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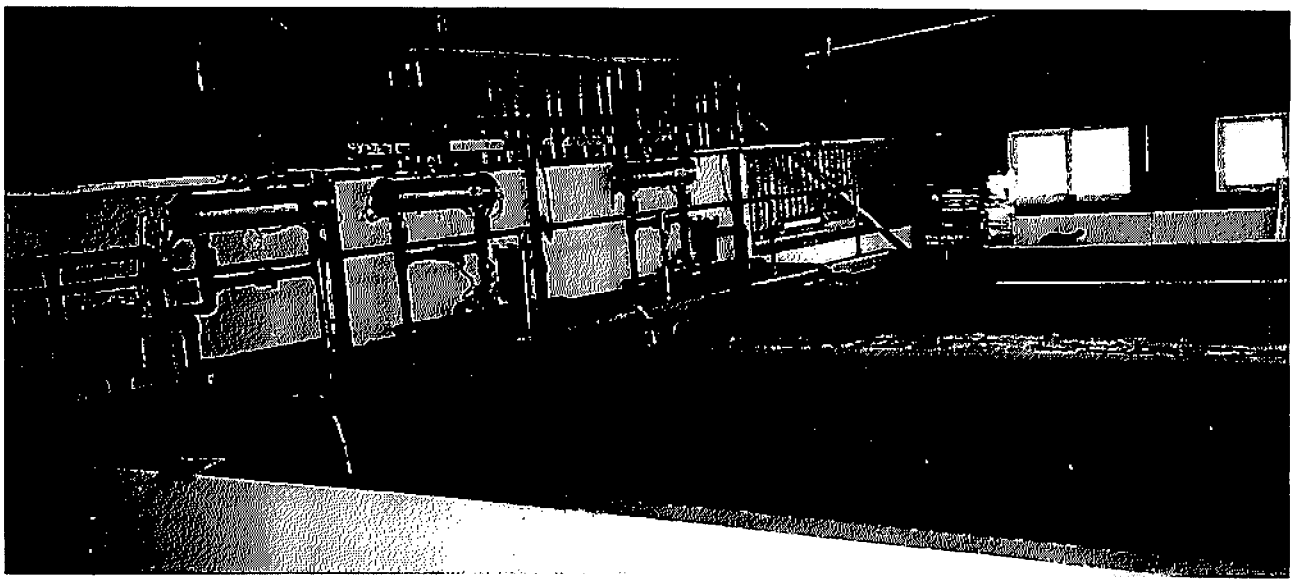
The Sea Fish Industry Authority

Seafish Technology



Site Visit to Inspect Oyster Depuration Tanks at La Rocque Fisheries Limited

Confidental Report No. 142

P. Wilson
April 1998

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1. Introduction

La Rocque Fisheries Limited on the island of Jersey have installed three purification tanks to depurate Pacific Oysters *(Crassostrea gigas)* taken from their nearby oyster growing lays. The tanks, which had been built to a French design, require approval from the States of Jersey Department of Agriculture and Fisheries. Seafish were asked by La Rocque to make a site inspection and give an opinion on the suitability of the tanks for depurating Pacific and Native *(Ostrea edulis)* Oysters. Peter Wilson, Senior Fish Technology Engineer at Seafish visited on Wednesday 15 April 1998.

2. Site

The purification tanks are housed within a large new building which also contain two oyster washing and grading lines. The building is located at Grouville in the South East of Jersey.

