

PROJECT: INTAKE
SYSTEM: Semi-closed system in sea
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CtrlAQUA

UV requirements for inactivation of viruses, bacteria and sea lice

RESEARCH QUESTION:

To determine the required reduction equivalent UV doses to inactivate selected Atlantic salmon pathogens.

DURATION: 2020-2023

SALINITY TESTED: Salt water

HIGHLIGHTS:

- The UV dose to inactivate several Atlantic salmon pathogens was compiled and, it was further experimentally determined for six selected agents.
- Two viruses: Infectious salmon anaemia virus – ISAV and Infectious pancreatic necrosis virus – IPNV.
- Three bacteria: *Yersinia ruckeri* – yersinosis agent, *Moritella viscosa* – winter ulcer disease agent and *Tenacibaculum finnmarkense* – tenacibaculosis agent.
- One ectoparasite: Sea lice copepodites – *Lepeophtheirus salmonis*.
- Two collimated beam apparatus were used: a low-pressure and monochromatic UVC lamp ($\lambda=254$ nm) and, medium-pressure and polychromatic UVC lamp emitting at multiple wavelengths, ($\lambda=220-300$ nm).
- A UVC dose < 25 mJ/cm₂ inactivates (99.9%) all bacteria and viruses tested and reviewed, with exception of IPNV (43–250 mJ/cm₂).
- Very high UV doses >100 mJ/cm₂ are required for sea lice losing its mobility and to have any relevant mortality.
- Differences between the two UV technologies are visible at high UV doses (25-100 mJ/cm₂); medium pressure then

requires significantly lower doses to inactivate pathogens.

RECOMMENDATION:

- It is recommended to use a UV dose of 25 mJ/cm₂.
- When IPNV is present in the water a UV dose needs to be higher and a medium-pressure UV is recommended.
- UVC is not recommended to eliminate sealice copepodites.

READ MORE:

D8.2.INTAKE2020_Power-point summary on required UV doses to inactivate Atlantic salmon pathogens.

D8.3.INTAKE2020_Report on the required reduction equivalent UV doses to inactivate selected Atlantic salmon pathogens and the impact of UV treatment of UV treatment on seawater microbial communities' equilibrium.
D8.1.INTAKE2021_Power-point summary on required UV doses to inactivate Atlantic salmon sea lice_Nofima.



READ MORE:

D8.1INTAKE2021_Power-point summary on required UV doses to inactivate Atlantic salmon sea lice_NORCE.

D8.3INTAKE2022_Power-point summary on

The factsheet is not yet ready for implementation. More testing under commercial conditions is needed.

the UV inactivation of naturally occurring pathogens in intake water from semi-closed systems.

Table 1. Required UV doses (mJ/cm₂) to inactivate selected Atlantic salmon pathogens.

Pathogen	UV dose	Reference
Virus		
Infectious salmon anaemia virus (ISAV)	2 – 7.5	this study, 1,2,3
Infectious pancreatic necrosis virus (IPNV)	43 – 250	this study, 1,2,3
Viral haemorrhagic septicaemia virus (VHSV)	0.8 – 3.3	1,3,4
Infectious hematopoietic necrosis virus (IHNV)	1 – 4	4,5
Bacteria		
<i>Vibrio anguillarum</i>	2.9 – 24	7,8
<i>Aliivibrio salmonicida</i>	2.2	9
<i>Aeromonas salmonicida</i> subsp <i>salmonicida</i>	0.1 – 24	7,9
<i>Yersinia ruckeri</i>	2.7 – 24	this study, 7,9
<i>Moritella viscosa</i>	2	this study
<i>Tenacibaculum finnmarkense</i>	3.3	this study
Ectoparasite		
<i>Paramoebae perurans</i>	4*	10
<i>Lepeophtheirus salmonis</i> copepodites	> 100 [#]	this study

Notes:

to reproduce.

#UV dose at which 30% of copepodites lose mobility

1 UV dose range for low pressure and medium pressure UV. At high UV doses > 25-50 mJ/cm₂ the inactivation differs significantly between these two UV technologies.

2 If not stated otherwise in the table inactivation refer to log 3 i.e., 99.9%

3For reference details see DELIVERABLE 8.2/2020. Power-point summary on required UV doses to inactivate Atlantic salmon pathogens.

*UV dose at which amoebae lose ability dites lose mobility.