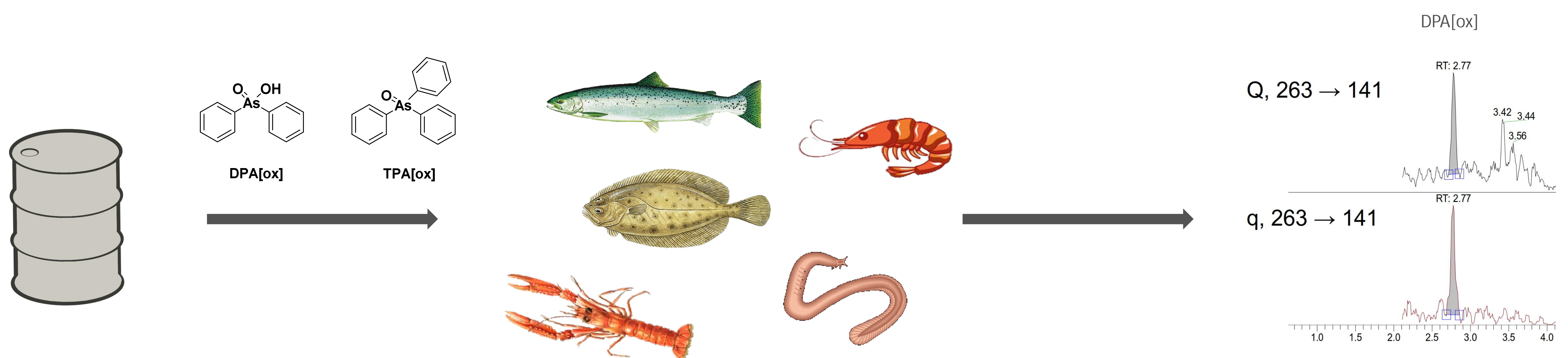


Detection of Chemical Warfare Agent-Related Phenylarsenic Chemicals From Different Marine Biota Samples

Hanna Niemikoski, Tomi Rautanen, Paula Vanninen

VERIFIN, Finnish Institute for Verification of the Chemical Weapons Convention, University of Helsinki, Finland



BACKGROUND

After World War II, disposal of chemical warfare agents (CWAs) began by sea-dumping. Hundreds of thousands of tonnes of chemical ammunitions were dumped in the Baltic Sea and Skagerrak area between Norway and Denmark. During previous international projects investigations have shown that sediment samples collected near dumping areas are contaminated with CWAs as a result of leaking containers. These leaking toxic chemicals are posing a threat to marine environment. In aqueous environment CWA-related phenylarsenic chemicals degrade forming hydrolysis and oxidation products.

There are hardly any previous studies of possible uptake of CWA-related chemicals by marine biota. During DAIMON project novel methods for detection of phenylarsenic chemicals from fish muscle, gills and liver samples were developed. Quantitative analysis of these chemicals and their degradation products are needed to prove the presence of these products in aquatic biota in order to support risk assessment for possible accumulation in food chain.

RESULTS

Totally 187 marine biota samples (eg. cod, saithe, flatfish, lobster, shrimp, hagfish) were collected from three different dumping areas in the Baltic Sea and North Sea and analysed. Also 120 cod samples from the Gdansk deep reference area were analysed for CWA-related phenylarsenic chemicals. 25 % of analysed fish muscle samples contained CWA-related phenylarsenic chemicals, diphenylarsinic acid DPA[ox] and triphenylarsine oxide TPA[ox]. Concentrations of detected chemicals were at parts per billion (ppb, ng/g) concentration levels. This is the first time when CWA-related chemicals have been detected from marine biota species which are widely used as human nutrition. CWA-related phenylarsenic chemicals have been detected from marine biota samples as their pentavalent oxidation state. Due to the lack of information regarding how these agents behave in living organism it is impossible to predict interactions or transformations of these chemicals. Based on that, more information is needed to elucidate total concentrations of CWA-related phenylarsenic chemicals in marine biota samples.

Key observations

- CWA-related phenylarsenic chemicals are accumulating in marine biota tissues
- 25 % of analysed fish muscle tissues have contained CWAs
- Chemicals are also accumulating in fish liver
- Total phenylarsenic CWA concentrations in marine biota are still unknown
→ information about metabolism and toxicities are essential

Sea-dumped chemical munitions

Corrosion, leaking

Accumulation in Marine Biota

