Operational Manual

OYSTER DEPURATION DISPLAY UNIT FOR HIGH-END RESTAURANTS

NAIP Component 2 Project
A Value Chain on High Value
Shellfishes from Mariculture Systems

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
Kochi

Farmed oyster with plump meat inside shell

Oyster Farms in Sathar Island near Kochi

OYSTER DEPURATION DISPLAY UNIT FOR HIGH-END RESTAURANTS

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Objective

Considerable interest has been generated recently on consumption of live oysters in high-end restaurants in cities such as Kochi. A major lacuna in this lucrative and emerging enterprise is the lack of consumer confidence on quality of live oysters, particularly purity of oysters with respect to microorganisms. In a meeting with a large number of chefs of star hotels in Kochi at David Hall on 9th June 2010 organized by the CGH Earth group, scientists of CMFRI gave an exposition on farming of oysters and methods of its purification.

A consensus that emerged during the meeting was that oyster purification should be done in a manner which is visible to the restaurant clients. Accordingly the CMFRI is proposing a model ULTRA-PURE DEPURATION DIPLAY UNIT (DDU) the details of which are presented in this manual.

Introduction – What is Depuration?

The process of expelling contaminants from gills and guts of oysters by providing them with good purified seawater before they are used for consumption is called depuration

Oysters are two shelled animals which live in our coastal waters. They feed by filtering small microscopic algae and particulate organic matter present in the water. When filtering the seawater for feeding they may accumulate certain amount of bacteria present in the water. This can be removed if we place them in good filtered seawater for a period of 18-24 hours. The oysters will cleanse themselves by pumping the pure

seawater through their gut. During this process, the gut will become clean. This process of expelling contaminants from gills and guts of oysters by providing them with good purified seawater before they are used for consumption is called depuration.

Oyster Growing Areas

The CMFRI developed a technology for farming oysters in backwaters using simple wooden farm structures. Currently there are two main oyster growing areas in Kerala, viz., Ashtamudi Lake (Kollam district) and Vembanad Lake (Ernakulam district). Farming is done mainly by women self help groups (SHGs) and the current production is nearly 2500 tonnes per annum.

The quality of seawater where the oysters are grown is very important, mainly because of the oyster's filter feeding habit. The purity or contamination levels in the water will be reflected in the oyster which is farmed there. The CMFRI has been

Chefs from Belgium visiting oyster farms in Sathar Island near Kochi

continuously checking the water quality of the oyster growing areas in Kerala and it has been found that our waters are fairly unpolluted in terms of microbial content (Class A as per European standards- Appendix 1). These areas also pass the tests for heavy metals and biotoxins as the concentration are either nil or below detectable level. One very positive point for our growing areas is that these sites do not have any harmful algal blooms which cause toxicity. To summarize, we can grade our oyster growing areas as "CLEAN".

Farmed oysters have one added advantage over oyster growing in bottom of the sea/backwater because they are living in water column which ensures that they do not come into contact with the mud/sand of the bottom. Hence there will not be any sand particles within the oyster. However, it is always safe to depurate oysters before they are consumed so that all traces of microbes can be removed making the oyster guts very clean and safe for consumption.

Types of Depuration

Two methods are commonly followed. One is to have a continuous flow of purified seawater over the oysters, i.e., water is let in from one end of the tank and allowed to flow out through the other. This is called a continuous flow-through system. The second method, which is the most commonly used one, is the fill and draw method. In this method the purified seawater is kept in the tanks with oyster for up to 12 hours and then the water is drained. The process is repeated for another 12 hours to complete the depuration. In order to economize use of seawater, the second method is preferred for this project. Here the seawater can be recycled by using small mechanical and UV filtration units to purify the water for at least 3 cycles after which it can be discarded.

Treatment of Raw Seawater

Seawater Source: The seawater for depuration should be sourced from a clean area (sea or beach) and should be pumped only during high tide (if pumped during low tide, fresh water from land may mix with seawater and salinity will become low). It is better to avoid areas where freshwater from land drains to the backwater/sea. The raw sea water should have salinity between 15 to 34 parts per thousand (or 1.5 to 3.4% salt content).

Sedimentation Tank: While pumping / emptying seawater to the storage tank it is advisable to pass it through a filter bag which will collect all the floating macro particles like wooden pieces, leaves etc. The seawater which we collect from the sea will have minute silt particles (they are not contaminants) and this can be removed by holding the seawater in a tank (sedimentation tank T1 in Figure 1) for 12 hours without disturbance. All the minute silt particles will settle down and we will get clear seawater.