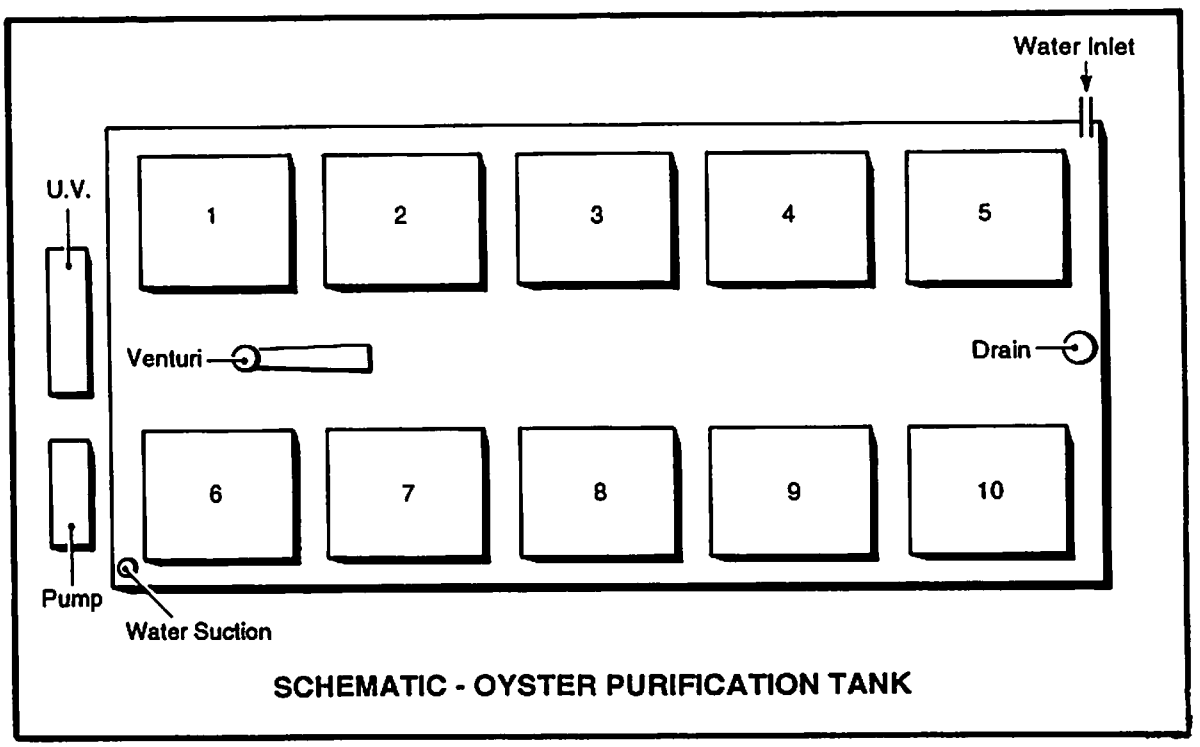
3. Seawater Supply

A pump house is located in the intertidal area some 350 metres from the purification tanks and supplies a $70m^3$ (approximate) reservoir located next to the oyster plant building. Due allowance appears to have been made for the settlement of sediment and subsequent cleaning of the holding tank. Seawater is pumped out from a point well clear of the tank bottom. On the day of the visit, salinity was measured at 35 parts per thousand (full seawater strength).

Seawater reservoir

4. Purification Tanks

The three identical purification tanks are built alongside each other and are of rendered reinforced concrete construction, coated internally with a light grey epoxy paint. One tank was measured and had internal dimensions of 7.65m (length) x 3.45 m (width) x 1.5 m (depth). Seawater is circulated via a pump and ultra violet steriliser unit (UV) from a single pipe at the bottom of one corner of the tank to an outlet pipe above the water surface at the other (see Schematic). Water circulation rate is specified at $30m^3/hr$, although there was no means of confirming this and the UV with 4 x 115 watt lamps is rated to give a minimum dose of $25mJ/cm^2$ at the specified water flow. A $30m^3/hr$ venturi aerator pump is located at the water suction end on the tank floor with its outlet knozzle directed horizontally down the centreline of the tank.



SCHEMATIC - OYSTER PURIFICATION TANK

5. Tank Loading

Pacific oysters are brought directly to the building from the lays and are first washed and sorted. It is important that pre-depuration handling techniques do not overly shock and hence stress the oysters as this can result in a reduced level of activity when they are re-immersed. Although oysters were not seen going through the washing/sorting process, the handling equipment used at this stage appeared to be suitable.

The oysters are put into mesh stack/nest type boxes with external dimensions of 600 mm x 500 mm x 185 mm and a nominal capacity of 35 litres. A nominal load of 20 kg per box was

specified and resulted in rather more than the 'double overlapping layer' required in the United Kingdom. However, the need to ensure that sufficient space be left within the box to allow for the oysters to open their shelf halves in order to resume filtration activity, appeared to be well understood and I do not consider the depth of oysters within the box to be a problem.

The boxes are stacked on purpose-built stainless steel pallets, four boxes to a layer and five layers deep. A total of ten pallets (4000 kg of oysters) are positioned in the tank in two rows such that a wide gap (in excess of 1 metre) is left down the centreline and a free gap of 150 mm - 250 mm is left between the pallets themselves and the tank walls. It is intended that pallets be loaded/unloaded mechanically by suspending them from the tines of a fork lift truck. In time it is hoped that an overhead crane be used to fully mechanise this operation.

6. Filling with Seawater

With the current plumbing arrangement, seawater is pumped directly into the tank from the reservoir and not through the UV steriliser unit. This potentially exposes the oysters to any contamination that may be present in the seawater prior to it passing through the UV during re-circulation. With the present plumbing configuration I would recommend that the tank is filled with seawater only and recirculated through the UV for a few hours before loading the oysters. An alternative option may be to re-plumb the seawater supply line such that seawater enters the tank via the UV. Another option would be to install a separate UV unit on the tank filling line from the reservoir.

