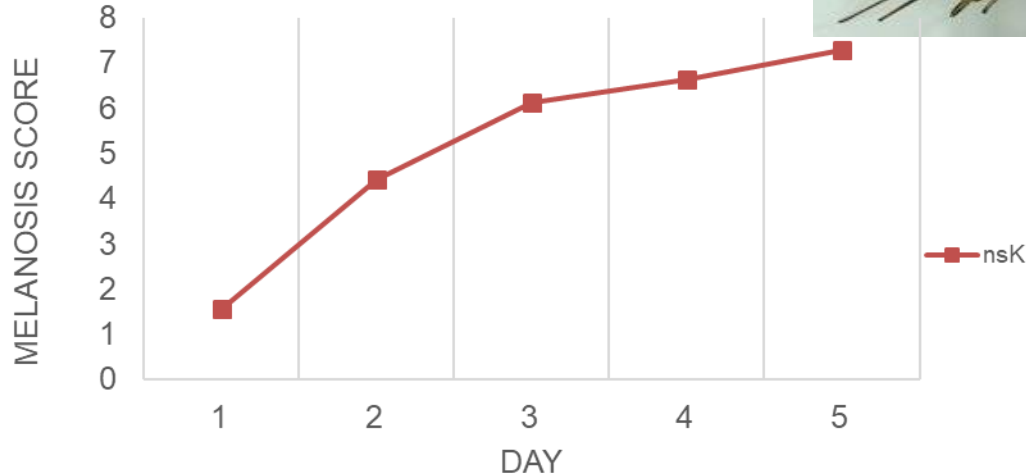


A detailed photograph of a shrimp, likely a common shrimp (Decapoda), shown from a side profile. The shrimp is translucent with a yellowish-orange hue, particularly in the tail and legs. It has long, thin antennae and several pairs of legs. The background is dark and textured, possibly a black surface or water.

# SMBS (sodium disulfite) application in Shrimp to prevent product melanosis

Monika Weiß, Mirko Bögner, Vanessa Fuchs, Enno Fricke,  
Matt Slater, Eva Hollenbach

# Why SMBS?



Melanosis is considered a color defect and reduces consumer acceptance

# SMBS and the shrimp immune system

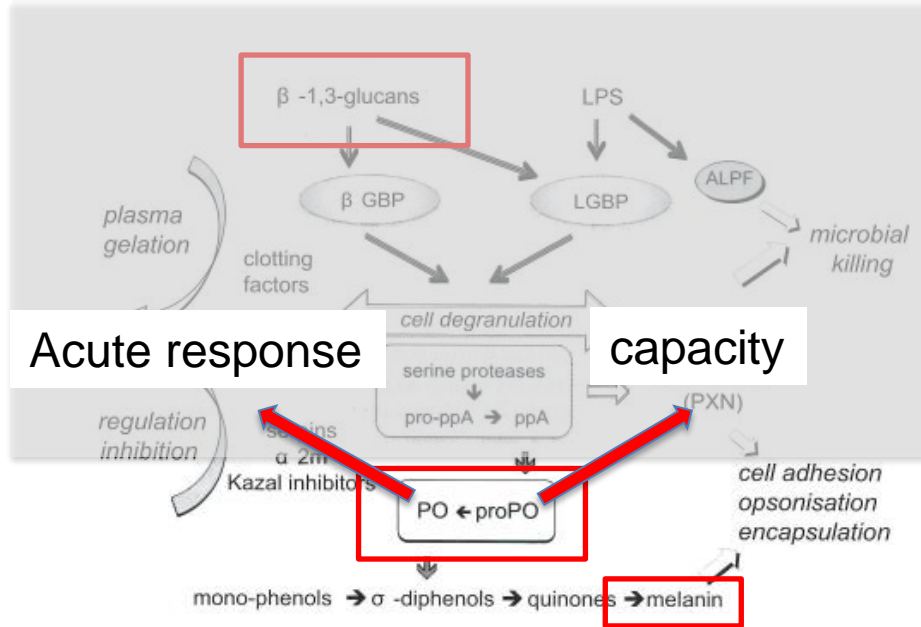
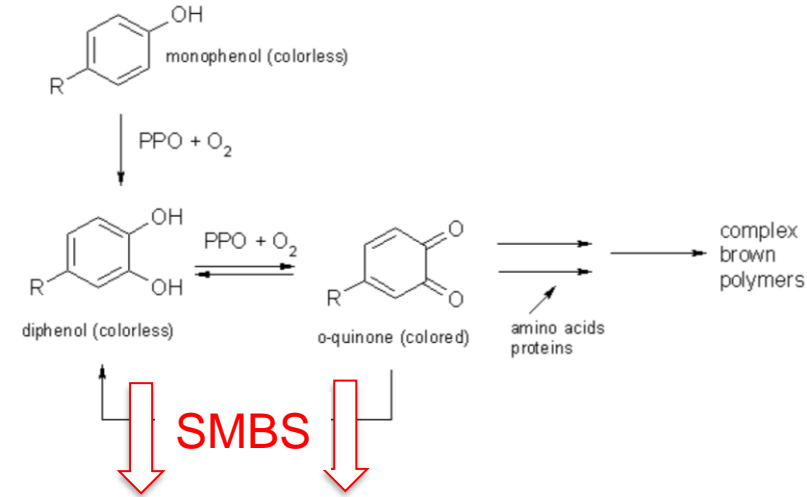


