Effects of Storage on Amnesic Shellfish Toxins (AST) in King Scallops (Pecten maximus)

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**Background**

Since 1998, king scallops obtained from Scottish offshore sites have been monitored for domoic acid (DA) and epi-DA, the amnesic shellfish toxins (AST) (Gallacher et al., 2000). However, there is limited published information on the effects of storage conditions (e.g., freezing) on concentrations of AST within scallop tissues. The stability of AST under different storage conditions should impact on how samples are managed/stored for both routine monitoring programmes and prior to scientific investigations.

The objective of this study was to assess the effect of freezing whole king scallops (i.e., in their shell) and dissected scallop organs on AST concentrations in different scallop organs and tissue. Scallop were stored frozen for up to 10 days either whole or dissected into the adductor muscle (AM), gonad (GO), and all remaining tissue (RT) – including the hepatopancreas, the outer mantle, and the gills (see Fig. 1). Subsequently, these tissue types from both the whole and dissected animals were analysed for AST content using High Pressure Liquid Chromatography with UV diode array detection (HPLC-UVDAD: Quilliam et al., 1995).

**Methods**

- Scallops naturally contaminated with AST (~280 μg AST·g⁻¹) were collected from the West Coast of Scotland.
- Ten scallops were dissected into three tissue types (AM, GO, and RD) and each tissue type was immediately analysed for AST.
- Scallops (n=40) were dissected immediately into AM, GO, and RD and each tissue type was stored at -20°C. After 1, 3, 6, and 10 days, ten samples of AM, GO, and RD were analysed for AST.
- Whole scallops (n=40) were stored in their shell at -20°C. After 1, 3, 6, and 10 days, ten scallops were dissected into AM, GO, and RD. Each tissue type was individually analysed for AST.

**References**


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**Results**

**Stability of AST in frozen scallop tissue**

- **Adductor muscle**
  - At time 0 the mean concentration of AST in the AM was 0.29 μg·g⁻¹.
  - Following freezing, AST concentrations appeared to decrease to 0.1 μg·g⁻¹. The changes in concentration were significant (General Linear Model GLM, P<0.002) although large inter-animal variability was observed (Fig. 2A).

- **Gonad**
  - At scallop GO were in a mature state. AST levels in the GO showed an initial reduction after freezing (3 μg·g⁻¹ on day 0 to 13 μg·g⁻¹ on day 1) with concentrations remaining constant for the remainder of the experiment (Fig. 2B). The overall changes in AST concentration were not significant (GLM, P<0.01).

- **Remaining tissue**
  - Mean AST concentrations in the RD ranged from 290 μg·g⁻¹ at time 0 to 233 μg·g⁻¹ after 10 days (Fig. 2C). The highest mean AST concentration was seen at time 0. Again, changes in AST concentrations were not significant (GLM, P<0.01).

**Stability of AST in whole frozen scallop tissue**

- **Adductor muscle**
  - The AM showed a significant increase in AST concentrations during the experiment (GLM, P<0.001). Prior to freezing the mean AM concentration was 0.29 μg·g⁻¹. Following freezing, concentrations increased to 5.1 μg·g⁻¹, with these concentrations increasing to 7.5 μg·g⁻¹ after 10 days (Fig. 3A).

- **Gonad tissue**
  - All scallop GO were in a mature state. A decrease in AST concentration in the GO was observed but concentrations then increased to a mean level of 16 μg·g⁻¹ (Fig. 3B). These changes are significant (GLM, P<0.048) although large inter-animal variability was observed.

- **Remaining tissue**
  - A significant decrease in AST concentration in the RD was seen after freezing (GLM, P<0.001). Concentrations decreased from a mean of 290 μg·g⁻¹ on day 0 to 106 μg·g⁻¹ after 10 days (Fig. 3C).

**Conclusions**

- AST concentrations showed a significant increase in the AM and a significant decrease in RD following frozen storage of whole king scallops.
- Frozen storage of whole scallops may lead to contamination of the AM with AST during defrosting. This may be caused by toxic hepatopancreas (HP) fluid coming into contact with the AM.
- AST concentrations in tissues that were dissected prior to freezing change significantly, but this is probably due to high inter-animal variation.
- It is recommended that scallops are dissected and individual organs are stored frozen, rather than freezing shellfish in their shell, if levels of AST in individual organs are being investigated.