

**For discussion on  
18 March 2002**

**LegCo Panel on Food Safety and Environmental Hygiene**

**Review on Control of Fish Tank Water  
for Keeping Live Seafood**

**PURPOSE**

This paper reports on the findings of the review conducted by the Food and Environmental Hygiene Department (“FEHD”) on the control of fish tank water for keeping live seafood. Members are invited to comment on the recommendations of the review.

**BACKGROUND**

2. To safeguard food safety and public health, FEHD monitors the quality of fish tank water used in the keeping of live seafood through legislative control, licensing/tenancy conditions, regular sampling surveillance, and the issue of guidelines to the seafood shop/stall operators. In 2001, four fish tank water samples were found to contain *Vibrio cholerae* and as a result, two food premises and two market stalls were suspended from operation for thorough cleansing and disinfection. The incidents raised public concern over the adequacy and effectiveness of existing control over fish tank water. The issue was discussed by the LegCo Panel on Food Safety and Environmental Hygiene at a special meeting held on 5 September 2001. At the meeting, FEHD announced that a review would be conducted to evaluate the effectiveness of the filtration and disinfection systems used by the trade and to make recommendations for improvement. The review has now been completed.

**SCOPE OF THE REVIEW**

3. The Terms of Reference of the Working Group set up to conduct the review are to -

- (a) review the effectiveness of the existing control mechanism and the filtration and disinfection methods adopted by the trade for maintaining the hygiene quality of fish tank water;
- (b) study methods and technologies that are effective and practical for use in the filtration and disinfection of fish tank water; and
- (c) make recommendations on measures to strengthen the control of fish tank water.

4. Apart from carrying out literature review on the various methods and technologies used for filtration and disinfection of fish tank water, the Working Group has conducted a questionnaire survey and visited a wide range of seafood retail outlets to study the source of their fish tank water supply and their filtration and disinfection systems. Field visits and interviews with stakeholders such as seawater suppliers were also conducted to collect relevant information.

## **FINDINGS OF THE REVIEW**

### ***Filtration and Disinfection Facilities***

5. Seawater is known to harbour cholera organisms, while live seafood itself can also act as a vehicle for cholera transmission. The existing surveillance system is effective in monitoring the overall and premise-specific quality of fish tank water. The source of the cholera organisms is, however, difficult to establish as it can come with the seawater, or from the seafood itself. Seawater quality is subject to climatic changes. Contamination of fish tank water can also occur at the different stages of abstraction, transport, storage and delivery. In view of the long chain of possible opportunities for contamination of the water between the collection of seawater to the use in fish tanks at the retail outlets, the provision of a properly installed and well-maintained filtration and disinfection system with good management practices plays a pivotal role in quality assurance of fish tank water.

6. Filtration is a process employed to remove the visible and non-visible impurities present in the water. The results of the questionnaire survey conducted by the Working Group revealed that the types of filter materials most commonly used by the trade were spongy filter, sand filter and activated carbon

filter. According to Codex Alimentarius Commission<sup>1</sup>, disinfection is defined as the reduction, by means of chemical agents and/or physical methods, of the number of micro-organisms in the environment to a level that does not compromise food safety or suitability. The three most common methods used by the trade for disinfection of fish tank water include UV radiation, ozonation and copper-silver ionisation. The Working Group has evaluated the efficacy of these filtration and disinfection methods and found that each of the methods could produce the desired results provided that they were properly used. As each filtration and disinfection system has its own merits and entails different operating costs, the Working Group considered and recommended that it should be left to individual operator to make its own selection of the appropriate filtration and disinfection system to suit their operational settings and purposes.

7. The Working Group found that the efficacy of these filtration and disinfection methods could be undermined by the lack of regular maintenance or improper management practices. The results of the questionnaire survey and field visits conducted by the Working Group revealed that seafood retail outlets generally lacked a monitoring system or properly laid down procedures for cleansing and maintaining their filtration and disinfection facilities. In addition, there were considerable variations in their practices, both in terms of knowledge on the design of the filtration and disinfection systems, as well as the standard of management practices. In view of this, the Working Group considered that proper documentation of maintenance work was essential and accordingly recommended that more comprehensive guidelines should be issued to seafood operators. The guidelines should be user-friendly and should provide specifications of the common filtration and disinfection methods so as to facilitate the operators to make an informed choice. The guidelines should also cover the standard of management practice for achieving better quality control of fish tank water.

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<sup>1</sup> The Codex Alimentarius Commission under the United Nations is recognized by the World Health Organization, the Food and Agricultural Organization and the World Trade Organization as the international authority for setting food related standards.