Figure 4. Highly simplified representation of the components of the prophenoloxidase activating system and their biological effects.




Reversible:

- formation of colorless compound
- reduction to diphenol



It is widely used for p

- Issues:
  - a small perce
  - irritates skin a
- labelling requirem
- regulatory max. of

 <https://www.globalseafood.org/advocate/preventing-melanosis-in-shrimp/>

used antioxidant is sodium metabisulfite. Sulfites in various forms have been used in foodstuffs for centuries, and sodium metabisulfite has been used to control blackening of foods like wine and tomatoes since the 1950s.

In the case of shrimp, many attempts have been made to replace sodium metabisulfite, but without success. Metabisulfite acts with the intermediate reaction elements of melanosis, in particular quinone and sulfaquinone, by reducing the oxygen available for oxidation reactions.

### Prevention key

The use of sodium metabisulfite after shrimp harvesting must be done before postmortem mechanisms lead to the appearance of melanosis. Once the mechanisms start, they can, at best, only be slowed down. To avoid a spectacular peak of melanosis at the time of defrosting, the sodium metabisulfite should be used immediately after harvesting and cooling the shrimp.

The postharvest treatment consists of dipping the shrimp immediately after harvest in two successive baths: first in clean, chilled water and then in a chilled metabisulfite solution. Depending on shrimp size, the concentration of metabisulfite can vary 6 to 15 percent.

- a|

The main problem with this method is maintaining a constant concentration of metabisulfite in the second bath. Part of the initial metabisulfite is absorbed by the shrimp, but the main factor of variation is the dilution by the addition of ice. It is therefore very important to define a method of reinforcement that ensures the efficiency of treatment throughout the harvesting process.

To reinforce the bath, technicians usually just add more metabisulfite powder. This method is not very efficient because metabisulfite powder is not easy to dissolve in chilled water, and a large portion will ineffectively fall to the bottom of the tank.

# Literature study: concentration and exposure time



Author	Year	Title	SMBS concentration	Incubation time	Temperature SMBS solution	shrimps size
Andrade	2015	Standardization of sodium metabisulfite solution concentrations and immersion time for	1,2,3,4,5%	10,20,30 min	7°C	10g
Cintra						
Góes						
Lucien-Brun						
Finne						
Churchird						
Rahimabadi						
Miget						
Bean						
Diouf						
Falgout						
Haby	2010	Intensive technical assistance for Louisiana shrimp fishermen Intensive technical assistance for the Gulf and South Atlantic shrimp industry	1,25%	1min		

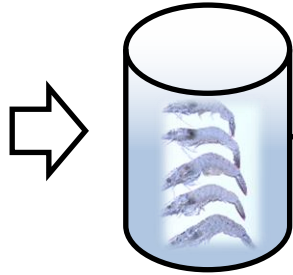
**Concentration of SMBS solution: 1.5 – 2.5 %**

**Incubation time: 5 - 20 minutes**

**Treatment procedure: cooled solution**

# Trial 1: concentration and exposure time

675g H<sub>2</sub>O  
200 g Ice  
125 g SMBS solution



5 n melanosis

3 n sulfite concentration in muscle

3 n (pro) Phenoloxidase in haemolymph

Ø weight =  $17.54 \pm 2.98$  g

**SMBS Concentration :**

**1.5%**

**2%**

**2.5%**

**Incubation time:**

**5 min**

**15 min**

**10 min**

**20 min**



## Determination Melanosis score after Montero 2001

- 1 foto per day from day 1 to 10 (5)
- determination of score by 3 work group members

### Score for Melanosis

0 = absent

2 = slight (up to 20% of prawns' surface affected)

