



Polycymakers' Event 31.02.2021

Nutritious, safe, and sustainable seafood for consumers

Detoxification procedure to reduce PSP (paralytic shellfish poisoning)

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Bivalve molluscs are marine organisms that feed on plankton present in the water column.

Under certain circumstances, planktonic toxic species proliferate causing a harmful algal bloom (HAB). During these episodes, mollusc become toxic and are not suitable for consumption.

Depending on the planktonic species proliferating, HABs can induce different toxic symptomatology: ASP (Amnesic Shellfish Poisoning), DSP (Diarrhetic Shellfish Poisoning) and PSP (Paralytic Shellfish Poisoning)

Molecules involved in DSP are lipophilic, whereas molecules involved in ASP and PSP are hydrophilic.

According to REGULATIONS (EC)Nº 853/2004 and 854/2004, in order to protect public health, harvesting areas are closed when toxin levels reach certain level in the mollusc flesh.

In the case of PSP, the limit level is 800 µg STX diHCl equiv./kg.

The closure of harvesting areas have important economic consequences along the mollusc value chain: producers, depuration plants, transforming factories and trading, as well as tourism.

Table IV European annual losses per country for the mussel industry

Country	Average Loss \$
France	9,216,234
Spain	6,069,746
Netherlands	5,285,977
Italy	4,313,943
United Kingdom	2,700,281
Ireland	2,272,724
Germany	908,131
Greece	819,030
Norway	132,440
Croatia	104,454
Sweden	66,086
Denmark	56,989
Albania	47,639
Bulgaria	28,806
Montenegro	14,413
Portugal	12,930
Channel Islands	12,396
Slovenia	11,375
Russian Federation	9,216
Ukraine	6,961
Bosnia and Herzegovina	3,694
Iceland	1,988
Serbia and Montenegro	130
TOTAL	32,065,171



European mussel production in 2016 was 480 000 tonnes (valued at €420 million, or \$465 million)

According the ASIMUTH project (CONTRACT SPA.2010.1.1-01) FP7 Collaborative Project, the annual loses for the mussel industry in Europe was 32,065,171 \$ (mean of 2000-2009; document released in November 2011).

Is not possible to separate loses due to the different toxins, since they can co-occur.



