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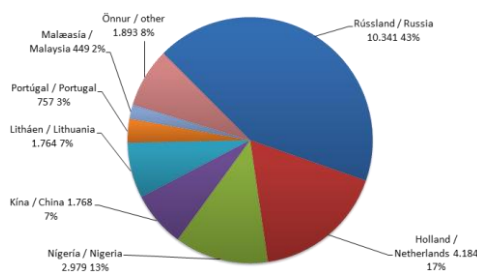
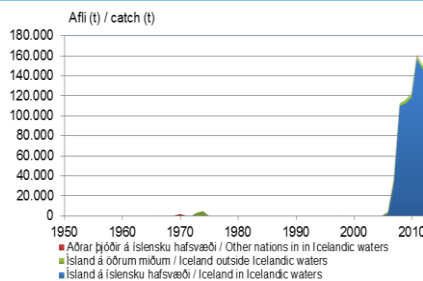
Quality optimisation of frozen mackerel products

Paulina E. Wasik

Atlantic Mackerel (*Scombrus scomber*)



- **Atlantic mackerel (*Scombrus scomber*) is one of the most valuable species in marine industry due to its nutritional value**
- **The mackerel is known from widespread relocations and has been discovered in Icelandic waters since 2006**
- **Icelandic mackerel is now exported mainly to Eastern Europe and gained great economical importance**
- **Frozen storage of the mackerel is main long term preservation method and it is a important task for industry to optimize this process in order to increase quality of the products**

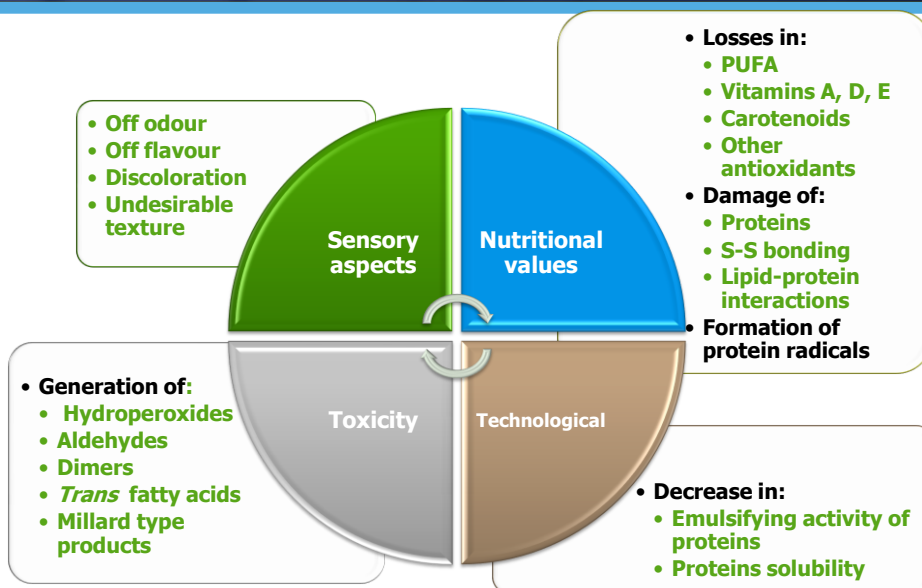


Source: Statistics Iceland

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Quality changes due to lipid oxidation occurred during frozen storage of fish



Factors affecting lipid oxidation development during frozen storage



- 1) Seasonal variation of lipid content, composition and lipid stability
- 2) Geological variation of fishing grounds
- 3) Fish processing of raw material
- 4) Freezing methods
- 5) Storage time (3, 6, 9, 12 months)**
- 6) Storage temperature (-18°C, -25°C)**