## ***Sources of Fish Tank Water***

8. The efficacy of the filtration and disinfection system also depends to a certain extent on the quality of influent water. Traditionally, local seafood trade uses natural seawater for keeping live seafood. However, the quality of seawater varies according to factors such as climatic changes and pollution. Hence, it is difficult to implement legislative control over seawater suppliers as no assurance can be given that specified abstraction points are suitable and safe for suppliers to obtain seawater at all time. Synthetic seawater, which is prepared by dissolving synthetic sea salt mixture with an appropriate amount of water, is considered a more reliable source than natural seawater. While examining whether the use of synthetic seawater should be made mandatory, the Working Group considered that imposing the requirement to use synthetic seawater would cause difficulty for the trade, especially operators of market stalls, many of whom are using natural seawater supplied free or at a low cost. The supply of fish tank water by a centralised seawater treatment plant is also considered not feasible and cost-effective because of the small number of business involved, the substantial operating cost of the plant, and the ultimate question of accountability between the seawater suppliers and the seafood shop/stall operators.

## **RECOMMENDATIONS**

9. Based on the above findings and having regard to the existing operational practices of the seafood trade, the Working Group has drawn up a set of recommendations including the specifications of the three common disinfection methods with a view to strengthening the control on the quality of fish tank water. The Expert Panel on Microbiological Safety of Food and the Advisory Council on Food and Environmental Hygiene have been consulted on the recommendations which are set out at Annex.

## **THE WAY FORWARD**

10. To facilitate the seafood trade in better controlling the quality of fish tank water, FEHD has, based on the recommendations of the Working Group, drawn up a set of revised guidelines to replace the existing guidance note issued to the seafood shop/stall operators. To enable the operators to have a better understanding of the principle and management practices that they should adopt for proper installation and maintenance of their filtration and disinfection

facilities and to seek their views on the revised guidance notes, FEHD had conducted four briefing sessions for the operators and suppliers of filtration and disinfection facilities in January 2002. The participants in general supported the introduction of the revised guidance notes. In addition, FEHD would take the following actions -

- (a) issue the proposed guidelines to all seafood shop/stall operators for their comments towards the end of March 2002;
- (b) conduct inspections to all seafood retail outlets advising them on the proper installation and maintenance of filtration and disinfection systems; and
- (c) brief operators of market fish stalls on the revised guidelines through the Market Management Consultation Committee.

11. Upon completion of trade consultations and taking into account the views expressed by the operators, FEHD would finalize the guidance notes for issue in April 2002. Pamphlets would also be prepared for distribution to the operators to guide them on how to comply with the revised guidance notes.

## **CONCLUSION**

12. The provision of a properly installed and well-maintained filtration and disinfection system with good management practices is essential in quality assurance of fish tank water for keeping live seafood. FEHD will continue to work with the trade in enhancing environmental hygiene and food safety, and to educate and remind food handlers and consumers that no measure is more effective in the prevention of cholera than proper food preparation and thorough cooking of seafood.

Food and Environmental Hygiene Department  
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## **Recommendations of the Working Group**

### **General**

- (a) Cholera is a communicable disease of much public health concern. A surveillance programme to monitor the quality of fish tank water forms an important component of the overall control mechanism.
- (b) An effective filtration and disinfection system plays a pivotal role in quality assurance of fish tank water. Proper documentation of maintenance work is essential. More comprehensive guidelines should be issued to the seafood shop/stall operators.
- (c) The quality of influent water should meet the highest standards as practically feasible so that the filtration and disinfection system can achieve its desired effect.
- (d) Controlling the quality of natural seawater supplied to the trade is not the most effective solution.
- (e) The most effective means in the prevention and control of cholera are the observance of good personal, environmental and food hygiene.

### **Filtration Facilities**

- (a) The filtration / disinfection system should be a closed loop system capable of providing continuous filtration and disinfection action.
- (b) The filtration facility should be installed upstream of the disinfection facility and not vice versa.
- (c) The use of fine sand filter is preferable. If resources permit, coral sand filters with both coarse and fine sand should be used. The sand filters should be fitted with automatic backwash cleansing device to facilitate self-cleansing of the equipment.
- (d) The filter materials should be cleansed and replenished preferably at least once a week and once a month respectively. If spongy filter is used, or where there is a higher stock density of fish or poorer water quality, more regular cleansing and replenishment of the filter materials should be carried out.

- (e) Water turbidity should be monitored. When unacceptable, the filter should be cleansed or replaced.

### **Disinfection Facilities**

The most common disinfection methods used by the trade i.e. UV radiation, ozonation and copper-silver ionization are effective for disinfection of fish tank water, although other methods can also be used provided that concrete scientific evidence is available. Recommended specifications are :

#### *UV Radiation*

- (a) The UV lamp should be operating at the wavelength of UVC range (i.e. 280nm – 100nm) with peak effect at 254nm. Operational and design parameters which would determine the UV dose include water turbidity, UV lamp intensity, fish tank capacity, power rating of the pump, and circulation rate etc. The operators should work with the supplier to ensure that the system in place meets the design specifications aiming to achieve an optimal disinfection efficacy. The use of a double barrel UV lamp tube and higher lamp intensity is preferable. From the occupational safety point of view, the UV lamp should be sealed completely to avoid human exposure to the UV radiation.
- (b) The UV lamp should be replaced periodically, preferably at 6 to 9 months interval, depending on the life span of the lamp, but well before its natural burnt out time.
- (c) The quartz sleeves of the UV lamp should be cleansed at least once monthly. The cleansing operation can be carried out by the system supplier or by trained personnel of the operator. Disconnect the unit and clean the lamps by wiping with a soft cloth moistened with ethanol or any other solvent as recommended by the manufacturer.
- (d) The system should be maintained regularly by the UV lamp supplier, preferably at least once every 6 months.