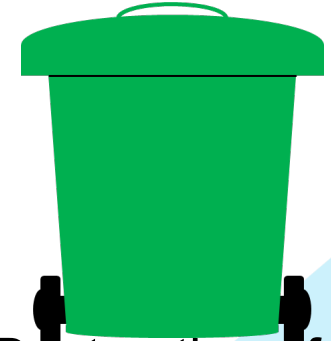
PSP Toxic shellfish



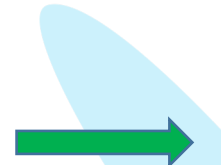
Analytical results over
legal limit



Industrial processing



Destruction of a
non edible product

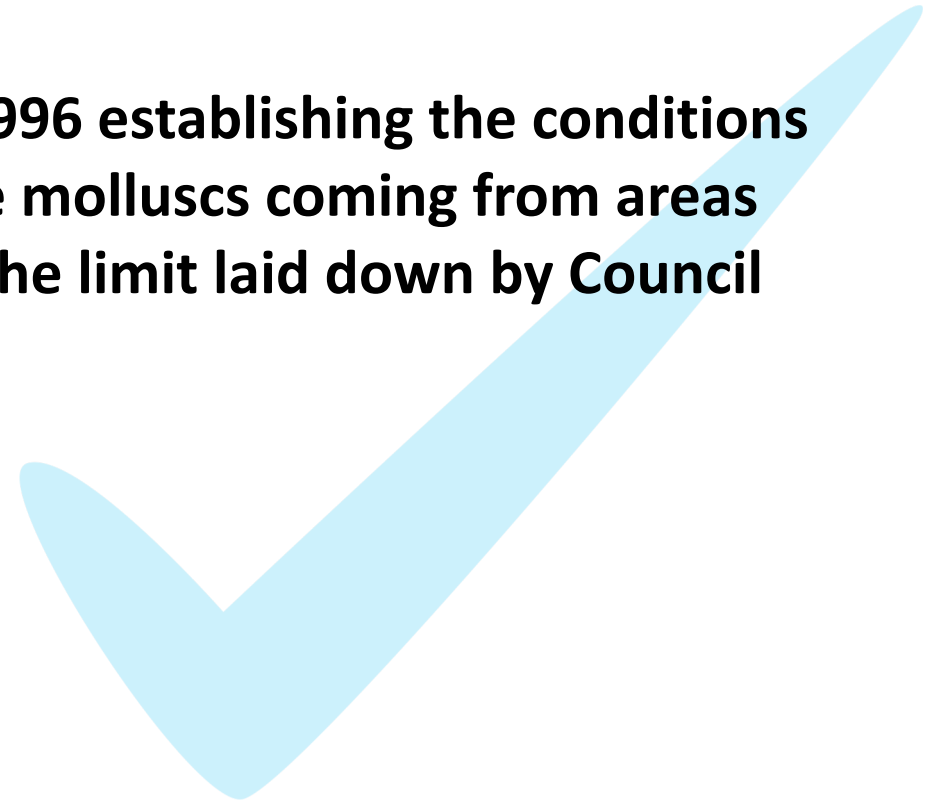


Edible product for the market

According to REGULATIONS (EC)Nº 853/2004 and 854/2004, in order to protect public health, harvesting areas are closed when toxin levels reach certain level in the mollusc flesh (800 µg STX diHCl equiv./kg for PSP)

European legislation makes an exception for this level, allowing harvesting and processing of the giant cockle *Acanthocardia tuberculatum* in production areas where the PSP level in the edible parts of these molluscs is higher than 800 µg STX diHCl equiv./kg but lower than 3000 µg STX diHCl equiv./kg. and establishes the conditions of harvesting, processing and control.

96/77/EC: COMMISSION DECISION of 18 January 1996 establishing the conditions for the harvesting and processing of certain bivalve molluscs coming from areas where the paralytic shellfish poison level exceeds the limit laid down by Council Directive 91/492/EEC



COMMISSION DECISION

of 18 January 1996

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(Text with EEA relevance)

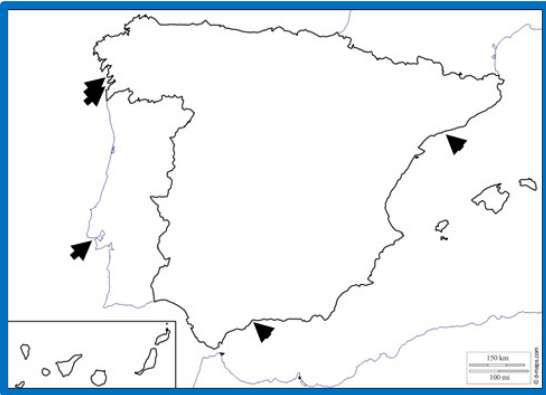
(96/77/EC)

Heat treatment applicable to bivalve molluscs *Acanthocardia tuberculatum* with the objective of reducing the PSP toxin to a level lower than 80 µg per 100 g

Molluscs have to undergo the following operations sequentially :

1. Preliminary cleaning in fresh water for a minimum of two minutes at a temperature of 20 °C, plus or minus 2 °C.
2. Pre-cooking in fresh water for a minimum of three minutes at a temperature of 95 °C, plus or minus 5 °C.
3. The separation of flesh and shells.
4. Second cleaning in running fresh water for a minimum of 30 seconds at a temperature of 20 °C, plus or minus 2 °C.
5. Cooking in fresh water for a minimum of nine minutes at a temperature of 98 °C, plus or minus 3 °C.
6. Cooling in running cold fresh water for approximately 90 seconds.
7. The separation of the edible parts (foot) from the non-edible parts (gills, visceras and mantle) mechanically with water pressure.
8. Conditioning in containers closed hermetically in a non-acidified liquid medium.
9. Sterilization in autoclave at a minimum temperature of 116 °C for a time calculated according to the dimension of the containers used but which can not be lower than 51 minutes.