Filtration/ Purification: The clear seawater has to be first purified mechanically (through sand filters) and chemically (through activated charcoal). This can be done through the use of commercially available EHEIM make (German) composite filters with inbuilt pump which are available locally (see Appendix 2 for details).

Seawater Storage: This filtered seawater is stored in Tank 2 (T2) which is placed below T1 on a stand as shown in Fig 1. This arrangement saves space by reducing the footprint and uses gravity to make water flow from T1 to T2. Before use in the depuration tank, this seawater has to be sterilized by passing through a mini UV disinfection unit which is available locally from aquarium suppliers (see Appendix 3 for details). Thus, by

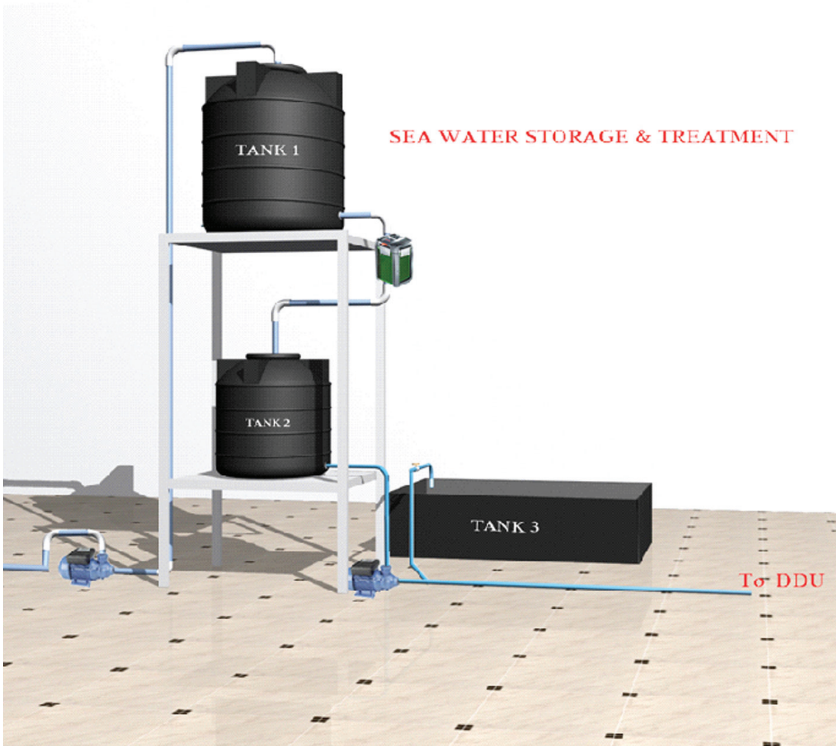


Fig 1. Layout seawater storage (T1 & T2), treatment and oyster stock tanks (T3)

using functionally different water purification components we can ensure that the seawater in which we are going to place the oysters for depuration is fully purified.

Depuration Display Unit (DDU)

The depuration display unit envisaged is very simple. The tank designed for this purpose is rectangular (100x50x50 cm LxBxH equaling 0.5 m^2) made either with FRP or acrylic having one of the longest side transparent for clear viewing of oysters (see Fig 2). The tank has a conical bottom (height 30 cm) through which the faeces produced by the oyster can be easily removed. From the base of the rectangular portion at 10 cm height, a 5 cm wide

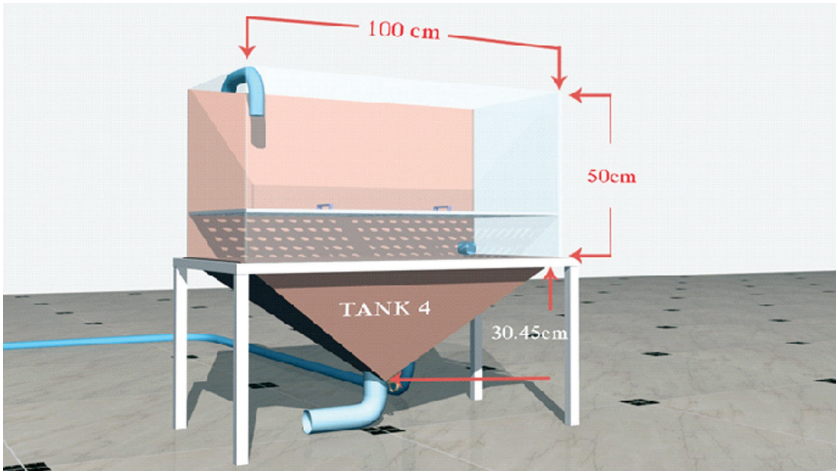


Fig.2 . Design and layout of the DDU (T4), front view

ledge is provided to place two oyster loading trays. These trays are perforated with 1 cm diameter holes and are provided with handles for easy lifting.