4 = moderate (20 to 40% of prawns' surface affected)

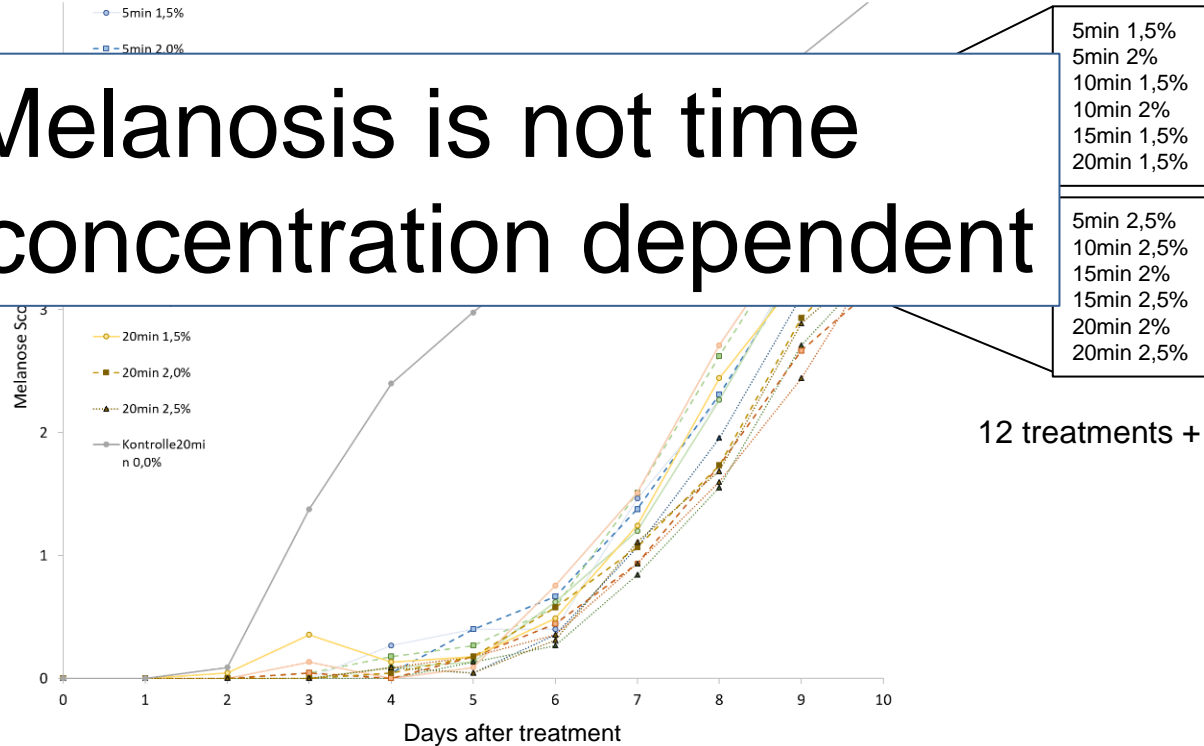
6 = notable (40 to 60% of prawns' surface affected)

8 = severe (60 to 80% of prawns' surface affected)

10 = extremely heavy (80 to 100% of prawns' surface affected)

