Supersaturation of gasses in RAS systems

N2, O2, CO2

NMBU: 2nd Nordic Workshop 2018

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Re-use of water. Accumulation of waste and toxins High fish density and small water exchange Necessary to add oxygen

Water

Groundwater Drainage water Sea water (salt)

Be aware of: Temperature 02 CO2 Nitrogen N2 Iron Water amount L/sec pН

Why is N2 dangerous to fish?

• N2 diffuses faster over the gills than O2. Supersaturation due to accumulation. Emboli = air bubbles in the blood. Bleeding in the gills Bad feed conversion, stress, and raised mortality. Secondary infections.

Bleedings due to N2



Nephrocalcinosis (CO2)



Treating of freshwater

Do nothing Aeration by airlift Trickling filter Low pressure diffuser

Groundwater degassing



Groundwater degassing





Treatment of "used" water:

Airlift, 2-4meter Bio-filter, with or without air/O2 Trickling filter Adding liquid oxygen ?

Bio-filter

Watch out for sludge collecting areas Good aeration or oxygenation Lack of O2 can give N2 by denitrification. Moving bet filter. Watch out for the depth

Aeration and oxygenation of used water

Trickling filter: Good but demands a lot of space, and lifting the water min. 2 m Airlift: Good oxygenation, but what about N2. Be aware of depths more than 2 m. Diffuser: Good for oxygenation and degassing. Low pressure (80cm). Very important with small bobbles!!!

Low pressure diffusing





What can we measure?

CO2: The free CO2 should be measured. Gives a snapshot of amount. Can change... O2: easy to measure Total gas: easy to measure. N2: Calculated or measured directly (Oxyguard TGP) But the equipment can be effected by liquid O2!!!

N2 affected by liquid O2

	Gas trial N2 versus liquid O2				Harris State	Self Sale		,00 mg/l
28. september 2016					No.		1	kalibrerring
ſ	Temp	pH li	CO2 %	CO2	% ilt	mg O2	Total gas	Nitrogen
Groundwater	10	7.0	E000/	1 ma/l	400/		101	117 0 0/ NO
Groundwater	10	7,0	522%	4 mg/l	40%		101	117,9 %N2
,								
Groundwater + O2	10	7	522%	4 mg/l	130%		104	96,5 %N2
г								
	4.0	_	5000/		00/			
Groundwater -O2	10	1	522%	4 mg/l	0%		92	117,6 %N2

Signs of supersaturation

Dark fish, exophthalmos Fish in the surface Swollen swim Blatter No appetite Organs look normal Microscope: Bobbles in mucus and gill-capillary (O2) Bleedings in gills.(N2) Along the kidney we see 2 light red stripe

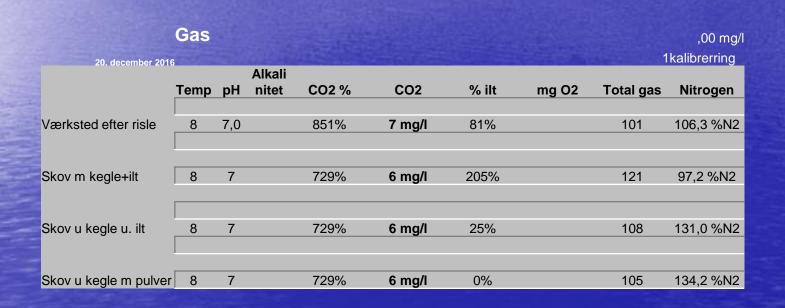
Why is the degassing failing?

No exchange of air: Trickling filter covered Size of bubbles= low water contact. Under dimensioned aeration. 1:5m3? High water speed in/into level tank. Air-bobbles to pump/cone... can happen on the pressure site in pipes...

Highspeed water and bubbles



Air into O2-cone



Questions?????

