

The Peaceful Sleep: More Efficient Ways to Sedate Oysters for Sampling

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Background





Anesthesia: the temporary loss of sensation that can cause relief from pain, muscle relaxation, and/or unconsciousness.

For oysters, MgCl_2 (magnesium chloride) has been proven to be one of the most effective chemicals for oyster anesthesia with the lowest mortality.

Benefits of Oyster Anesthesia

- Usually, sampling kills the oysters
- Anesthesia reduces stress and allows tissue biopsies, sex determination, and other physiological and genetic studies (Suquet et al, 2009)
- Simplifies the surgical techniques used in pearl production and extraction (Suquet et al., 2009)



M8266 ▶ Sigma-Aldrich

Magnesium chloride

(0)

anhydrous, ≥98%

Synonym(s):

Magnogense

Linear Formula:

MgCl₂

CAS Number: 7786-30-3

Molecular Weight: 95.21

EC Number:

MDL number: MFCD00011106

PubChem Substance ID: 24897235

NACRES:

SKU	Pack Size	Availability	Price
M8266-100G	100 G	Estimated to ship on July 25, 2022 Details...	\$28.60
M8266-1KG	1 KG	Estimated to ship on July 25, 2022 Details...	\$61.20



Economic Component: MgCl₂ is expensive

Suquet et al. (2009) found that the ideal concentration of MgCl₂ for optimal anesthesia was **50 grams per liter** over a 16 hour duration.

MgCl₂ costs \$61.20 for 1000 grams

At this concentration:

1. Every liter used will cost \$3.06 of MgCl₂
2. Our setup of 3x30 liter tanks would cost \$275.4
3. At high concentrations, harder to dissolve and creates health risks of excess heat insolution and irritation of respiratory tract

Objective

Create a more effective method of utilizing $MgCl_2$ to knockout oysters in a cheaper, faster, and safer way.



Methods



Experiment Setup

30 oysters

30 oysters

30 oysters



30 L water
X g MgCl₂

30 L water
X g MgCl₂

30 L water
X g MgCl₂



Procedure

1. Placed all oysters in tanks
2. Every hour, pulled out oysters that had been anesthetized
3. Placed nails between the shells to prop them open for sampling
4. Used a scalpel to remove a portion of mantle
5. Removed the nail
6. Weighed the oyster and measured its height
7. Put the anesthetized oysters in a broodstock tank to recover
8. After a couple days, recorded the recovery rate of oysters in the experiment



Different Trials

Trial 1:

Density: 3 tanks filled with 30L containing 30 oysters each

Water flow: Pump

Concentration: 5 g/L of MgCl₂



Trial 2:

Density: 3 tanks filled with 30L containing 30 oysters each

Water flow: Pump

Concentration: 5 g/L of MgCl₂

Extra: Starved for 24hr and added 100 mL algae to each



Trial 3: Control

Density: 1 tank filled with 30L containing 30 oysters (repeat from next day)

Water flow: NO pump

Concentration: 50 g/L of MgCl₂

Extra: kept out of air 12 hr



Trial 4:

Density: 1 tank filled with 30L containing 30 oysters (repeat from next day)