For recycling of seawater in the DDU, an outlet is provided just below the perforated tray. Water is drawn from this outlet and

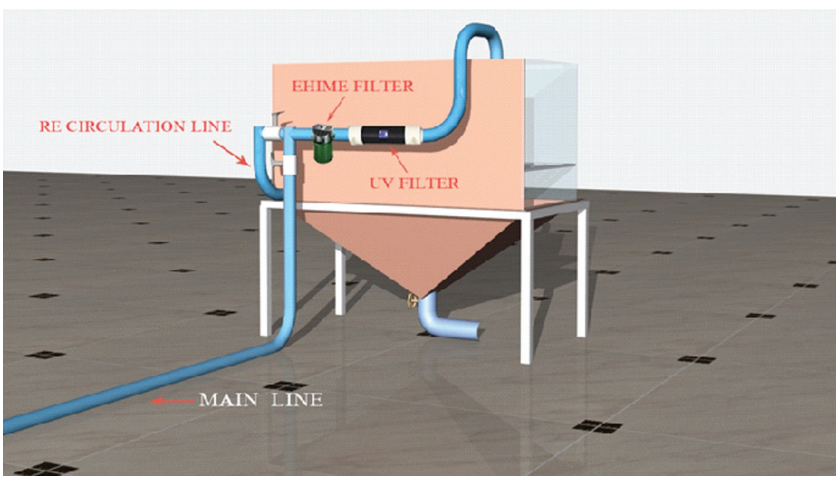


Fig.3. Design and layout of DDU, Rear view showing re-circulation system with Eheim and UV filters

passed through a mini EHEIM filter, and then through the UV disinfection unit for reuse. This ensures purified recycled water for 3 runs. The entire unit is placed on a wooden stand as shown in Fig.3.

Operational Management

- The oysters used for depuration should not have silt on the shell surface. They should be washed (using jet pumps) well and scrubbed with a wire brush before placing in the tanks.
- Oysters have to be checked before loading for broken/ punctured shell as these oysters would die easily and then the water will be contaminated due to leak of decaying oyster meat. Therefore, do not use such oysters.

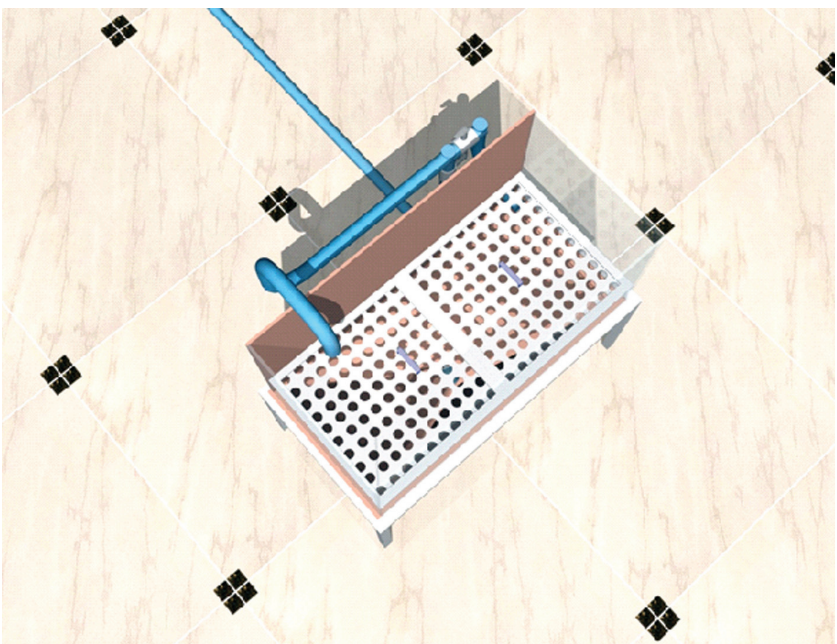


Fig. 4. Design and layout of the DDU, Top view showing dual perforated panels with handles. Bottom picture shows DDU without panels