#### *Ozone*

- (a) The seafood shop/stall operators should require their suppliers to ensure that the system in place meets the design specifications aiming to achieve optimal disinfection efficacy.

- (b) It is crucial that all ozone disinfection systems be pilot-tested and calibrated prior to installation to ensure that they are able to produce optimal ozone concentration for disinfection.
- (c) For optimum disinfection efficacy, human safety and animal health, the system should be installed with an ozone contact tank where ozonation is done inside the tank with sufficient contact time. Continuous introduction of ozone directly into the fish tank is not recommended as the direct contact of ozone can be harmful to fish and the release of excessive ozone off-gas can be hazardous to humans in the vicinity.
- (d) From the occupational safety point of view, the operators should install an ozone leakage detector at the vicinity of the ozone generator and contact tank. Premises installed with the ozone disinfection system should have good ventilation. Ambient ozone levels should be monitored by the ozone leakage detector and equipment shutdown and alarm device should preferably be incorporated into the system when levels exceed 0.1ppm. An ozone off-gas destructor should be equipped for the destruction of excessive off-gas generated. Should there be practical difficulties for installation of such device, the ozone generator and contact tank should be installed in a well ventilated area fitted with ozone leakage detector with automatic alarm and equipment shutdown device.
- (e) Regular maintenance of the equipment should be carried out by the system supplier or trained personnel preferably at quarterly interval. The ozone source must be switched off during the cleansing and maintenance operations.
- (f) If UV radiation is used to generate ozone, the UV lamp used should be regularly replaced preferably at 6 to 9 months interval, but well before its natural burnt out time.

### *Copper-silver Ionization*

- (a) The operators should require the suppliers to ensure that the system in place meets the design specifications aiming to achieve an optimum disinfection efficacy. Measurement of residual ions levels in the fish tank water should be carried out preferably at biweekly interval.
- (b) The operators should consult the supplier of the system on the dosage of copper / silver ions to be used to ensure its effectiveness while not producing any undesirable side effects to the live seafood.

- (c) The operators should monitor the pH value of the fish tank water preferably on a daily basis to ensure the pH is within the range of 7.2 to 7.8 for optimal disinfection.
- (d) The electrodes of the ionizer should be replaced preferably at yearly interval.
- (e) Regular maintenance of the system should be carried out by the system supplier or trained personnel preferably at quarterly interval.

### **Sources of Fish Tank Water**

The Working Group has reviewed the existing source of seawater supply and examined other possible options with the following recommendations :

- (a) Suppliers should avoid abstracting seawater from coastal waters or other sources where the quality of seawater is doubtful.
- (b) Synthetic seawater is a more reliable source and its use is recommended.
- (c) Marine salts should be sourced from reliable suppliers.
- (d) To establish a new plant to provide centralized seawater supply may not be financially viable.
- (e) The control on the source of fish tank water should not be made mandatory, and the operators should have a choice on the source of supply.

### **Management Practices**

#### (a) Premises and Environmental Hygiene

- (i) The floors and walls of the fish tanks should have a smooth and impermeable surface and can be easily cleaned.
- (ii) The wall and floor surfaces of the food preparation area of seafood and its surrounding should be kept clean and tidy.
- (iii) All food wastes e.g. ~~ls~~ and viscera should be put in impervious dust-bins, with the lids on after depositing waste into the bins.
- (iv) Equipment and instruments and their surfaces which are intended to come into contact with live fish and shellfish must be made of corrosion-resistant material which is easy to wash and clean repeatedly.

#### (b) Handling of Equipment

- (i) The use of receptacles not properly connected to the filtration / disinfection facilities for keeping live fish for sale should be avoided.
  - (ii) Tank water should be changed periodically as this is an effective means to remove toxic substances produced by the stock after a considerable period of time. It will also enhance the efficiency of the UV radiation.
  - (iii) Equipment such as ~~fish~~ and hose, being used in contact with tank water, should be properly stored to prevent cross contamination with other food items.
- (c) Personal Hygiene
- (i) When handling fish tanks, clean rubber gloves should be worn.
  - (ii) Hands should be kept clean and washed with soap and water before handling food and after visiting the toilet. Clean overalls should be worn at work.
- (d) Fish Stock
- (i) Live fish and shellfish should be kept separately in different tanks and at an optimal stock level so as to avoid overcrowding and introduction of pollutants / bacteria.
  - (ii) Live bivalve mollusks should be washed free of mud with clean water before being kept in the storage tanks.
- (e) Documentation and Record Keeping
- (i) The operators should assign a dedicated staff to take care of the cleansing and maintenance of the whole system.
  - (ii) Proper documentation on the cleansing and maintenance schedules of the filtration and disinfection system should be kept by operators.

The Working Group has also recommended that a set of revised guidelines be drawn up for issue to the seafood operators. Meanwhile, the Working Group considered that the existing licensing and tenancy conditions generally adequate.