Species	Location	Harvesting date	Present phytoplankton	Average result ($\mu\text{g STX}$ diHCl equiv/kg) (n=2)
Mussel (<i>Mytilus galloprovincialis</i>)	Ría of Vigo (Vigo A)	09/07/2018	Alexandrium spp	1072 \pm 11
Mussel (<i>M. galloprovincialis</i>)	Ría of Vigo (Redondela C)	23/07/2018	Alexandrium spp	1604 \pm 330
Mussel (<i>M. galloprovincialis</i>)	Ría of Vigo (Redondela C)	23/07/2018	Alexandrium spp	737 \pm 134
Mussel (<i>M. galloprovincialis</i>)	Andalucía (Benalmádena)	02/08/2018	Gymnodinium catenatum	812 \pm 270
Mussel (<i>M. galloprovincialis</i>)	Portinho da Costa (Lisbon)	22/10/2018	Gymnodinium catenatum	9001 \pm 345
Mussel (<i>M. galloprovincialis</i>)	Catalonia	05/03/2019	Alexandrium minutum	4205 \pm 43
Mussel (<i>M. galloprovincialis</i>)	Catalonia	05/03/2019	Alexandrium minutum	2317 \pm 261
Mussel (<i>M. galloprovincialis</i>), frozen		05/03/2019		
Clam (<i>R. philippinarum</i>)	Ría of Pontevedra	27/07/2018	Alexandrium spp	1041 \pm 23
Clam (<i>R. philippinarum</i>), frozen	Ría of Pontevedra	27/07/2018	Alexandrium spp	903 \pm 204
Scallop (<i>Pecten maximus</i>)	Andalucía	22/08/2019	Gymnodinium catenatum	3232 \pm 466
Scallop (<i>P. maximus</i>) eviscerated	Andalucía	22/08/2019	Gymnodinium catenatum	1976 \pm 117
Scallop (<i>P. maximus</i>)	Andalucía	22/08/2019	Gymnodinium catenatum	3171 \pm 30
Scallop (<i>P. maximus</i>), eviscerated	Andalucía	22/08/2019	Gymnodinium catenatum	1779 \pm 126

The EU protocol was applied to: mussels, clams and scallops

Minor differences:

Separation of edible and not edible parts was not performed in mussels and clams

The effect was studied in canned and pasteurized product

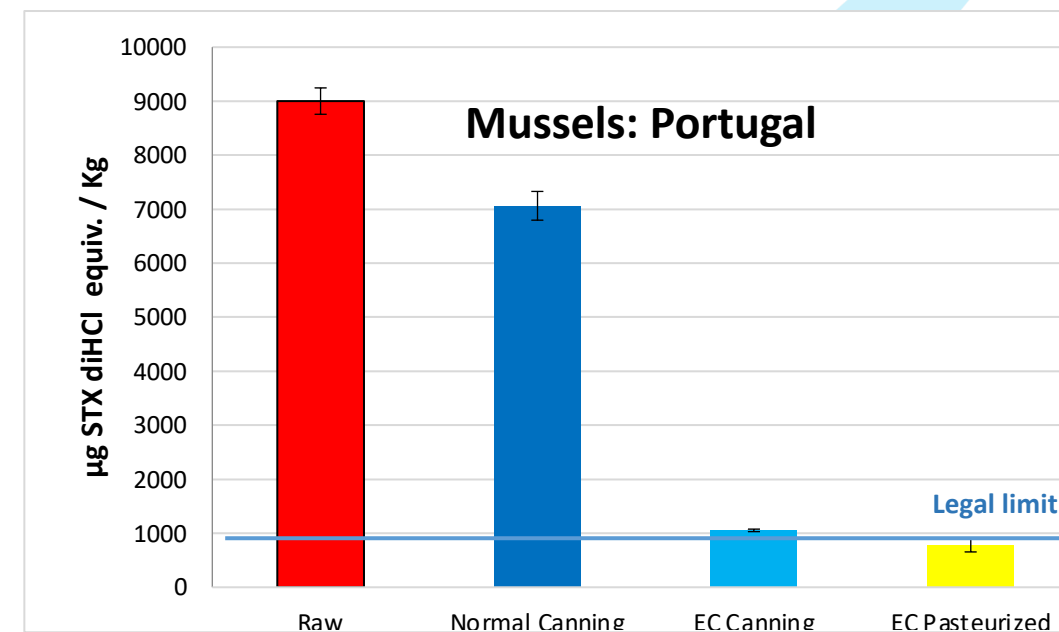
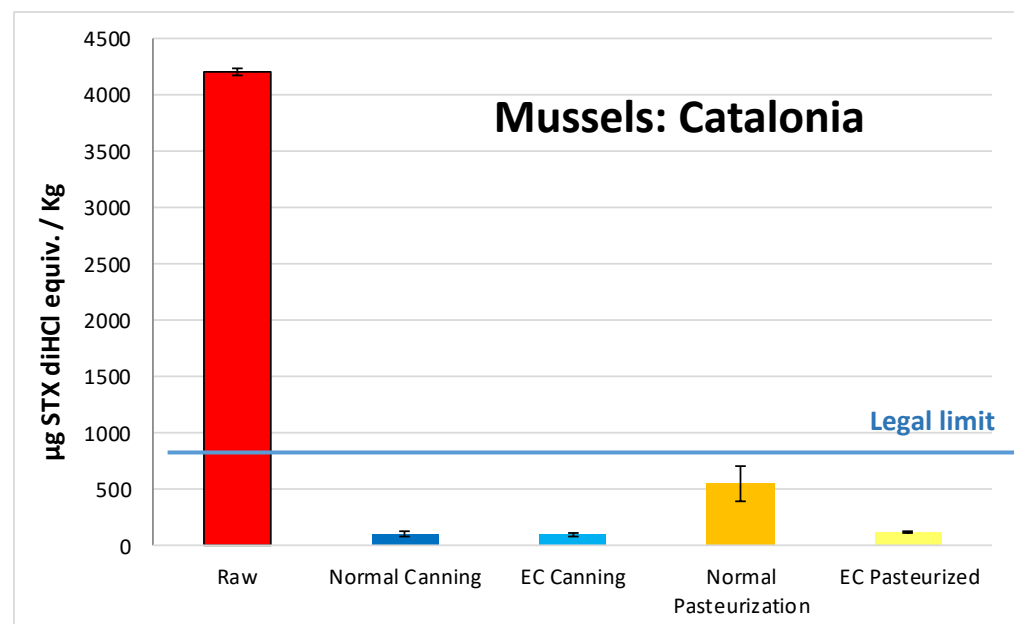
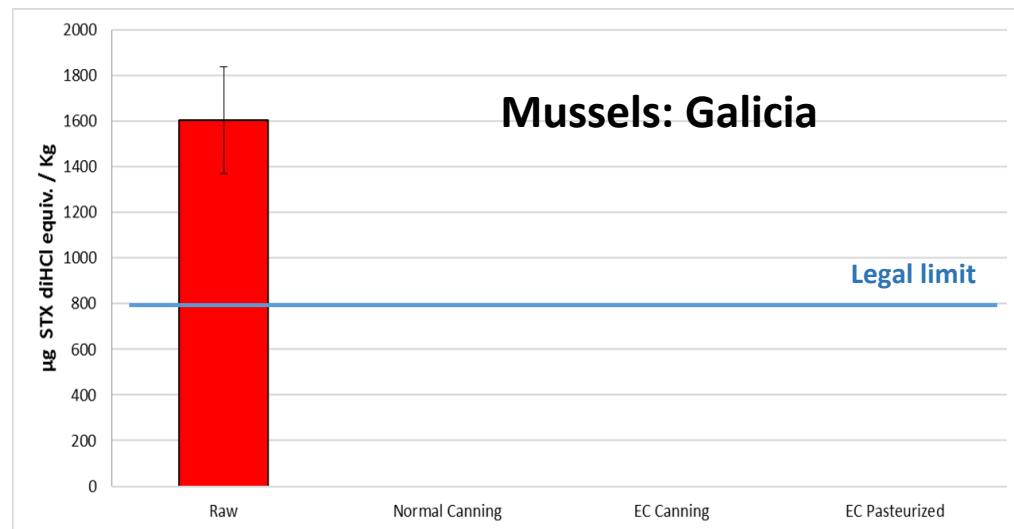
Raw material vs traditional canning or pasteurization with or without the detoxification protocol