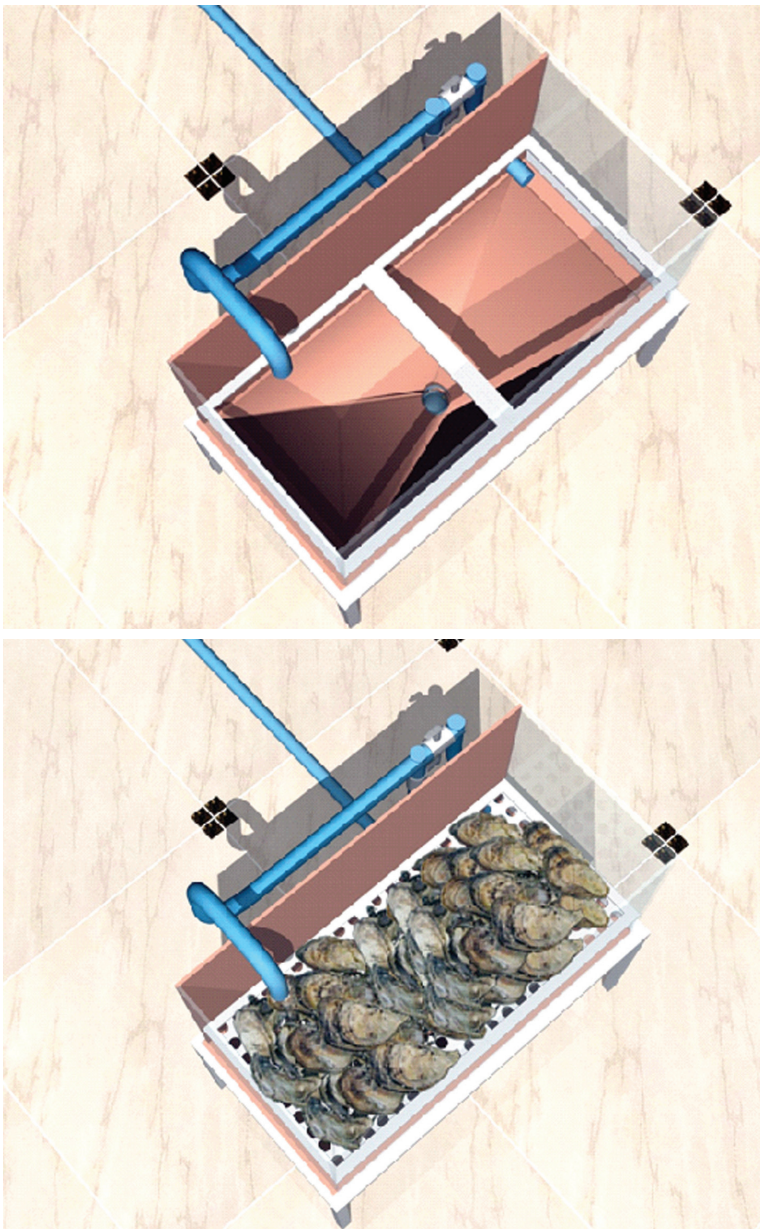


Fig.5. DDU partially loaded with oysters for depuration

- The number of oysters that can be loaded into the DDU is limited by the utilization of dissolved oxygen by the oysters in confined un-aerated water. The safe loading density has been determined by FAO as 300 oysters/m^2. For the present DDU (0.5 m^2) 150 oysters can be loaded per run of 18-24 hours.
- A maximum of 2 layers (one on top of another) of oysters is permitted. If too many oysters are placed in the tank, they will use up all the oxygen present in the water and they will be stressed. Moreover, the self cleaning process will not be effective because of overcrowding. The present loading density will give each oyster about 750 ml of water which is good enough for self cleaning.
- Technically caution has to be exercised to ensure that whatever is let out by the oyster does not go into the oyster again. For this oysters are not placed directly in the tank rather they are loaded into perforated trays and the faecal matter is removed by draining.
- What happens during depuration? When we place the fresh live oysters, straight from the farm, into our depuration tanks, they will start taking in or filtering the purified seawater. Biologically, the oyster which is still alive will start producing faeces i.e. removing all that is present in its gut and secondly, the purified water will remove the traces of microbes / other contaminants (if any) in the oyster. (Actually it is as if the oyster is having a shower in clear ultra purified seawater, grooming itself!!!).
- Depending on the daily requirement of oysters by restaurants, we may have to keep an oyster storage tank (T3 in Figure 1). This has a capacity of 1 tonne and is made of FRP and could be placed close to the T2 tank. This tank can hold up to 500

oysters with aeration and oysters can be loaded in crates and placed on the crenulated platforms. Faecal matter present in the tank should be siphoned off once every day.