Water flow: Pump

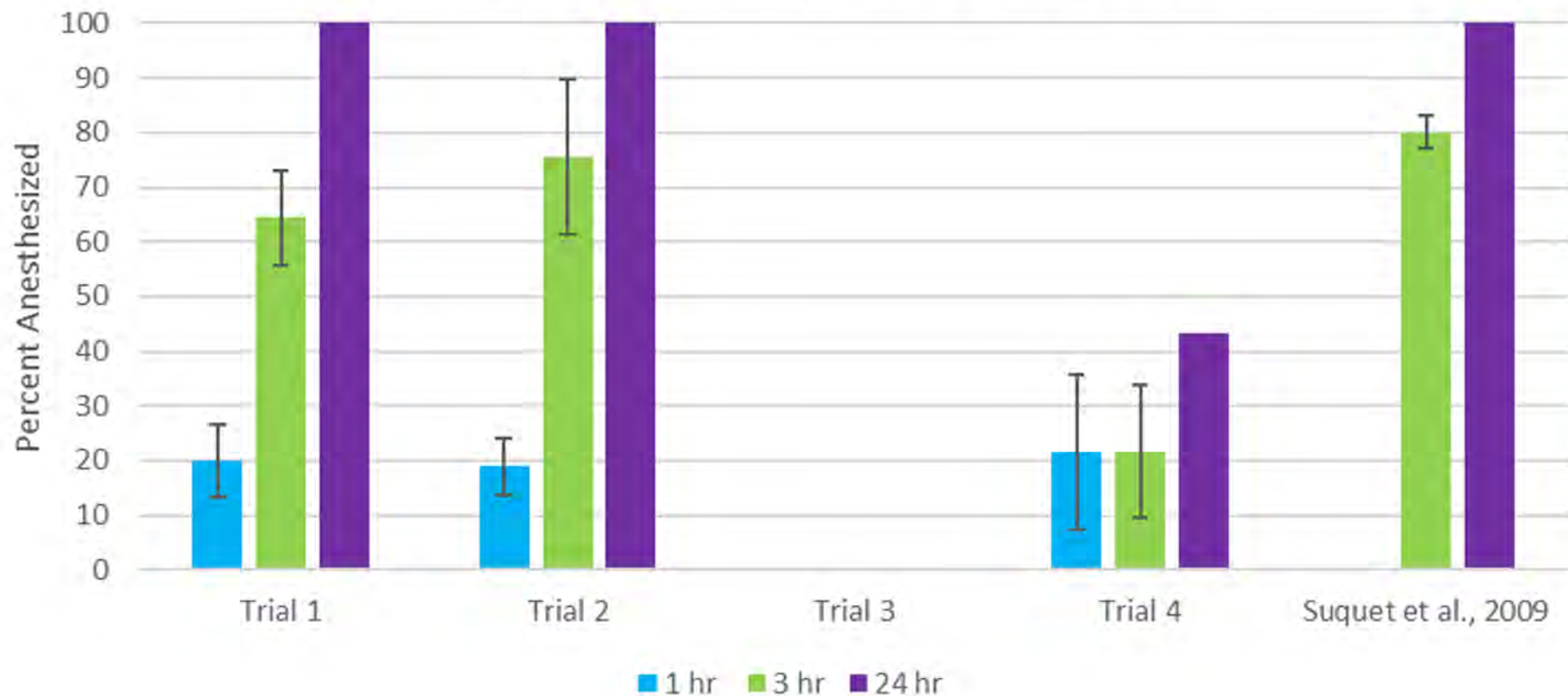
Concentration: 50 g/L of MgCl₂



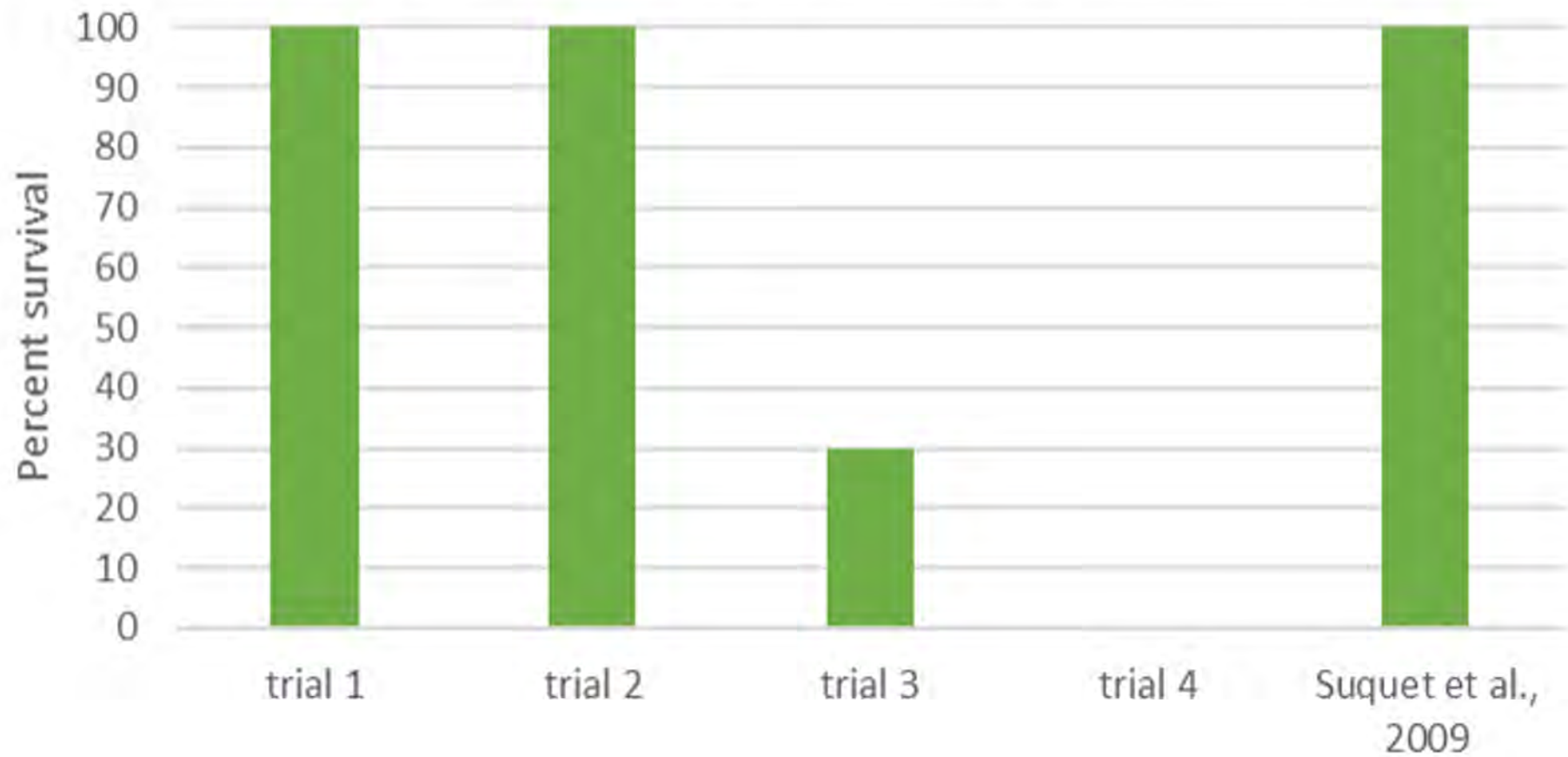
Results



Percentage Anesthetized at 1hr, 3hr, and 24hr



Recovery Percentage of Oysters Anesthetized



Recovery Rate Problems

Problem:

Our 50 g/L solution was grey with particulates on the bottom

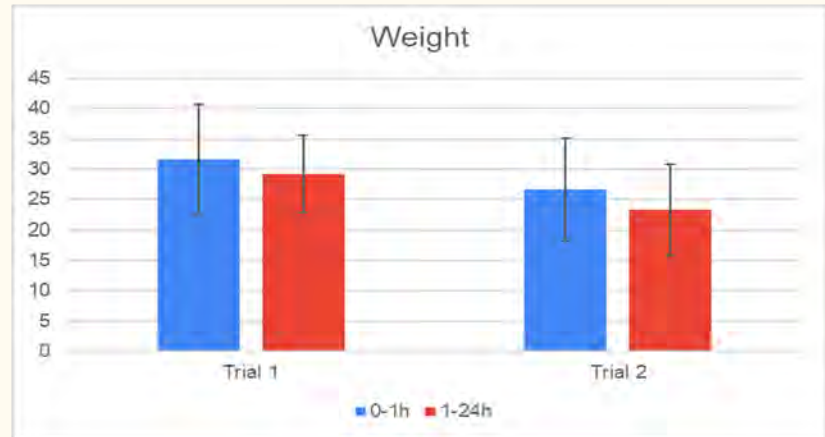
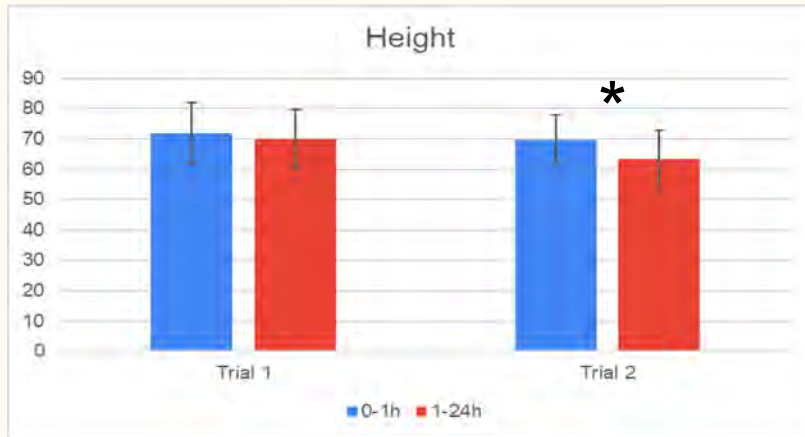
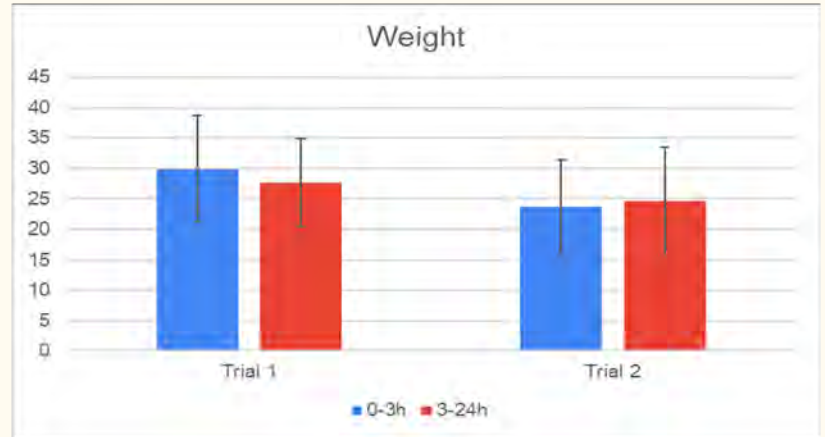
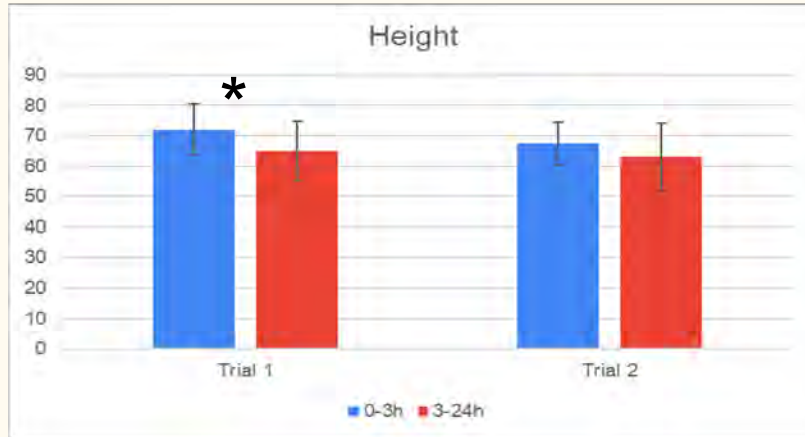
Potential Fixes:

- Mix $MgCl_2$ 80% of the water, then adding remaining volume (Cold Spring Harbor Laboratory, 2002)
- Pour water into solute and mixing throughout (Admin, 2021)
- Heat mixture while stirring



Weight and Height Discussion

*Significance $\alpha < .05$



Conclusions

Best protocol for anesthesia:

- Adding a pump
- Starving oysters
- 5 g/L with pump

Future Steps

- Repeat experiment at a lower volume of water
- Increase the concentration of $MgCl_2$ in intervals
- Test the type of pump and filtration system
- More trials related to starving and feeding amounts
- Determine ideal oyster number to water volume to minimize excess water use

Citations

Wikimedia Foundation. (2022, July 26). *Anesthesia*. Wikipedia. Retrieved August 1, 2022, from <https://en.wikipedia.org/wiki/Anesthesia>

Suquet M., Kermoysan G., Araya R., et al. (2009). *Anesthesia in Pacific oyster, Crassostrea gigas*. Aquatic Living Resources: EDP Sciences. <http://dx.doi.org/10.1051/alr/2009006>

Cold Spring Harbor Laboratory Press. (2002). Stock Solutions. Retrieved August 1, 2022, from <https://www.cshlpress.com/pdf/sample/2014/LabRefV1/LabRefV1Ch1S1.pdf>

Admin. (2021, July 23). *Preparation of 1m magnesium chloride (mgcl2) stock solution*. Laboratory Notes. Retrieved August 1, 2022, from <https://www.laboratorynotes.com/preparation-of-1m-magnesium-chloride-mgcl2-stock-solution/>



Acknowledgments



Questions