7. Unloading Oysters

A 100 mm diameter plug type drain is located in the floor of each tank. This is well clear of the stacked boxes of oysters and is considered to be suitable. If an overhead crane is eventually installed, care must be taken not to suspend loaded pallets over the top of a tank which is in use.

If oysters are to be washed in the tanks this should be with fresh water after the tank has been drained down. If seawater from the reservoir were to be used instead it would have to be 'clean' and passed through a UV unit at the specified dose first.

8. Dissolved Oxygen

Bivalve molluscs require an adequate level of dissolved oxygen to be available to them in seawater in order to maintain their depuration activity. A level of at least 50% saturation is generally accepted as the minimum required although for oysters this may need to be higher.

The seawater re-circulation system via the UV is left running continuously, nominally recirculating at a rate of one tank water volume per hour and providing some re-oxygenation. The venturi aerator had so far been switched on for a half hour period in every hour. The level of dissolved oxygen present in a tank loaded with oysters was measured with the aerator on and again after it had been switched off for just over two hours. The seawater recirculation remained on all the time. The level of dissolved oxygen was measured along one side and at both ends of the tank, at the top and bottom and in between pallets. With the venturi on, no dead areas were found with a level of 103% saturation at the water inlet end reducing to 102% at the water suction. With the venturi off, there were again no dead areas found with a saturation level of 100% reducing along the tank to 97%. The saturation level was also measured at the centre of the top and second box layer of the pallets at the water outlet end of the tank. Levels here were 94% and 93% respectively. The seawater temperature was 10.6° C.

Venturi aerator

9. Suitability of the Tanks for Oyster Depuration

Stacked box purification systems are used in both France and the United Kingdom but use different techniques to maintain adequate levels of dissolved oxygen.

In the United Kingdom the boxes are positioned closely together across the tank and between flow screens fitted at either end. Oxygenated seawater is then recirculated through the flowscreens which help maintain a flow through all of the boxes. However, dissolved oxygen levels do fall as the seawater passes through the molluscs and sometimes requires high water circulation rates to maintain minimum dissolved oxygen levels.

The French system requires pallets of boxes to be stacked apart to allow a powerful flow of highly oxygenated water from a venturi pump to be circulated around them. It would appear from the dissolved oxygen levels monitored within the tank that this was indeed the case. The dissolved oxygen level within the stacks was reduced but not greatly so. However, the seawater temperature of 10.6° C was relatively low for oysters (in the United Kingdom a minimum of 8° C is required) and dissolved oxygen levels should be checked at higher seawater temperatures. The venturi appears to be a very effective method of re-oxygenating the seawater but it does cause a considerable amount of turbulence which could cause disturbance to the oysters and re-suspension of sediment if boxes of oysters were not positoned correctly within the tank. It is because of these concerns that this approach has not been adopted within the United Kingdom. However, the turbulence does appear to be contained within the one metre plus wide gap down the centre of the tank between the box stacks. It will require a satisfactory microbiological test, as discussed in Section 10 to confirm that there is no harmful effect.

There appeared to be no reason for switching the venturi on and off at half hourly intervals which would in itself cause varying flows and possible re-suspension of material each time the pump was switched back on again.

10. Microbiological Test

A microbiological test had been carried out prior to the site visit. Some oysters had been artificially dosed with *E. coli* (provided by the local Public Health Laboratory) and samples, each of six oysters, positioned within a fully loaded tank in mesh bags. The results were as follows:

	Oyster Sample Location	*E. Coli*/100 g
Pre depuration	Dosing tank	1,750
Post depuration	Pallet 1 - bottom layer/tank wall	40
	Pallet 3 - second layer from top/tank wall	90
	Pallet 8 - second layer from top towards centre	110
	Pallet 10 - top layer/tank corner	220

Although the post depuration results meet the required minimum product standard of 230 *E. coli*/100 g, one would normally expect to see levels at <20 from a correctly designed and operated purification system. A poor result from pallet 8 alone, could possibly have been caused by turbulence from the venturi. However, this would not account for the levels in pallets 3 at 10. The seawater temperature at the time of the test was not known but was considered to have been low and could have accounted for this, the oysters being less active. A second test should be carried out with sampling as overleaf:

	Oyster Sample Location	*E. Coli*/100 g
Pre depuration	Dosing tank - sample 1 Dosing tank - sample 2	
Post depuration	Pallet 3 - bottom layer/toward centre Pallet 4 - top layer/toward centre Pallet 8 - bottom layer toward centre Pallet 9 - top layer toward centre Pallet 10 - top layer tank corner Dosing tank	

This should confirm the effect, if any, of turbulent flow from the venturi. A control sample taken from oysters left in the dosing tank would confirm their physiological condition. The dosing tank must be cleaned out and refilled with clean seawater taken from the UV outlet before re-immersing the control sample in it. Seawater salinity must be measured and seawater temperature in both the dosing and purification tanks recorded at the start and finish of depuration.

