Billund Aquakultur Service A/S

Large-Scale Biosolids Dewatering

…….examples from the industry

Aquaculture Innovation Workshop #6, Vancouver, 28th of October, 2014

Presentation by Bjarne Hald Olsen, CEO at Billund Aquaculture, Denmark

Discharge from RAS

1. Process water from fish tanks
2. Spray water from cleaning the mechanical filters
3. Sludge from back-flushing of the fixed bed biological filters

Fish tanks

Mechanical filtration

Mesh size from 40 - 90 µm

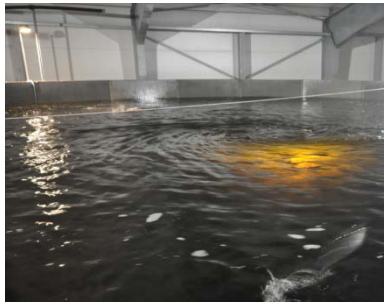
Average water consumption from 150 – 200 liter/kg feed

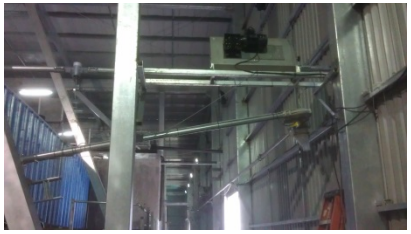
Biological filtration

The sludge coming from back flushing varies according to flushing interval and efficiency of the back flushing.

What influence on the sludge volume

- Fish species
- Feed Conversion Rate (FCR)
- Fish feed
  - Production methods (extruded, pelletized)
  - Composition of the feed (ashes, fibre, starch, carbon hydrate etc.)
  - Digestibility of the raw materials (dissolved and un-dissolved waste, amount of excrements)
  - Physical quality of the feed (dust and broken pellets)
  - Feeding methods (mechanical transport of the feed, pneumatic transport of the feed)
  - Excrements (consistency)
- Feeding system
- Management (feeding strategy, feed waste)





Sludge volumes from “Langsand Salmon”

Water consumption:

- Maximum feeding per day: 3.000 kg feed/day
- Water consumption per kg fish feed: 400 liter/kg feed
- Total water consumption: 1.200 m^3/day

Type of discharge water:

- Sludge water from mechanical filters: 200 liter/kg feed – 500 mg SS/l ~ 0,05 %DM ~ 100 g DM/kg feed
- Sludge water from biological filters 5 liter/kg feed – 5.000 mg SS/l ~ 0,5 %DM ~ 25 g DM/kg feed
- “Clean” water from fish tanks: 195 liter/kg feed - 15 mg SS/l ~ 0,001 %DM ~ 3 g DM/kg feed
- **Total water consumption: 400 liter/kg feed ~ 128 g DM/kg feed**

DM in sludge (% DM)	Liter of sludge per kg feed (liter/kg feed)	Sludge volume (m^3/day)
100,0	0,128	0,4
50,0	0,256	0,8
30,0	0,427	1,3
25,0	0,512	1,5
20,0	0,640	1,9
15,0	0,853	2,6
10,0	1,280	3,8
9,0	1,422	4,3
8,0	1,600	4,8
7,0	1,829	5,5
6,0	2,133	6,4
5,0	2,560	7,7
4,0	3,200	9,6
3,0	4,267	12,8
2,0	6,400	19,2
1,0	12,800	38,4
0,5	25,600	76,8
0,4	32,000	96,0
0,3	**42,667**	**128,0**

How much thickening of the sludge?

A question of final disposal!!!!

- Discharge to nearby sea, river etc
- Stored at a landfill
- Used for biogas
- Used as a fertilizer
- Etc.

