Ecotoxicity of natural gas on *Artemia salina*

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Introduction

Our motivation for this project comes from the recent events in the Baltic Sea. The gas pipelines Nord Stream 1 & 2 started leaking enormous amounts of natural gas at 3 spots. Various environmental organisations started questioning the dangers to sea life of these leaks, but none had a real answer. That's why we investigated the effects by ourselves. We started researching the ecotoxicity of natural gas on a species of brine shrimp, *Artemia salina*, which lives in salt environments such as the Baltic Sea.

Materials and methods

During the experiment, natural gas was pumped into the saltwater tanks. Sampling took place at regular intervals, during which the mortality rate was determined. Over the different batches, there were several changes to the gas and oxygen flow rates to determine their influence on the results.

We performed the following tests:

1. Determination of optimal salt mixture
2. Determination of ecotoxicity on 2 different batches
3. Influence of oxygen on natural gas ecotoxicity
4. Influence of seawater on ecotoxicity (without air)
5. Determination of ecotoxicity at reduced flow rate (1/2)

Figure 1: Setup during ecotoxicity testing

Results

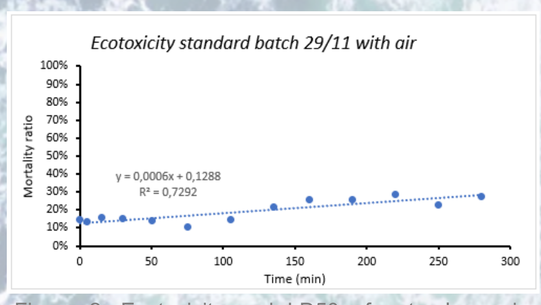

Figure 2: Ecotoxicity and LD50 of natural gas in aerated standard batch

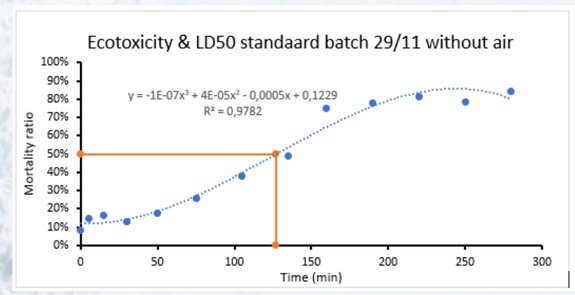

Figure 3: Ecotoxicity and LD50 of natural gas in un-aerated standard batch

LD50 = 5,011 m³

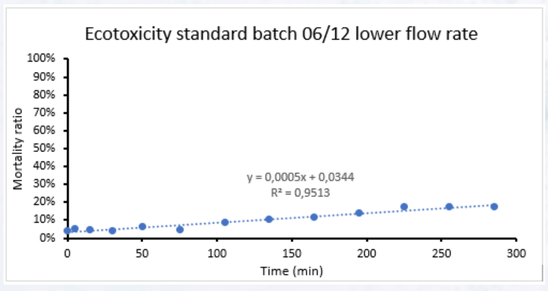

Figure 4: Ecotoxicity and LD50 of natural gas with reduced flow rate in standard batch

V_{tot} = 6,113 m³

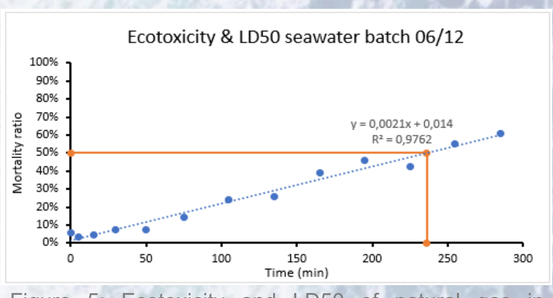

Figure 5: Ecotoxicity and LD50 of natural gas in seawater

LD50 = 9,318 m³

A rest period (without natural gas) lasting 24 hours took place after each of these measurements. After this pause, a new count was done. The results of these measurements showed that many artemia had died during these 24 hours. This is because the artemia had already ingested a deadly amount of natural gas, which would kill them during this period.

Batch	Mortality ratio (280 min)	Mortality ratio (24 hours)
With air	27%	69%
Without air	84%	100%
Lower flow rate	17%	48%
Seawater	61%	93%

Table 1: Mortality ratio 24 hours after shutting down natural gas

Figure 6: *Artemia salina* after exposure to natural gas

Figure 7: *Artemia salina* after exposure to natural gas

Conclusion and discussion

Natural gas certainly has an impact on *Artemia salina*. As a result, it also has an impact on the entire ecosystem. However, there are certain observations to be made regarding the ecotoxicity of natural gas.

- A first observation is that the addition of air to the water greatly reduces the ecotoxicity. This is because oxygen dissolves better in water than natural gas, driving the natural gas out of the water.
- The flow rate of natural gas plays an important role in the ecotoxicity. Its lower flow rate significantly lowers its impact.
- Finally, there is an important difference between seawater and synthetic salt water. The composition of seawater is many times more complex; certain of the components in seawater have an impact on the ecotoxicity of the natural gas.

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