Methods	
Water content	Weight loss during drying at 105°C for 4h (ISO 1983) / Near Infrared Reflectance measurements (NIR)
Lipid extraction	Bligh & Dyer method (1959)
Phospholipid content	Colorimetric method (Stewart 1980)
Fatty acids composition	Gas chromatography of fatty acid methyl esters (FAMES) according to the AOCS (1998).
Free Fatty acids (FFA)	Lowry & Tinsley (1976), with modifications from Bernardez et al. (2005)
Thiobarbituric Acid Reactive Substances (TBARS)	A modified method of Lemon (1975)
Peroxide values (PV)	A modified method of the ferric thiocyanate method (Shantha & Decker 1994)
Fluorescence compounds	Perkin-Elmer LS 50B fluorescence spectrophotometer
Color measurement	DFK 31BF03 CCD digital camera. LensEye software

Effect of storage time and temperature on hydroperoxide rate

- **Peroxide value (PV) - primary oxidation products, main initial product of autoxidation**

- **PV significantly increased during the frozen storage of mackerel**

Control < 3m < 6m < 9m < 12m

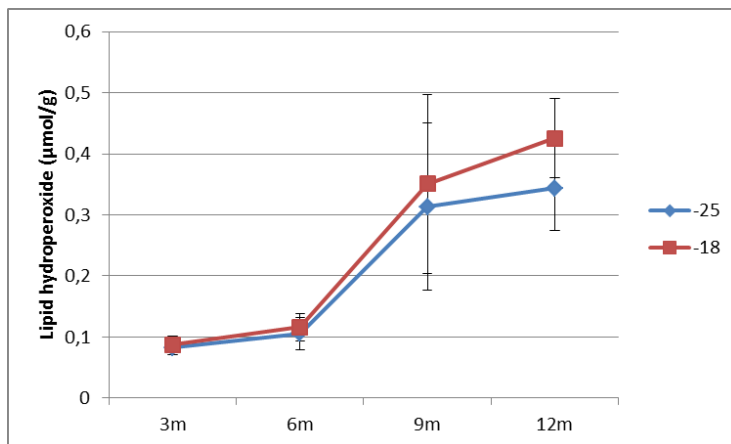
- **The rate of formation hydroperoxide after 9 months and 12 months storage was significantly higher in the samples stored at -18°C comparing to the samples stored at -25°C**

Control < -25°C < -18°C

Effect of storage time and temperature on lipid peroxide development



The rate of peroxide (PV) was significantly lower at -25°C at -18°C after 12 months storage
 $-25^{\circ}\text{C} < -18^{\circ}\text{C}$



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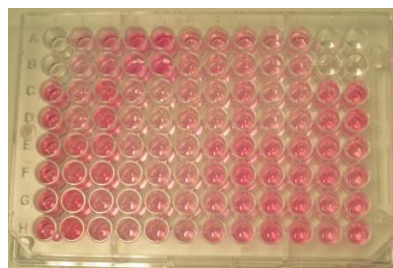
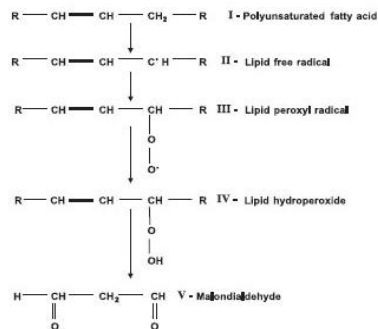
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Effect of storage time and temperature on Thiobarbituric acid reactive substances (TBARS)



- TBARS – secondary oxidation products arise mainly as a result of decomposition of primary oxidation products
- TBARS rate was rather stable during frozen storage but was significantly higher in the samples stored at -18°C comparing to the samples stored at -25°C

