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

Review of technologies for intake water treatment in S-CCS

RESEARCH QUESTION:

- Intake water treatment can help to manage major treats in the production of salmon at sea (e.g. sea lice, AGD, surface pathogens, harmful algae), but large flows typical for S-CCS require large treatment capacities.

Review of current technologies for treating intake water Summary and comparison of potential solution that might allow for the cost-efficient treatment of large volumes of intake water

DURATION: 2019

HIGHLIGHTS:

- Technology overview summarized in Figure 1
- Ultrasound most likely not a feasible technology for treating large flows typical for S-CCS.
- Microscreen filtration is effective to remove sea lice, particulates and increases disinfection efficiency (Screen sizes 50 - 100µm necessary)
- UV and AOP allow for disinfection without harmful chemical residues
  - UV treatment is effective to control pathogens but is sensitive toward particulates. Less effective against certain viruses (e.g. IPNV)
  - Advanced oxidation process (AOP) could be a powerful tool to increase disinfection efficiency in intake water treatment, if it can be scaled up successfully
- Dissolved air flotation (DAF) could potentially help in managing harmful algae blooms (HABs)

RECOMMENDATION:

- Combination of microscreen filtration and UV treatment remains the most promising technology for intake water treatment.
  - E.g. 50 µm screen + 35 mJ/cm2 UV, effective to control invertebrate larvae and bacteria in water w/ up to 95 NTU (10-15 in natural waters) (Waite et al., 2003)
- UV-LEDs could increase economic viability of intake water treatment in the future, but not commercially viable on large scale yet
- Investigating potential of AOP for disinfection and DAF for managing HABs in S-CCS

PRACTICAL CONSIDERATIONS:

- Necessity to systematically address the key question: How much treatment is enough?
  - More research into minimal requirements for water treatment and re-evaluating risks for SCCS (e.g. potential for spray contamination in open SCCS with intake water treatment, or quantifying added benefit of microfiltration in relatively clean salt water before UV treatment)
  - More emphasis on individual risk assessment for different sites
  - "Modular" thinking on intake water treatment, how much treatment is needed when?
  - Dynamic adaptation to stocking and/or "threat level" to save energy
- Partial recirculation could reduce the need for intake water treatment, potentially only "closed" operation during HABs or known disease outbreaks?

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

READ MORE:

For detailed overview on technology and SWOT analyses, see D12.6/TREAT/2019

Technology	Principle	Mode of action		Effective against			
		Particle removal	*Disinfection*	*Sea lice*	*HABs*	*Bacteria*	*Viruses*
Microscreen filtration	Size exclusion	✓	×	✓	(✓) *Size-dependent*	×	×
UV	Damage to nucleic acids, inactivation	×	✓	(✓)	✓	✓	(✓) *Dose-dependent*
AOP	Oxidation of organic matter and damage to nucleic acids (inactivation)	×	✓	✓?	✓?	✓? *More data required*	✓?
DAF	Foam fractionation	✓	×	? *More data required*	?	×	×
Ultrasound	Particle disruption	(×)	(✓)	✓?	✓? *More data required*	✓?	✓?

Figure 1: Overview on reviewed intake water treatment technologies. UV: Ultraviolet light, AOP: Advanced oxidation process, DAF: Dissolved air flotation.