- With initial water storage of 2 tonnes, theoretically 2700 oysters can be depurated. The storage tank (T3) can also be converted into a depuration tank for meeting extra requirements in the kitchen.
- Live oysters can be stored in aerated seawater for a period of 5 days without feeding and loss of meat weight.

Materials required for ULTRA PURE OYSTER DEPURATION –DISPLAY UNIT

	Item with specification	Purpose	Specification	No. required	Approx-imate cost	Source
1	Tank -1 Sedimentation tank	For settling water by which silt (suspended inorganic solids) can be made to settle and the resultant clear seawater can be used for further purification	2000 litre capacity storage tank (Syntex type)	1	10,000	Universal Sanitary House, Jews Street or any other sanitary store
2	Tank -2 Storage tank	For storing clean settled seawater	1000 litre capacity (Syntex tank) -Cylindrical	1	5,000	Universal Sanitary House, Jews Street or any other sanitary store
3	Tank – 3 Oyster storage	For storing oysters in bulk (Max holding capacity 500 oysters)	Rectangular FRP tank- One tone capacity, Inner white, crenulated in between for placing oyster trays	1	23,000	Art India Masjid Bldg Deshabhimani Road Cochin 17 Cell: 9846095451)
4	Tank 4 Depuration display unit (DDU)	Specially designed tanks for depurating oysters	Rectangular-conical tank made of FRP or acrylic (dimensions given separately)	1	20,000 (6 mm acrylic) 18,000 (FRP with acrylic) 5000 (wooden stand	Art India Masjid Bldg Deshabhimani Road Cochin 17 Cell: 9846095451
5	Eheim filter	For mechanical, chemical and biological filtration	Model 2215 with in situ pump	2	18,000	Rahul Aquarium Centre, Mumbai 09224657973 09892321249
6	Pumps	For pumping seawater	0.5 HP	2	6000	Local plumbing shops

7	Mini UV disinfection unit	For killing microbes in seawater	8W power	1	5000	RAC, Mumbai As #5 above
8	Salinometer (Refractometer)	Essential to check the salinity of seawater (if wide variations are there in the salinity of the depuration water, the oyster will be stressed)		1	2500	Laboratory Equipment Stores, MG Road (north end)
9	Crates	Perforated Plastic crates for loading oysters in the storage tank	50x30x15 cm	8	2500	Local plastic ware
10	Aerator and accessories	Essential for providing aeration (oxygen) for the oysters which will be loaded in the storage tank (Tank 3)	Aerator -1 Aeration tube-..m Air stone- 6nos T & L joints -3 nos each	1	2500	Mareena Aquarium, Veekshanam Rd, Kochi
11	Cloth Filter bag	For first filtration of raw seawater		1	1000	As #10 above
12	Plastic tubes	For siphoning the fecal matter in TANK-3			500	As #10 above
13	Miscellaneous items	Wire Brushes (for scrubbing oysters), soft scrubbers (for cleaning DD-Tanks), SS tongs for picking oysters from DD-tanks			500	Local

Appendix 1

Classification of Oyster Growing Areas as per EU standards

Criteria for classifying edible bivalve harvesting areas as per European Union Directives (Laing and Spencer, 2006).		
Class	**Microbial standard[1]**	**Post-harvest treatment**
A	Live bivalve molluscs from these areas must not exceed 230 Most Probable Number (MPN) *E. coli* per 100 g of flesh and intra-valvular liquid[2]	None
B	Live bivalve molluscs from these areas must not exceed the limits of a five tube, three dilution Most Probable Number (MPN) test of 4,600 *E. coli* per 100 g of flesh and intra-valvular liquid[3]	Purification, relaying in class A area or cooking by an approved method
C	Live bivalve molluscs from these areas must not exceed the limits of a five tube, three dilution Most Probable Number (MPN) test of 46,000 *E. coli* per 100 g of flesh and intra-valvular liquid[3]	Relaying for a long period or cooking by an approved method
Prohibited	>46,000 *E. coli* per 100 g of flesh and intra-valvular liquid[4]	Harvesting not permitted

[1]. The reference method is given as ISO 16649-3.

