a. Participation in Inter-laboratory Proficiency Testing and Results

Year of participation	Program Name	Analyte Tested	Reported results (ppm)	True value (ppm)	z-score	Remarks
2007	FAPAS	Cadmium	0.048	0.052	- 0.4	Passed
	APLAC	Cadmium	0.187	0.187	0.01	Passed
	APLAC	Lead	1.110	1.195	- 0.20	Passed
	FAPAS	Total mercury	0.051	0.053	- 0.2	Passed
	FAPAS	Total mercury	0.524	0.704	- 1.5	Passed

b. Survey Results and Discussion

Year of analysis & Sampling location	Analyte	Fish sample analysed		No. of samples analysed	Min. value of results (ppm) – wet weight basis	Max. value of results (ppm) – wet weight basis	Average value of results (ppm) – wet weight basis	Average Recovery (%)
		Common name	Scientific name					
2005 Samutsakorn province	Cadmium	Frozen cuttlefish	<i>Sepia</i> spp.	24	0.02 Detected but not quantifiable	0.90	0.36	103
		Frozen octopus	<i>Octopus</i> spp.	24	0.04	0.94	0.31	104
		Frozen squid	<i>Loligo</i> spp.	24	0.04	0.54	0.18	103
	Total Mercury	Frozen cuttlefish	<i>Sepia</i> spp.	24	Not detected	0.05	0.02 Detected but not quantifiable	97
		Frozen octopus	<i>Octopus</i> spp.	24	Not detected	0.08	0.02 Detected but not quantifiable	96
		Frozen squid	<i>Loligo</i> spp.	24	Not detected	0.04 Detected but not quantifiable	0.02 Detected but not quantifiable	97
	Lead	Frozen cuttlefish	<i>Sepia</i> spp.	24	Not detected	0.14	0.03 Detected but not quantifiable	94
		Frozen octopus	<i>Octopus</i> spp.	24	Not detected	0.09	0.02 Detected but not quantifiable	92
		Frozen squid	<i>Loligo</i> spp.	24	Not detected	0.11	0.02 Detected but not quantifiable	93

Year of analysis & Sampling location	Analyte	Fish sample analysed		No. of samples analysed	Min. value of results (ppm) – wet weight basis	Max. value of results (ppm) – wet weight basis	Average value of results (ppm) – wet weight basis	Average Recovery (%)
		Common name	Scientific name					
2006 Samutsakorn province	Cadmium	Canned skipjack	<i>Katsuwonus pelamis</i>	21	Not detected	0.06	0.02 Detected but not quantifiable	104
		Canned albacore	<i>Thunnus alalunga</i>	21	Not detected	0.03 Detected but not quantifiable	0.01 Detected but not quantifiable	102
		Canned yellowfin	<i>Thunnus albacares</i>	20	Not detected	0.02 Detected but not quantifiable	0.01 Detected but not quantifiable	105
		Frozen vannamei shrimp	<i>Penaeus vannamei</i>	21	Not detected	0.02 Detected but not quantifiable	Not detected	106
	Total Mercury	Canned skipjack	<i>Katsuwonus pelamis</i>	21	0.01 Detected but not quantifiable	0.26	0.08	97
		Canned albacore	<i>Thunnus alalunga</i>	21	0.12	0.54	0.28	99
		Canned yellowfin	<i>Thunnus albacares</i>	20	0.02 Detected but not quantifiable	0.17	0.07	95
		Frozen vannamei shrimp	<i>Penaeus vannamei</i>	21	Not detected	0.02 Detected but not quantifiable	0.01 Detected but not quantifiable	96
	Lead	Canned skipjack	<i>Katsuwonus pelamis</i>	21	Not detected	0.09	0.02 Detected but not quantifiable	94
		Canned albacore	<i>Thunnus alalunga</i>	21	Not detected	0.09	0.01 Detected but not quantifiable	93
		Canned yellowfin	<i>Thunnus albacares</i>	20	Not detected	0.07	0.02 Detected but not quantifiable	92
		Frozen vannamei shrimp	<i>Penaeus vannamei</i>	21	Not detected	0.06 Detected but not quantifiable	Not detected	92

Year of analysis & Sampling location	Analyte	Fish sample analysed		No. of samples analysed	Min. value of results (ppm) – wet weight basis	Max. value of results (ppm) – wet weight basis	Average value of results (ppm) – wet weight basis	Average Recovery (%)
		Common name	Scientific name					
2007 Samutsakorn province	Cadmium	Frozen Nile tilapia	<i>Tilapia nilotica</i>	22	Not detected	0.01 Detected but not quantifiable	Not detected	96
		Canned sardinella	<i>Sardinella gibbosa</i>	23	0.01 Detected but not quantifiable	0.10	0.03 Detected but not quantifiable	100
		Frozen baby clam	<i>Paphia undulata</i>	25	0.02 Detected but not quantifiable	0.35	0.12	96
		Frozen green mussel	<i>Perna viridis</i>	26	0.02 Detected but not quantifiable	0.79	0.10	94
	Total Mercury	Frozen Nile tilapia	<i>Tilapia nilotica</i>	22	Not detected	0.07	0.01 Detected but not quantifiable	88
		Canned sardinella	<i>Sardinella gibbosa</i>	23	Not detected	0.04 Detected but not quantifiable	0.02 Detected but not quantifiable	94
		Frozen baby clam	<i>Paphia undulata</i>	25	Not detected	0.06	0.01 Detected but not quantifiable	94
		Frozen green mussel	<i>Perna viridis</i>	26	Not detected	0.07	0.03 Detected but not quantifiable	98
	Lead	Frozen Nile tilapia	<i>Tilapia nilotica</i>	22	Not detected	0.03 Detected but not quantifiable	Not detected	92
		Canned sardinella	<i>Sardinella gibbosa</i>	23	Not detected	0.24	0.04 Detected but not quantifiable	88
		Frozen baby clam	<i>Paphia undulata</i>	25	Not detected	0.33	0.14	89
		Frozen green mussel	<i>Perna viridis</i>	26	Not detected	0.31	0.10	85