11. Conclusions

1. Seawater must be UV treated prior to it being used either to depurate the oysters or wash them after depuration.

2. Provided the results of a second microbiological test are satisfactory, the three purification tanks would appear to be suitable for the depuration of Pacific and Native oysters.

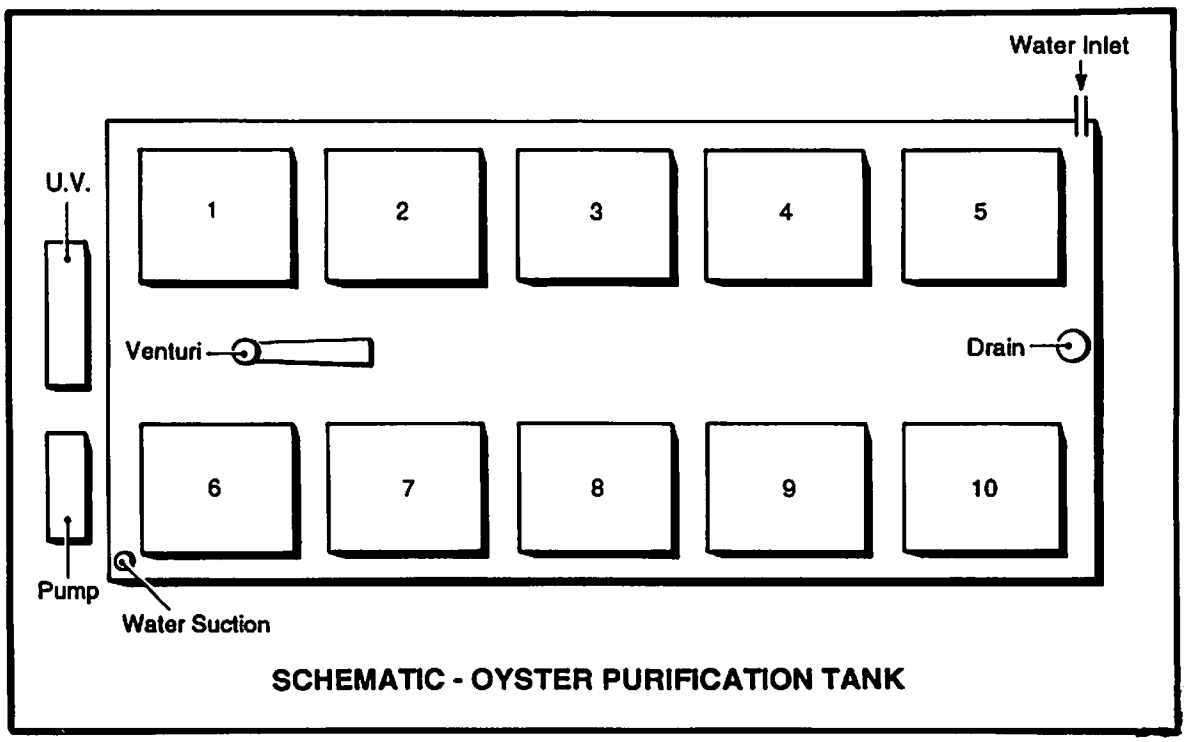
3. Pallets must be positioned in the tank as described in Section 5, with clearance all around the pallets and well clear of direct turbulence from the venturi.

4. Subject to any further advice from the French designer, it is recommended that the venturi be left on throughout the period of purification.

5. Dissolved oxygen levels should be checked when operating at higher seawater temperatures. Seawater temperatures should be recorded at the start and finish of each purification batch.

4. Purification Tanks

The three identical purification tanks are built alongside each other and are of rendered reinforced concrete construction, coated internally with a light grey epoxy paint. One tank was measured and had internal dimensions of 7.65m (length) x 3.45 m (width) x 1.5 m (depth). Seawater is circulated via a pump and ultra violet steriliser unit (UV) from a single pipe at the bottom of one corner of the tank to an outlet pipe above the water surface at the other (see Schematic). Water circulation rate is specified at $30m^3/hr$, although there was no means of confirming this and the UV with 4 x 115 watt lamps is rated to give a minimum dose of $25mJ/cm^2$ at the specified water flow. A $30m^3/hr$ venturi aerator pump is located at the water suction end on the tank floor with its outlet knozzle directed horizontally down the centreline of the tank.



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