TREATMENT OF WASTE WATER FROM FISH PROCESSING

Here is a brief description of methods for waste water treatment that, at this time are used in the fish processing industry, like:

- Sieving
- Grease separation
- Flotation
- Precipitation
- Sludge treatment
- Delegation to municipal waste water treatment plant

The operation is often intermittent running due to the fish at hand. The operation of treatment is there for also intermittent, which gives special problems.

All in all, the waste water treatment should be dimensioned for maximum load, which one should be able to read out of a flow measurer. It must be possible to take tests of the water before and after the treatment in order to control the efficiency. Manuals for operation and maintenance must be available as well as instructions of what to do when there is an alarm or other disturbers in the process. There must be a check list for operation and treatment.

A treatment plant should be built in the way that it is easy to keep it clean by flushing and mechanical cleaning.

Sieving:

Sieving is a common step in treatment of waste water. Mainly a method to remove particles bigger than the effective hole diameter from the fluid. When sieving one should avoid pumping so that big particles don't brake in to smaller and increases the BOD. It is important to remove as much particles as possible in this step which very much lowers the costs of further treatment. The thicker the incoming water is, the easier it is to remove particles by sieving. Older sieves, of which some still are in operation where mainly made as a transport screw for bringing fish solid wastes to a container. The bottom part had a hole perforation of about 10 mm. This was not an effective way since a lot of solids made it's way trough the perforation. This way is today only accepted as pre sieving.

In Swedish fish processing today rotating drum screens are most common. (Swedish Roto-Sieve or Danish Cabin plant). Slot screens (Hydrosieve) or drum screens that are fed from the outside (Roto-strainer) are not used. Nor vibrating sieves or centrifugal sieves (Centrisil). In slowly rotating drum screens the hole perforation is 0.5 – 2mm and in Centrisil from 0.1mm all the way down to 0.04mm. In vibrating sieves multiple sieve areas can be placed after one and other. These sieves are more complicated than for instance Roto-Sieve.

In a Roto-Sieve the waste water is transported axial in to the drum and radial out through the perforation. Separated particles are transported by the rotation of the drum and the internal screw out of the drum. During this transportation the screenings are being dewatered. The drum rotates with the speed of 10, 16 or 25 rpm depending of the load. In fish industry 25 rpm are most common. Lower speed, 16 rpm is better for the screenings and produces more effective dewatering. However a slower speed demands a longer drum at a curtain load. A lower speed gives a bigger effective screen opening (A peripheral speed of 0.8 m/s is a hole opening of 1.0mm equivalent to an effective opening of 0.5mm). Having a rotational speed of 3 rpm the sieve can be used as a sludge thickener (TS out 10%). The sieve can in this case be provided with smaller perforation the first half of the drum.

Pump capacity (l/s) at max level is dimensioning flow for the sieve. There should be a safety factor of 1.3. Trouble at the starting process are often due to wrong dimensioning. From the collecting basin there are a level controlled pumping to the Roto-Sieve. The pump should be of a merciful kind and sized for an as continuos load as possible. An over sized pump gives intermittent heavy load. The most merciful treatment of the waste water is to let it flow by gravity to the sieve. In order to get a continuos flow a small collecting basin could be necessary.

The capacity of the sieve is due to the total open area, the effective open area, the length of the sieve and the nature of the waste water. The flow capacity is between 1 – 200 l/s. The Roto-Sieve is available in the lengths 2.6, 2.0, 1.6 and 1,3 m with a relatively capacity of 1, 0.5, 0.44, 0.1.

The fish waste should after sieving be drip-dry. Foaming gives a lower amount of TS because of clogging the holes. It is possible to add foam reducing chemicals.

Over flow of the sieve can happen when the perforation gets clogged due to heavy load or mail function of the flushing device. The result is that the capacity of the sieve becomes to small to handle the incoming flow. In order to avoid that the water goes to the sludge container there must be an over flow system. Over flow water shall be separated and led back to the collecting basin. It also effects a switch that gives a signal to start flushing, give an alarm, stop the pumps or close inlet valves.

At sieving one shall use as small hole perforation as possible. Perforation are available down to 0.5mm. Slot openings are available down to 0.05mm. Sieves below 0.1mm hole openings are called micro sieves (used for drinking water). Existing drums can be changed to slot sieves. The slot sieve is effective to round shaped particles and the hole perforated sieve is effective to scales. The slot sieve has at 0.5mm openings an open area of 33% against 27% for the hole perforated sieve, which gives the slot sieve bigger flow capacity. Fat fish can be treated in a 1.0mm hole perforation or 0.5mm slots and white fish 0.5mm holes or 0.2mm slots.

Small openings gives in general more operating problems due to clogging. There is an optimal hole size for each kind of waste water. Normally the fish industry uses 1.0mm perforation which lives up to standard demands of the waste water at flotation. If the purpose is maximum susp-separation, smaller perforation should be used.

The Roto-Sieve has a special ability to handle fat in waste water due to the automatic cleaning of the perforated area. It has a continuos working nylon brush that rotates on the outside of the drum and a pipe with nozzles for intermittent flushing covering the hole length of the drum. Flushing must always be activated at over flow and from a timer (appr. 3 – 4 times/day 2 min if hot water or every our if cold water). The sieve must be fully covered and equipped with evacuation pipe.

Flushing is the most important help for a function without problems. Short intensive flushing using hot water is better than long cold water flushing. During flushing there should be no incoming flow.

It is possible to use fine sieved water for flushing. However the proper nozzles must be selected due to remaining particles in the water.

Cleaning is most important if the waste water contains spawn or milt. At greasy waste water hot water flushing is necessary. Manually cleaning using high pressure flushing could some times be necessary, but should be set to a minimum.

The degree of separation should be continuously measured. Instruments of this purpose must be provided.

Variations in effectiveness is normally big. The degree of separation increases when the concentration of the waste water gets higher. Some mixing of air comes to reality in the Roto-Sieve which is an advantage before grease separation, especially at self flotation (no air addition).

The collecting system after the sieve is also important. It should be proper dimensioned to be able to take care of the sievings. Preferably with an automatic device for preventing overflow. Drainage should be led back to the collecting basin. Steps should also be taken to minimise the smell.

Average degree of separation using a Roto-Sieve 1.0mm hole perforation (data from Norwegian investigations):

%	cod fillet waste	herring fillet waste	shrimp shell waste
DS	32%		53
BOD	26%	20 – 60	
Settable			70
DS in sludge	9		12