Control $< -25^{\circ}\text{C} < -18^{\circ}\text{C}$

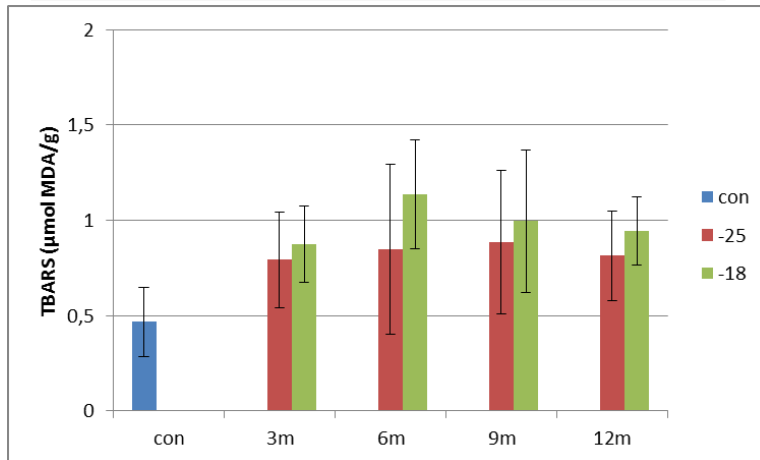


Effect of storage temperature on TBARS development



TBARS was significantly higher in the samples stored at -18°C than the samples stored at -25°C

Control < -25°C < -18°C



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Effect of storage time and temperature on Free fatty acids (FFA)



- **Free fatty acids (FFA)** arise mainly in enzymatic hydrolysis of phospholipids during frozen storage. Furthermore, accumulation of FFA may leads to interaction with proteins and causes quality lost
- **FFA rate increased significantly with storage time**
Control < 3m < 6m < 9m < 12m
- **FFA were significantly higher in the samples stored at -18°C than in the samples stored at -25°C**
Control < -25°C < -18°C

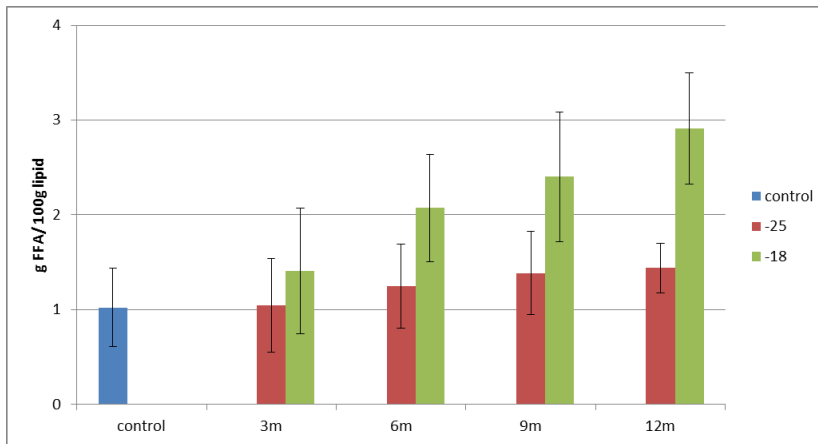
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Effect of storage temperature on FFA development



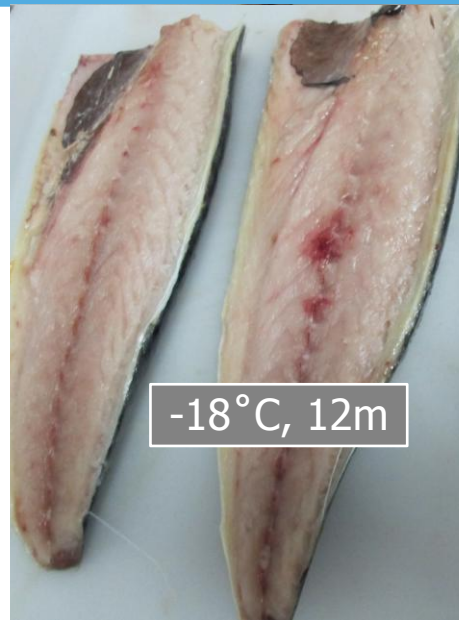
FFA were significantly higher in the samples stored
at -18°C than -25°C
Control $< -25^{\circ}\text{C} < -18^{\circ}\text{C}$



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Effect of different storage temperature on fish muscle quality



Thank you

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