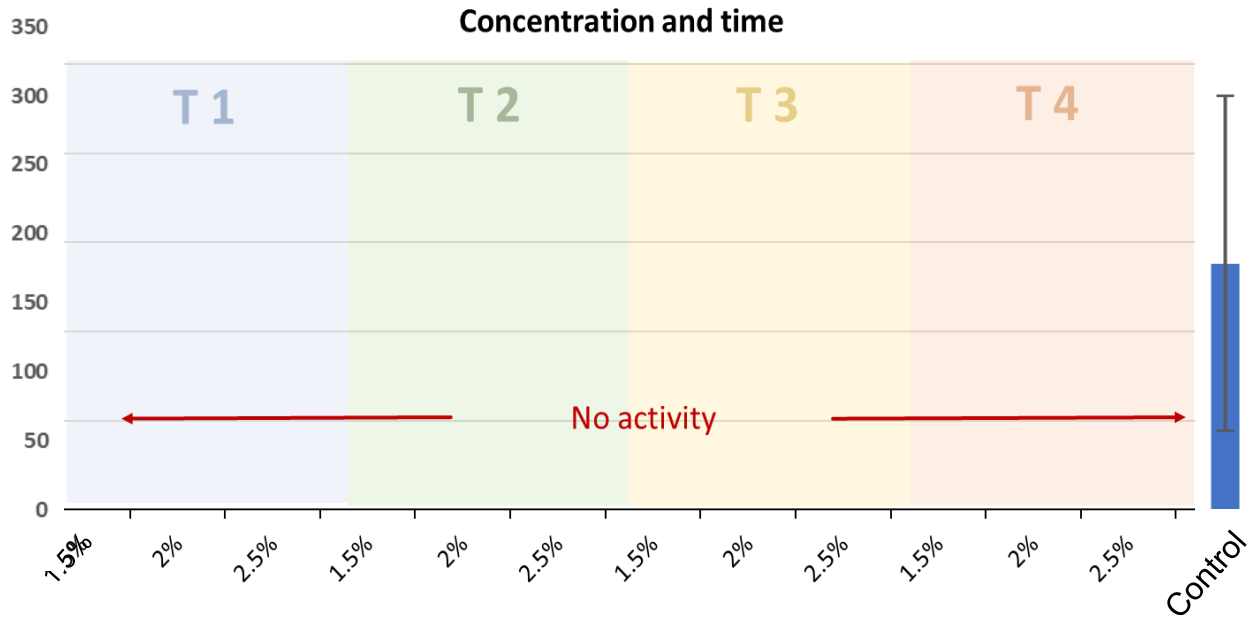
# Melanosis development

Melanosis is not time  
but concentration dependent

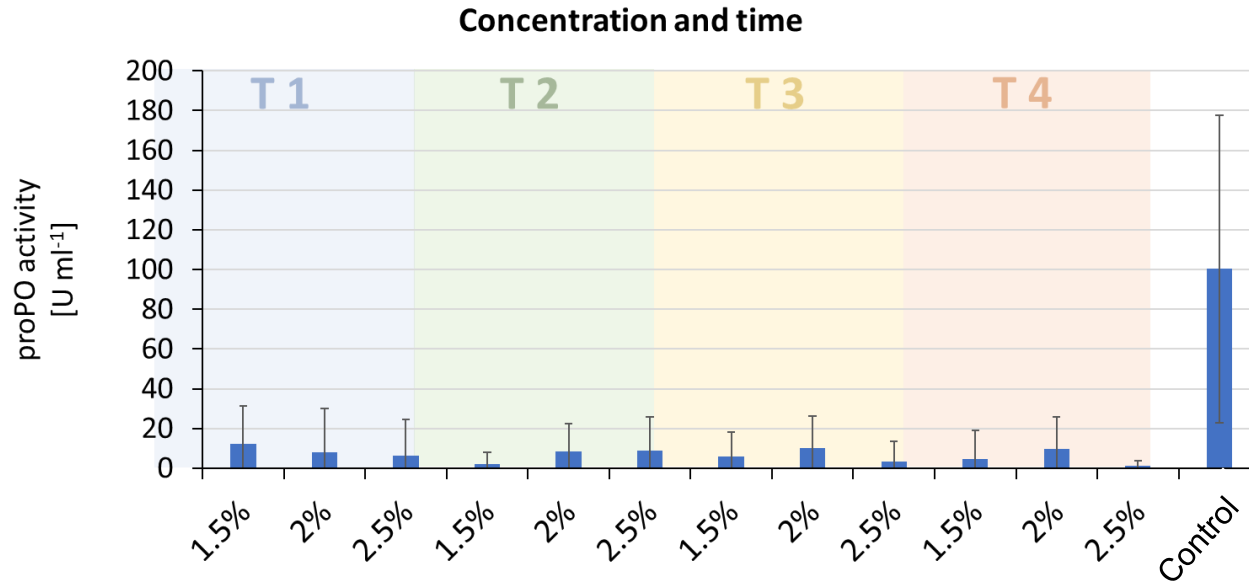




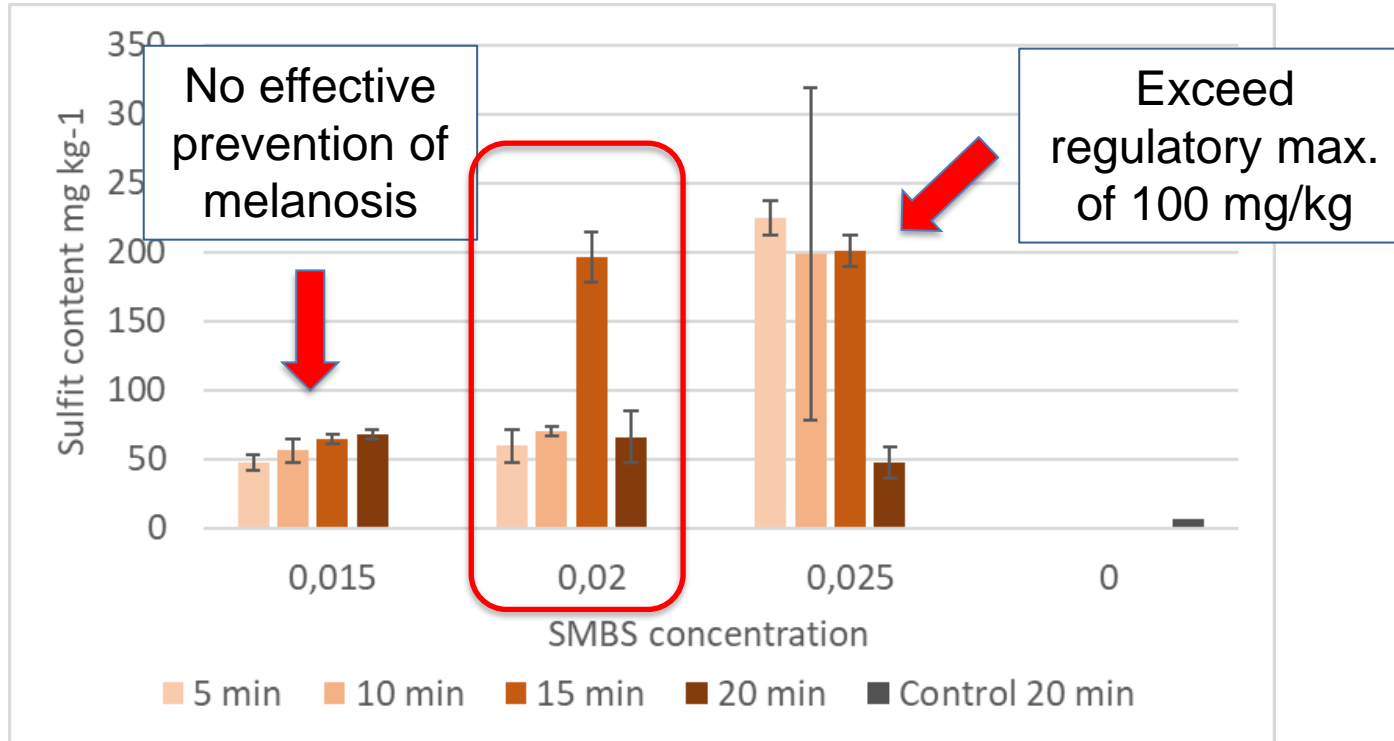
## Phenoloxidase activity



## proPhenoloxidase activity(proPO)



# sulfite concentration in muscle tissue



n = 2 (5 ind.)