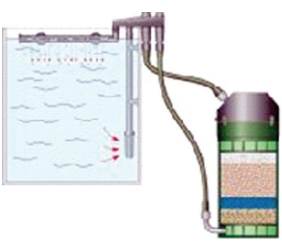
[2]. By cross-reference from Regulation (EC) No 854/2004, via Regulation (EC) No 853/2004, to the Draft Commission Regulation on Microbiological Criteria for Foodstuffs (SANCO 4198/2001, revision 16).

[3]. From Regulation (EC) No 854/2004.

[4]. This level is not specifically given in the Regulation but does not comply with classes A, B or C. The competent authority has the power to prohibit any production and harvesting of bivalve molluscs in areas considered unsuitable for health reasons

Appendix 2

EHEIM classic for DDU and between T1 and T2



From a compact external canister filter for aquarium sizes up to 250 l to a large filter for aquarium sizes up to 1500 l, the classic range features carefully tailored external canister filters, equipped with high quality components with an excellent price-performance ratio.

You can't go wrong when you choose a classic model external canister filters have everything a filter needs. What's more, they feature the proverbial EHEIM running smoothness and sophisticated functionality.

On the market for years and proven millions of times, the classic range has meanwhile become the basic model in the world of EHEIM external canister filters. Not all aquarium owners expect convenient optional comfort features, priming supports and filter baskets. But that doesn't mean that you have to do without the perfect pump output and filter efficiency, maximum running smoothness and endless continuous operation characteristics of EHEIM filters.

In short: you will find all the features which make up an EHEIM external canister filter in the classic models.

2213 – 2215 – 2217 Models for T4

Classic external canister filters for aquarium sizes up to 600 l – tried and tested millions of times. A balanced pump output to canister volume ratio ensures optimum conditions in your aquarium. With their low power consumption these models set standards in this class. Classic external canister filters can also be operated with sponges and pads. However EHEIM recommends layering with EHEIM filter media. Tailored filter media sets are available for every model. The pump head and filter canister are connected simply and very functionally with functional clips and a high quality silicone o-ring.

Appendix 3

UV Disinfection Unit

8W Classic UV Sterilizer 3/4" NPT w/o Wiper (Aqua UV)

The Aqua Ultraviolet Sterilizer is used to destroy single celled organisms such as water borne bacteria and viruses. The sterilizer is also used to control algae and and to kill fungi and protozoa. Aqua Ultraviolet Sterilizers are recommended for both fresh and salt water systems as well as ponds. The ultraviolet lamp emits a germicidal ray which alters or disrupts the DNA or RNA of targeted organisms such as algae, bacteria and protozoa. The Aqua ultraviolet sterilizer works better on filtered water. Any debris in the water can inhibit UV transmission.

Instructions:

The Aqua Ultraviolet Sterilizer can be installed vertically or horizontally. The best place to install your UV sterilizer is after the filter. If it is necessary to install the sterilizer before the filter, adequate pre-filtration should be used to prevent the quartz sleeve from breaking from debris. If your system is installed after the filter and is properly sized, the water should be clear in 3-5 days. If it is installed before the filter, the water should be cleared in 7-10 days.

The patented slimline Aqua Ultraviolet lamp last up to 14 months of continuous operation. After 14 months the lamp may still light, but the UV has diminished. The lamp has a 4 pin connection. The EZ Twist-Cap allows for quick and easy maintenance.

The Aqua Ultraviolet quartz sleeve may need to be cleaned to remove film from the surface that will hinder the effectiveness of the UV. It can be cleaned with swimming pool muriatic acid, lime away or a similar product. Do not use any type of abrasive substance on the quartz sleeve as it may scratch the quartz. The Aqua Ultraviolet is also available with a wiper. If the wiper is used regularly, your quartz sleeve will need little or no extra cleaning. (This model does not include a wiper.)

Specifications:

The Aqua Ultraviolet Sterilizer 8 watt unit is for saltwater aquariums up to 50 gallons and for freshwater aquariums and ponds between 5-200 gallons. The max flow rate is 642 GPH. The sterilizer includes the unit, ballast, lamp and quartz sleeve. The quartz sleeves allow for a 99.9% transmission rate.

Size:

Housing: 19" long x 3" diameter x 4 1/2" high with inlet/outlet
Cord and Ballast: 16.5' long
Inlet and Outlet Adapters: 3/4"

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Further Reading

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Notes :