Year of analysis & Sampling location	Analyte	Fish sample analysed		No. of samples analysed	Min. value of results (ppm) – wet weight basis	Max. value of results (ppm) – wet weight basis	Average value of results (ppm) – wet weight basis	Average Recovery (%)
		Common name	Scientific name					
2008 Samutsakorn province	Cadmium	Frozen salmon	<i>Oncorhynchus keta</i>	14	Not detected	0.05	0.01 Detected but not quantifiable	98
		Frozen ribbon fish	<i>Trichiurus sp.</i>	13	Not detected	0.05	0.02 Detected but not quantifiable	98
		Frozen imitation crab meat	<i>Nemipterus spp.</i>	29	Not detected	0.03 Detected but not quantifiable	0.01 Detected but not quantifiable	97
	Total Mercury	Frozen salmon	<i>Oncorhynchus keta</i>	14	Not detected	0.05	0.02 Detected but not quantifiable	88
		Frozen ribbon fish	<i>Trichiurus spp.</i>	13	0.01 Detected but not quantifiable	0.06	0.03 Detected but not quantifiable	89
		Frozen imitation crab meat	<i>Nemipterus spp.</i>	29	Not detected	0.09	0.03 Detected but not quantifiable	88
	Lead	Frozen salmon	<i>Oncorhynchus keta</i>	14	Not detected	0.05	0.01 Detected but not quantifiable	91
		Frozen ribbon fish	<i>Trichiurus sp.</i>	13	Not detected	0.14	0.03 Detected but not quantifiable	86
		Frozen imitation crab meat	<i>Nemipterus spp.</i>	29	Not detected	0.17	0.02 Detected but not quantifiable	89

c. Corrective Actions (if applicable)

No corrective action was taken as no results were found to exceed the regulations limits. However, in case of exceeding the importing country regulation, that lot of product will be rejected for export. The processor will be required to identify any other products that were produced from the same lot of raw material and provide a corrective action plan. A follow-up at plant may be deemed necessary in some cases. If the processor could not bring its system to comply with the safety requirement, the processor will be suspended for export. The processor will be withdrawn from the

Department of Fisheries list of approved fishery establishment when the offence is repeated.

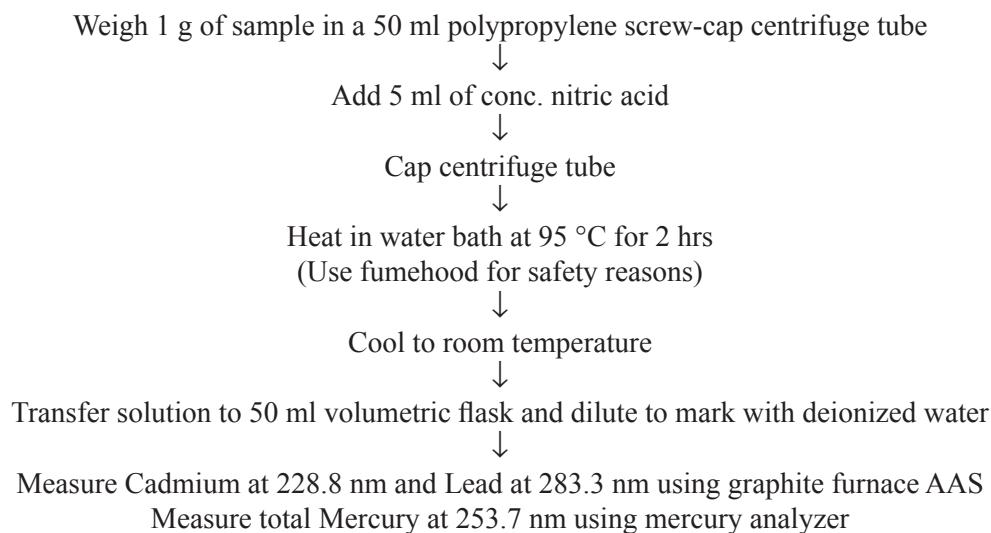
5. Problems and Challenges Encountered

The equipment is sometimes out of order.

6. Recommendations and Suggestions for Future Follow up Action

The fund should be given at the beginning of the year because it is easier to plan and conduct the activity.

Method of Analysis



Calculations

$$\text{Heavy metal (ppm)} = C \times 0.05 / W$$

C = Concentration of heavy metal from calibration curve (ug/L)

W = Sample weight (g)

References :

1. Official Methods of Analysis of AOAC International 18th edition. 2005. Chapter 9. Metals and other elements. 9.1.08. AOAC Official method 999.10. p. 16-19
2. Official Methods of Analysis of AOAC International 18th edition. 2005. Chapter 9. Metals and other elements. 9.2.24. AOAC Official method 974.14. p. 37.