Iodine in marine samples - Determination of Iodine and Iodine Compounds in Marine Samples by ICPMS and HPLC-ICPMS

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Publication date:
2014

Document Version
Publisher's PDF, also known as Version of record

Link back to DTU Orbit

Citation (APA):
iodine is an essential element for the human body, why the World Health Organization (WHO) has issued a recommendation that adults should have an intake of 150 µg of iodine/day. Despite this recommendation, it is estimated that 2 billion people worldwide are at risk of developing diseases related to iodine deficiency. A less common iodine-related disease is iodine excess, which is defined as an iodine intake larger than 600 µg iodine/day. In Denmark, analyses previously indicated a iodine deficiency in the population, but in recent years, the intake has increased. This could be due to recommendations of higher intake of fish, which is a good iodine source. Along with fish, seaweed is considered to be a good iodine source.

Previously it has only been the total iodine concentrations that has been measured and not the various iodine compounds, which may have different bioavailability and toxicity. Therefore, there is an increased interest in the development of analytical techniques for the determination of the different iodine compounds.

**INTRODUCTION**

Iodine is an essential element for the human body, why the World Health Organization (WHO) has issued a recommendation that adults should have an intake of 150 µg of iodine/day. Despite this recommendation, it is estimated that 2 billion people worldwide are at risk of developing diseases related to iodine deficiency. A less common iodine-related disease is iodine excess, which is defined as an iodine intake larger than 600 µg iodine/day. In Denmark, analyses previously indicated a iodine deficiency in the population, but in recent years, the intake has increased. This could be due to recommendations of higher intake of fish, which is a good iodine source. Along with fish, seaweed is considered to be a good iodine source.

Previously it has only been the total iodine concentrations that has been measured and not the various iodine compounds, which may have different bioavailability and toxicity. Therefore, there is an increased interest in the development of analytical techniques for the determination of the different iodine compounds.

**TOTAL EXTRACTION**

An experiment to find the most precise and accurate method for total iodine extraction was conducted. Five different methods were tested and the results (Fig. 1) showed that the 15 minutes extraction with ultrasound gave low yields. The 24 hours extraction at 25°C showed varying results and low precision. Finally the extraction at 90°C for 3 hours was chosen based on the best precision and accuracy.

**SAMPLES**

Twenty-four different seaweed samples were collected containing different seaweed species from different geographical areas.

**FISH**

Thirteen fish and shellfish samples from the a Norwegian marine powder company were analyzed.

**DIET EXAMPLE**

- The most precise and accurate extraction for total iodine was 3 hours at 90°C
- The fish and shellfish samples had iodine concentrations between 0.23-40 µg/g
- The seaweed samples had iodine concentrations between 0.5-8400 µg/g
- All the marine samples contained iodide (I-) and diiodotyrosine (DIT) with iodide as the most significant species. The results also showed a great variation in the distribution of moniodotyrosine (MIT) and iodate (IO3-).
- The samples were not quantified because it was observed that a small amount of the previous sample was transferred to the next measurement. This may have occurred due to insufficient cleaning of the needle in the HPLC autosampler.

**RESULTS FOR FISH AND SHELLFISH**

The results for the fish and shellfish showed that shellfish contained higher concentrations of iodine (2.4-40 µg/g) compared with the fish (0.23-7.7 µg/g). In Fig. 2 iodine concentrations are presented together with typical literature values. There was a large difference between these values. This difference could be due to the growth environment.

The results for the seaweed samples showed a larger variety in the iodine concentrations (0.51-8400 µg/g). Fig. 3 shows the concentration for some of the analyzed samples compared with typical literature values. The values found are in general within the range of the values found in the literature. Some values are below average literature values and some are above average literature values.

**RESULTS FOR SEAWEED**

Thirty-two marine samples were extracted with the enzyme pancreatic (extraction efficiency: 37-94%) and then analyzed by using a reversed phase column in a HPLC-ICPMS system. This method showed a good separation of four iodine species within 3.5 minutes (Fig. 4).

The results showed that all the samples contained iodide (I-) and diiodotyrosine (DIT) with iodide as the most significant species. The results also showed a great variation in the distribution of moniodotyrosine (MIT) and iodate (IO3-) in the samples.

**CONCLUSION**

- The most precise and accurate extraction for total iodine was 3 hours at 90°C
- The fish and shellfish samples had iodine concentrations between 0.23-40 µg/g
- The seaweed samples had iodine concentrations between 0.5-8400 µg/g
- All the marine samples contained iodide and DIT
- Notable variation was found in the distribution of iodate and MIT in the samples.

**REFERENCES**

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