## **Melanosis:**

- Effective prevention with concentration 2% and 2.5%

## **Phenoloxidase:**

- No activity in all treatments

## **Sulfit in muscle:**

- Acceptable with concentration 1.5% and 2%

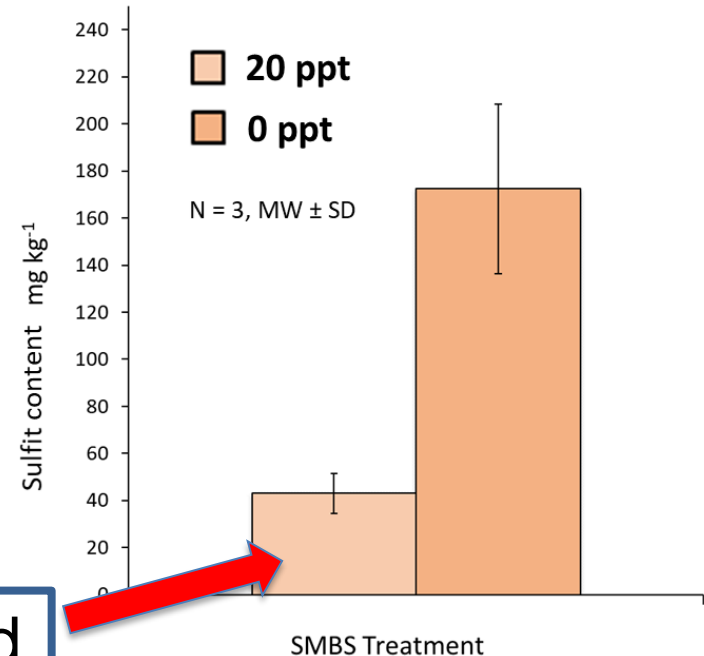
Concentration 2%, treatment time 10 min.

