METHOD DEVELOPMENT FOR THE SIMULTANEOUS DETERMINATION OF METHYLMERCURY AND INORGANIC MERCURY IN SEAFOOD

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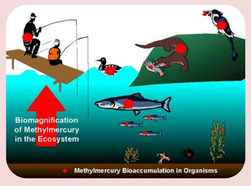
INTRODUCTION

- Mercury is a well-known pollutant due to the high toxicity of its species. All Hg forms are toxic, but the organic species are more toxic than the inorganic ones, so it is important to identify the species in the environment. Methylmercury is the most toxic species among the organic group. MeHg bioaccumulates in the food chain, with its concentration higher in fish than in water. Seafood is responsible for the highest source of Hg, especially MeHg, so, it can arrive to the human through the food chain. Predatory fish or animals that eat fish, accumulate more Hg.
- Maximum levels of Hg permited:
  - Codex Stan 193-1995 → Fish: 0.5 mg kg^{-1} for MeHg; Predatory fish: 1 mg kg^{-1} for MeHg.
  - EFSA → TWI: 1.3 µg kg^{-1} of MeHg (body weight).
  - Commission Regulation (EC) Nº 1881/2006 → 0.5 mg kg^{-1}; 1 mg kg^{-1} for total Hg, according to seafood type.
  - Brazilian Normative Instruction Nº14 → Fish farming: 0.5 mg kg^{-1} for total Hg; Predatory fish: 1 mg kg^{-1} for total Hg.



OBJECTIVES

- Determination of total Hg and speciation in seafood samples comprising fish, crustaceans and bivalves.
- Extraction, identification and quantification of MeHg, the most toxic form, which was selectively separated and determined by LC-UV-CV-AFS.

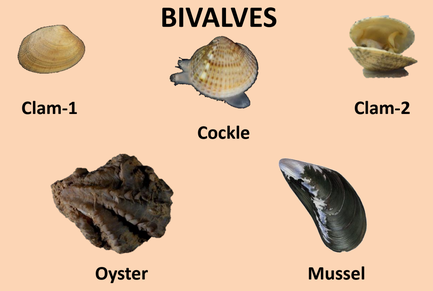
EXPERIMENTAL

SAMPLES: 24

CRUSTACEANS

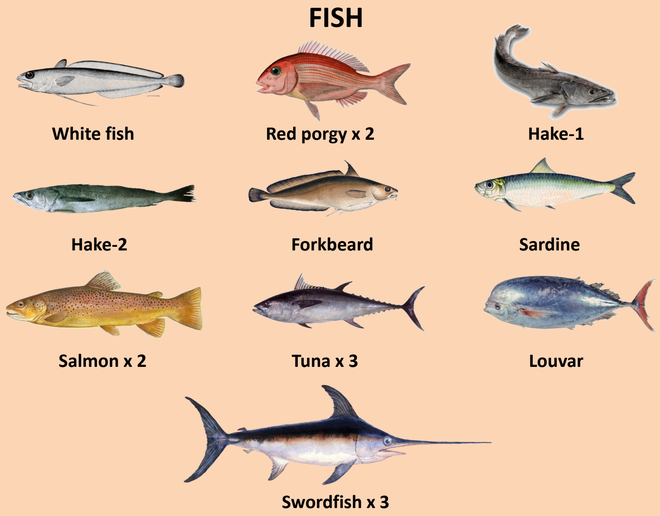
Prawn-1 | Shrimp | Prawn-2

BIVALVES



Clam-1 | Cockle | Clam-2 | Oyster | Mussel

FISH



White fish | Red porgy x 2 | Hake-1 | Hake-2 | Forkbeard | Sardine | Salmon x 2 | Tuna x 3 | Louvar | Swordfish x 3

TOTAL AND SPECIATION ANALISIS

QUALITY PARAMETERS: CRM

- ✓ DOLT-4:  Dogfish liver
- ✓ TORT-2:  Lobster hepatopancreas
- ✓ BCR-463:  Tuna fish

TOTAL: Microwave acidic digestion - ICPMS

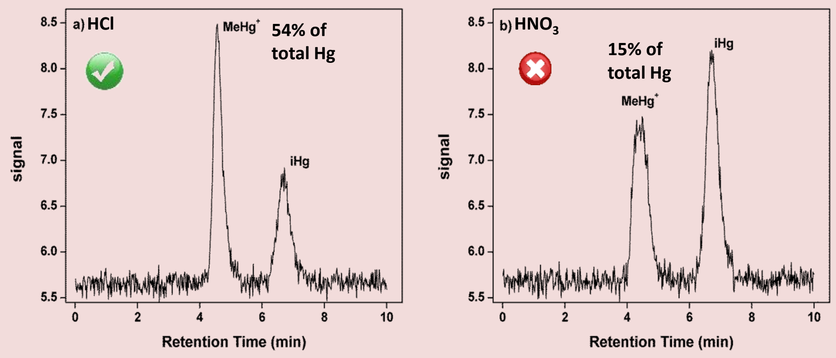
SPECIATION: Microwave assisted extraction – LC-UV-CV-AFS