Sludge volumes from “Langsand Laks”

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Sludge thickening 5% DM

Sludge thickening: Approx. 5% DM by use of coagulant, pH-regulation, polymer and belt-filter

Mixer tank

Chamber 1: High turbulence → Coagulation phase

Chamber 2: Flocculation phase, small particles → bigger particles

Chamber 3: Particles ready to sediment – mixing high enough to avoid that sedimentation

Sludge volumes from “Langsand Laks”

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Sludge thickening 15% DM

Sludge thickening: Approx. 15% DM by use of coagulant, pH-regulation, polymer and Geotube

Sludge volumes from “Langsand Laks”

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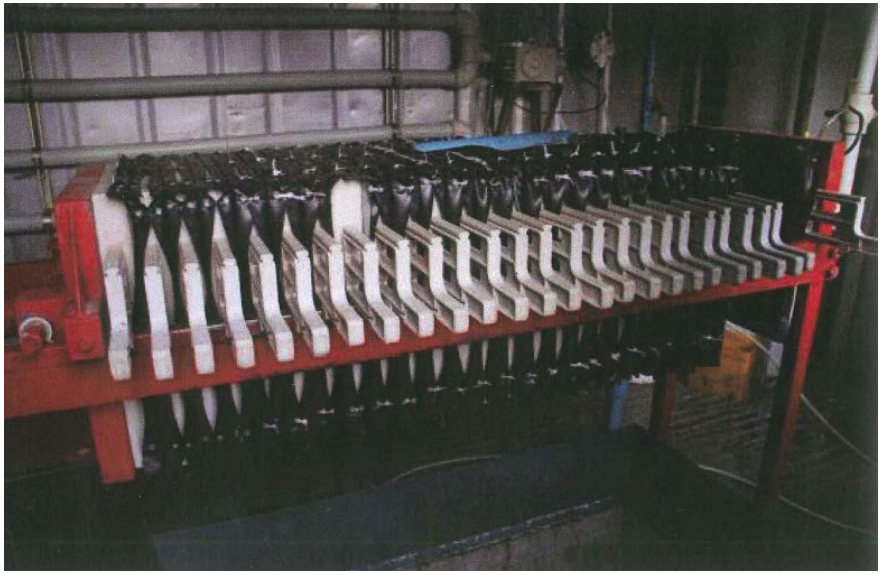
Sludge thickening 25% DM

Sludge thickening: Approx. 25% DM by use of coagulant, pH-regulation, polymer and chamber filter press



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1,0	12,800	38,4
0,5	25,600	76,8
0,4	32,000	96,0
0,3	**42,667**	**128,0**

Sludge thickening 30% DM

Sludge thickening: 30% DM by use of coagulant, pH-regulation, polymer, belt-filter and centrifuge

Sludge volumes from “Langsand Laks”

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- Water consumption per kg fish feed: 400 liter/kg feed
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- **Total water consumption: 400 liter/kg feed ~ 128 g DM/kg feed**

Dry matter in sludge (% DM)	Liter of sludge per kg feed (liter/kg feed)	Sludge volume (m^3/day)
100,0	0,128	0,4
90,0	**0,142**	**0,4**
50,0	0,256	0,8
30,0	0,427	1,3
25,0	0,512	1,5
20,0	0,640	1,9
15,0	0,853	2,6
10,0	1,280	3,8
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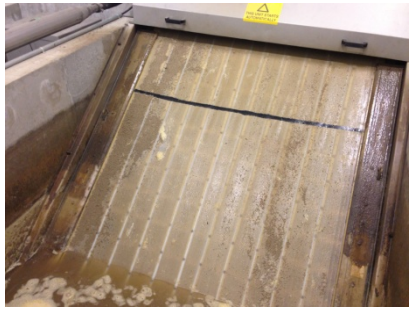
4,0	3,200	9,6
3,0	4,267	12,8
2,0	6,400	19,2
1,0	12,800	38,4
0,5	25,600	76,8
0,4	32,000	96,0
0,3	42,667	128,0

Sludge thickening +90% DM

Sludge thickening: Approx. 90% DM by use of belt-filter and composting









Sludge thickening – Alternative

Sludge thickening: Composting by use of worms

Sludge thickening – Alternative

Sludge thickening: Future!!!

Pyrolysis?

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Thanks for your attention