## Trial 2: Salinity

Salinity:	<b>0 ppt</b>	<b>20 ppt</b>
SMBS Konzentration:	<b>2%</b>	
Incubation time:	<b>10 min</b>	

- No differences in melanosis
- No differences in PO or proPO
- Significant differences in muscle sulfite concentration

**Treatment in saltwater recommended**



# SMBS – health hazard for employees?

*Occupational Medicine* 2008;58:545-550  
Published online 1 October 2008 doi:10.1093/occmed/kqn130

## Sodium metabisulfite induced airways disease in the fishing and fish processing industry

M. Steiner<sup>1</sup>, A. Scaife<sup>1</sup>, S. Semple<sup>1</sup>, G. ...

Background	Sodium metabisulfite is a common preservative in the fishing and fish processing industry. The prevalence of asthma and other respiratory disease in this industry is low.
Aims and methods	To describe three cases of asthma-like illness in the fishing and fish processing industry.
Results	Three patients, of whom two had a history of asthma, developed asthma-like illness after exposure to sodium metabisulfite. The illness was characterized by coughing, wheezing and/or shortness of breath. The illness was confirmed by a positive bronchial challenge test.
Conclusion	Exposure to sodium metabisulfite may cause an asthma-like allergy. Future exposure can cause asthma attacks with shortness of breath, wheezing, cough, and/or chest tightness.
Key words	Sodium metabisulfite, asthma, fishing, fish processing, occupational asthma.

### HAZARD SUMMARY

- \* Sodium Metabisulfite can cause an asthma-like allergy.
  - \* Contact can irritate the nose, throat, and/or eyes.
  - \* Breathing Sodium Metabisulfite can irritate the nose, throat, and/or eyes, causing coughing, wheezing and/or shortness of breath.
- Sodium Metabisulfite may cause an asthma-like allergy. Future exposure can cause asthma attacks with shortness of breath, wheezing, cough, and/or chest tightness.

New product "Shrimp Grade" SMBS

- 1. Is the new product as effective as the classic SMBS?**
- 2. Is the transport stress affecting the effectiveness?**

# „Shrimp Grade“ Transport simulation

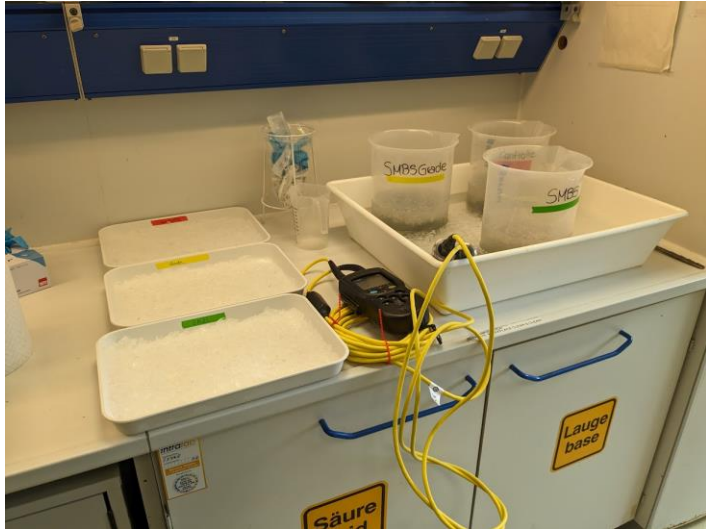


- Temp. Reduction ( $28^{\circ}\text{C} > 18^{\circ}\text{C}$ )
- Darkness
- High density:  $150 \text{ kg/m}^3$
- 90 min.
- oxygen supply