- ✓ Mobile phase: 20% solution APDC 0.0015M and NH_3CH_3COO 0.01M; pH 5.5 and 80% MeOH for MeHg and Hg(II) separation
- ✓ Stationary phase: C18 column ODS Hypersyl 250 x 4.6 mm

RESULTS

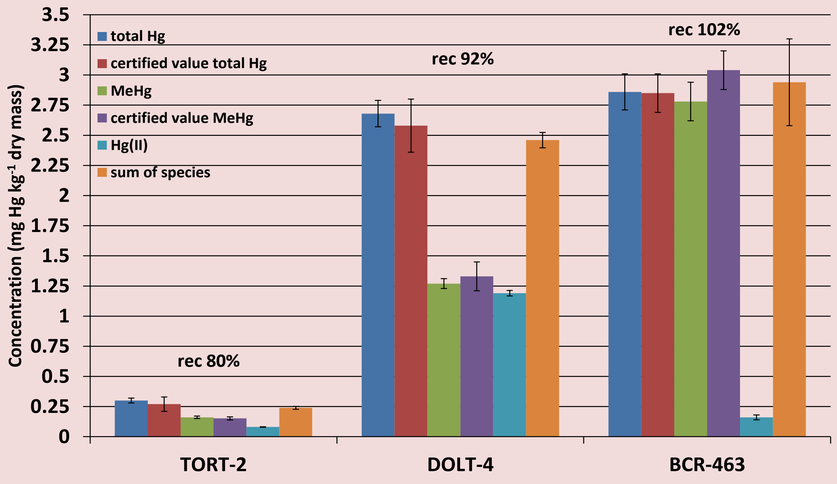
❖ Selection of extractant agent

DOLT-4 → MeHg is around 50% of total Hg

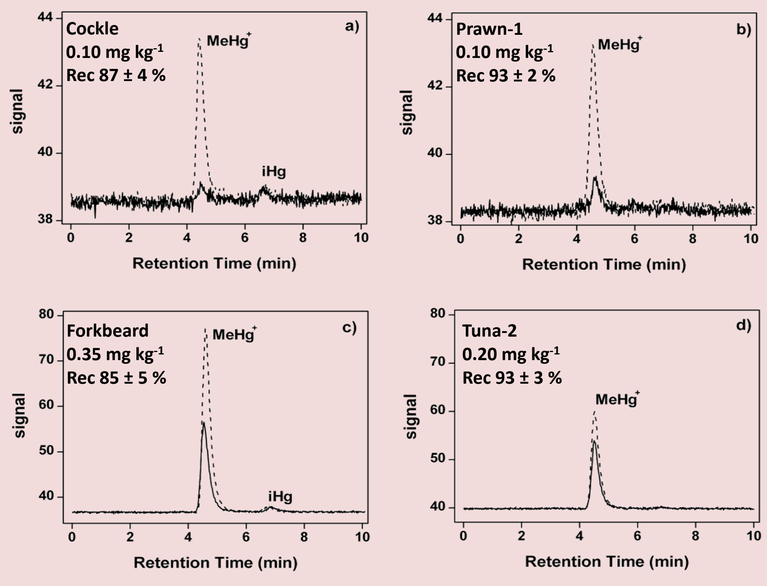


❖ Quality parameters

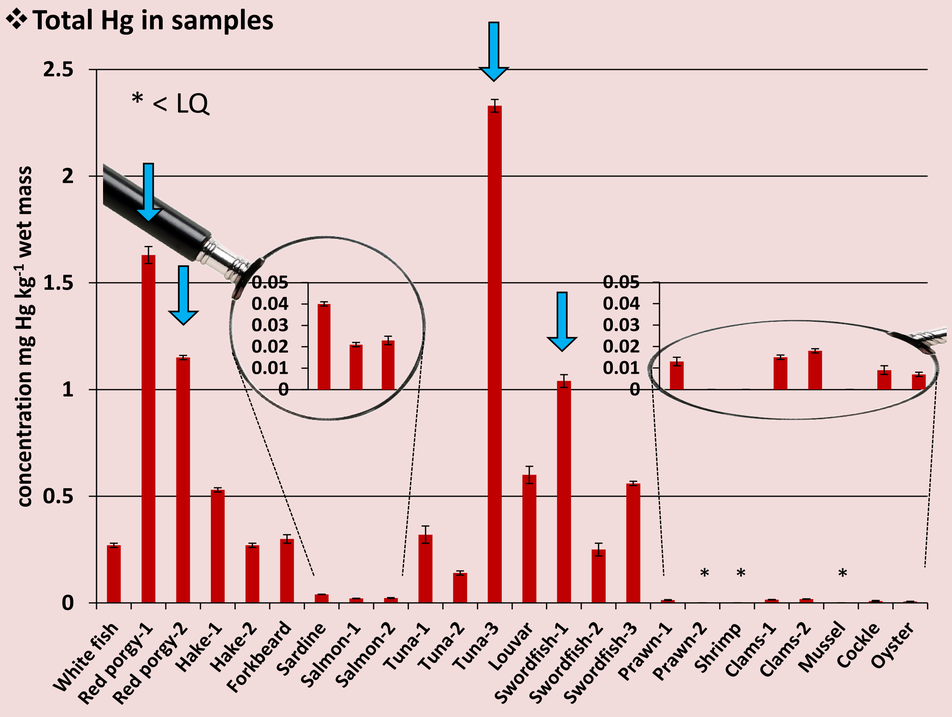
➢ Total and speciation in CRMs



➢ Recovery studies

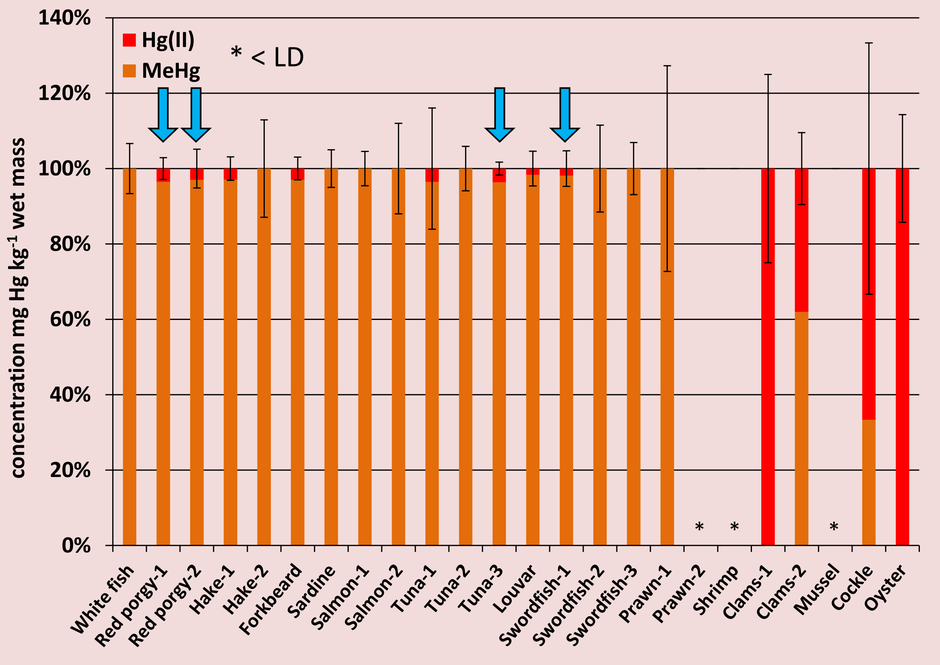


❖ Total Hg in samples



- ✓ Fish → mean Hg: 0.59 mg kg^{-1}
- ✓ Crustaceans and bivalves → mean Hg: 0.012 mg kg^{-1}
- ✓ Fish ↑ Hg
- → Exceed the maximum limit established

❖ Hg species in samples



- ✓ MeHg predominant in fish
- ✓ Hg(II) predominant species in shellfish
- ✓ ↑↑ MeHg in predatory fish (fat content)
- → Exceed the maximum limit established

CONCLUSIONS

- The present method could be a valuable tool for food control laboratories that assess MeHg in seafood samples (fish and shellfish).
- Four samples (red porgy-1 and 2, tuna-3 and swordfish-1, fish at the top of the chain food) present Hg concentration above the limits established. MeHg was the predominant species in all fish samples whereas Hg(II) was predominant in shellfish.
- Great variability in Hg species found in seafood reaffirm the need to monitor MeHg concentrations for food safety reasons.

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