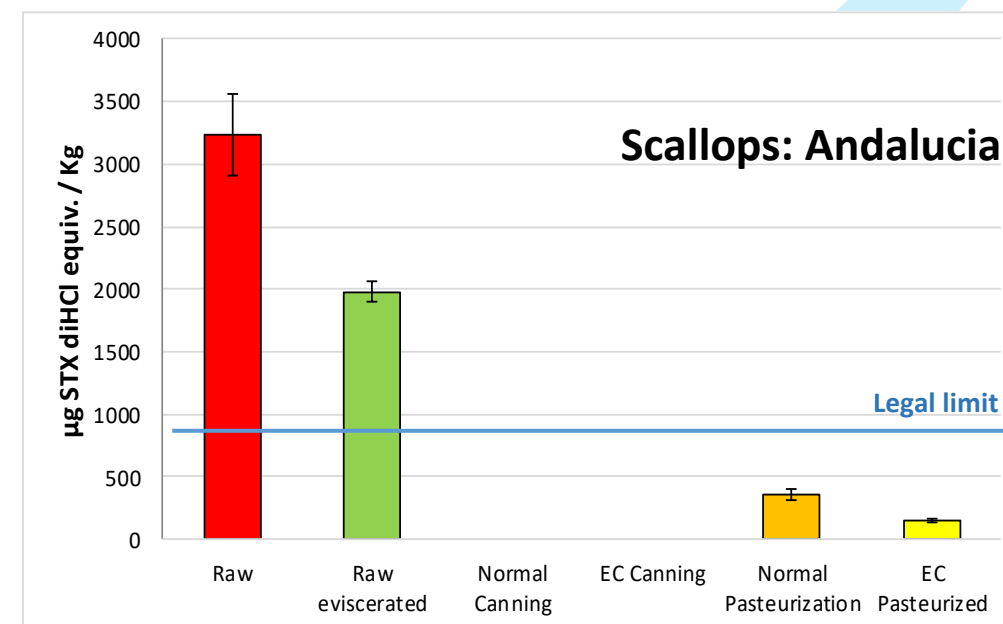
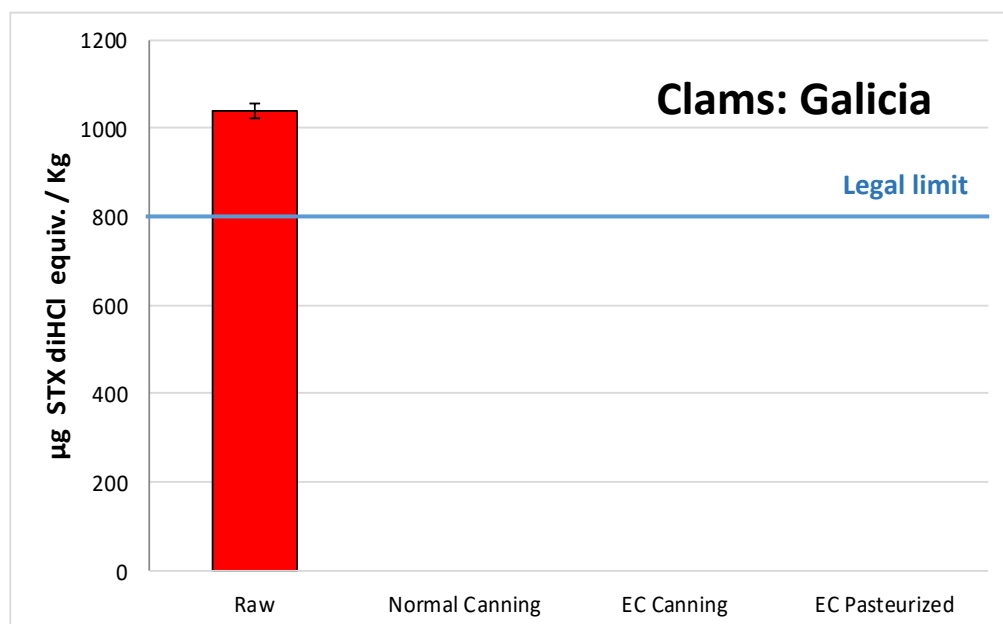
Analyses by the current methodology in two laboratories: Pre-column HPLC-FLD: AOAC

2005.06



PSP total levels





Conclusions

- This detoxification procedure was able to reduce PSP toxins in contaminated mussels, clams and scallops below the legal limit. This procedure could be applied at processing facilities.
- An 85 % detoxification is attained in all samples. An upper limit in the raw product which can be processed is necessary.
- A change in current legislation would be needed, for instance, expanding the currently in force 96/77/EC: COMMISSION DECISION of 18 January 1996

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Thank You

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