# „Shrimp Grade“ sulfite treatment



No stress

Control

10 Min

Stress

Control

Standard SMBS

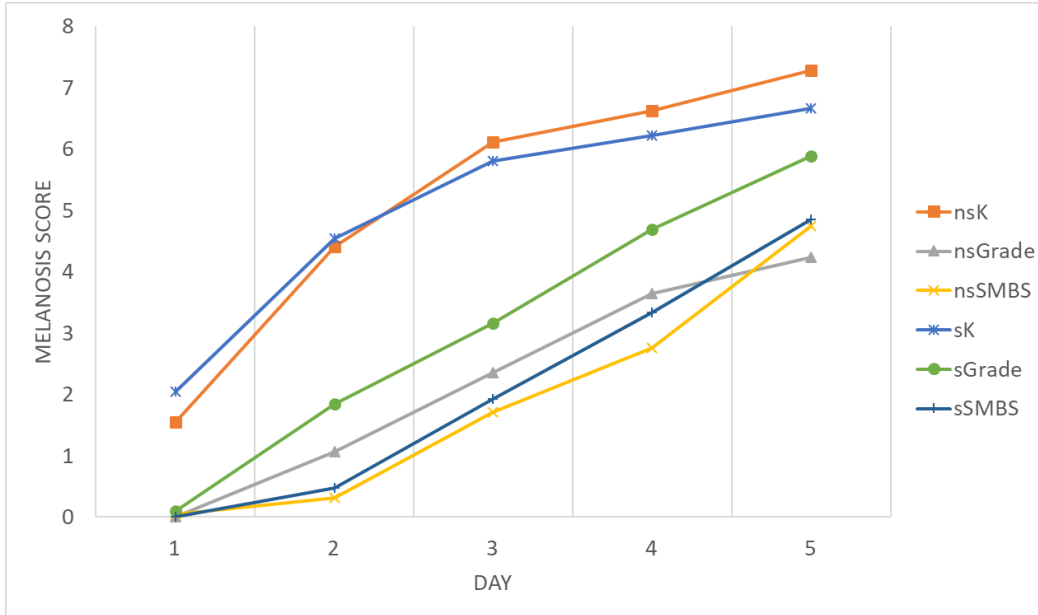
Standard SMBS

SMBS „Shrimp Grade“

SMBS „Shrimp Grade“

- Haemolymph sampling for **Phenoloxidase / proPhenoloxidase**
- Whole animal for **melanosis** and **sulfite** concentration

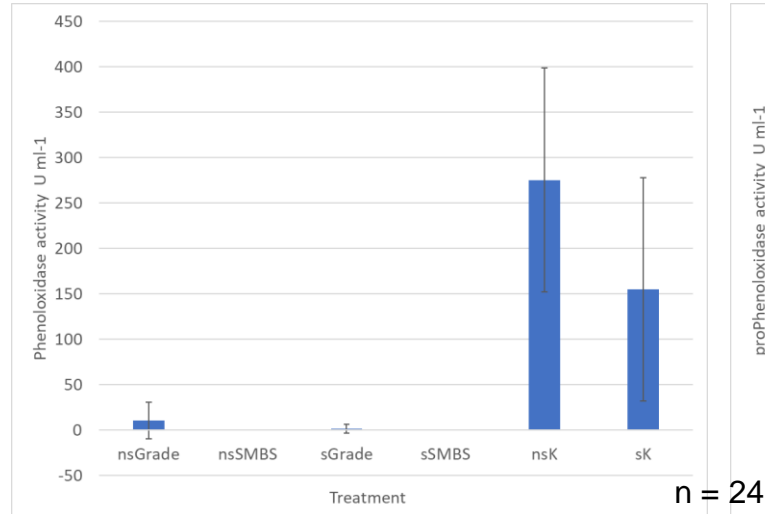
# „Shrimp Grade“ Melanosis



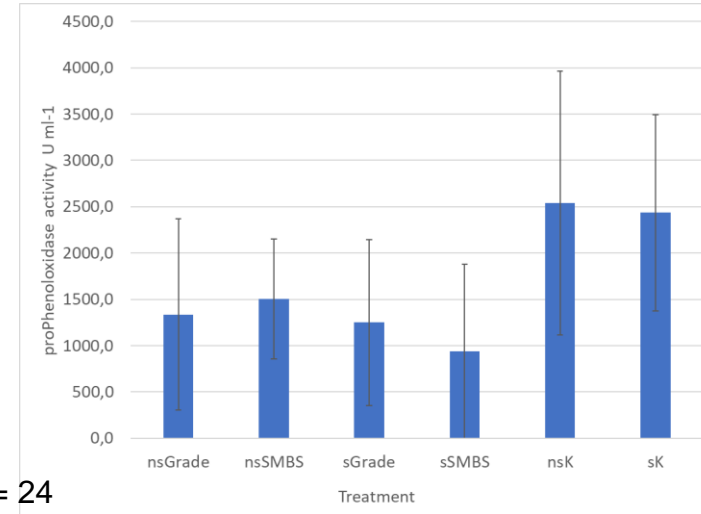
- Definitely delays melanosis
- Effectiveness slightly reduced

# „Shrimp Grade“ Phenoloxidase

## Phenoloxidase

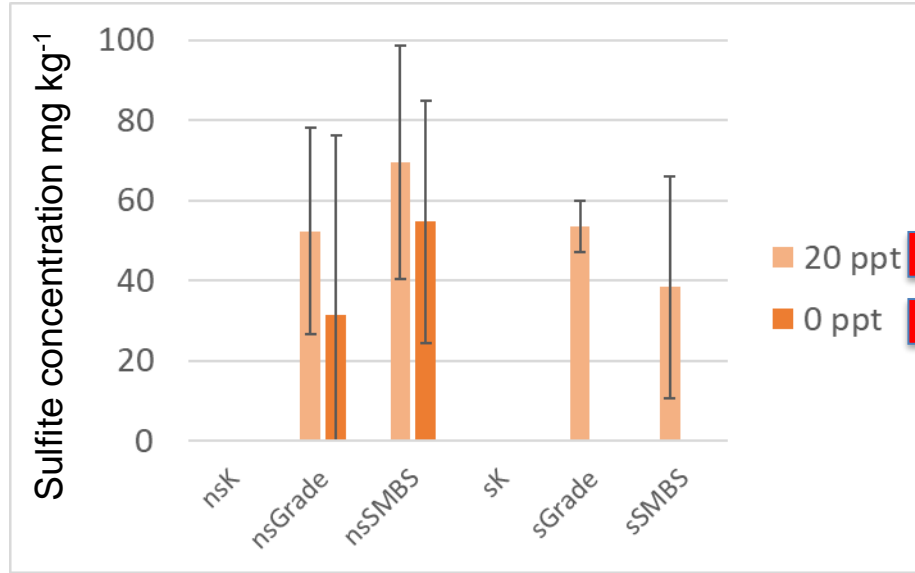


## proPhenoloxidase

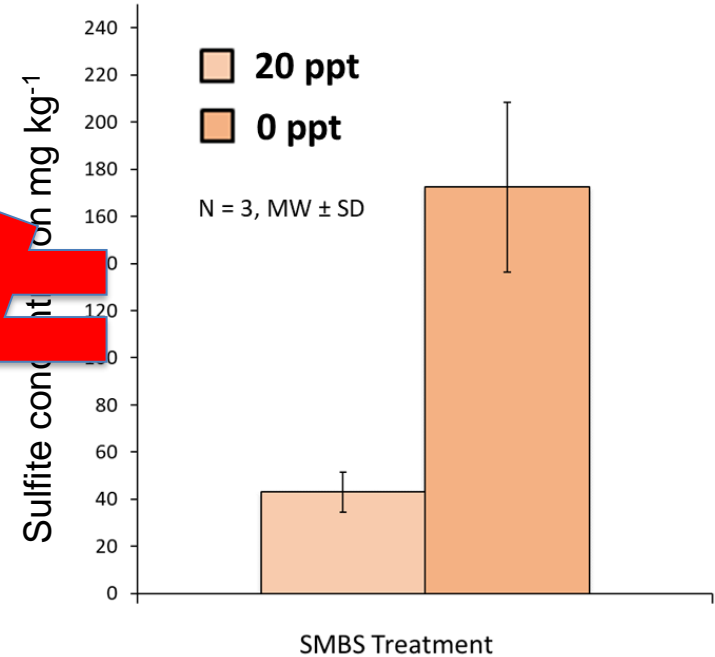


- Definitely reduces PO and proPO

# „Shrimp Grade“ – sulfite + salinity



## Trial 3: salinity



Control measurement with Biolan device:

# Easy sulfite measures?



# „Shrimp Grade“ Main Results

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- „Shrimp Grade“ really is more comfortable to handle

# „Shrimp Grade“ Main Results

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- „Shrimp Grade“ really is more comfortable to handle
  - **large improvement in user/employee safety**

# „Shrimp Grade“ Main Results

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- „Shrimp Grade“ really is more comfortable to handle
  - large improvement in user/employee safety
- „Shrimp Grade“ is effectively delaying melanosis



# „Shrimp Grade“ Main Results

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- „Shrimp Grade“ is effectively delaying melanosis
- Sulfite in muscle reliably below regulatory max

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- Sulfit in muscle reliably below regulatory max
- Salinity effect stays unclear

# „Shrimp Grade“ Main Results

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- „Shrimp Grade“ really is more comfortable to handle
  - large improvement in user/employee safety
- „Shrimp Grade“ is effectively delaying melanosis
- Sulfit in muscle reliably below regulatory max
- Salinity effect stays unclear
- Generally shrimp batch, previous history and individual condition seem to play a major role

# End



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