

AERATION IN AQUARIUM

CHAPTER 1: AERATION

4.1.1 Introduction

[Aquarium](#) fish like other fish breathe in water by means of gills, using oxygen dissolved in water. A certain minimum level of dissolved oxygen in water (normoxic condition) is essential for their survival. For a number of reasons, the water may have oxygen level critically depleted, endangering fish. The confined water of the aquarium is more prone to risk of depletion in level of dissolved oxygen (hypoxic condition). To offset the risk, it is necessary to provide additional means of aeration of water because oxygen of atmospheric air diffuses only slowly into water at the interface between it and air (the surface of water). [Aeration](#) achieves fast oxygen optimization in the following manner:

(a) a stream of air-bubbles, when forced through a column of water, provides enhanced interface area between air and water; smaller the bubbles better is aeration.

(b) water when sprayed like a fountain head (broken into tiny parts or drops) has increased surface area at the interface with air, achieving efficient aeration.

(c) a turbulence produced in water due to rising air bubbles as they break at the surface greatly increases the surface area of water at the interface with air.

(d) a movement of water (air driven or pump driven) speeds up circulation of dissolved oxygen (which in still water is a very slow process) as it spreads from surface down to bottom by diffusion.

[Aeration](#) is accomplished by any one of the following ways, singly or in combination:

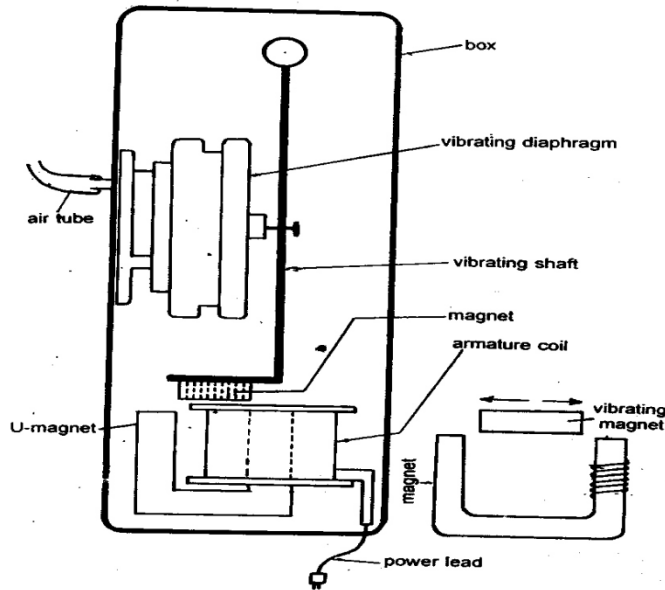
(i) Air is bubbled through the column of water using an aerator (air pump) and an air stone (diffuser). This combines the three processes stated above.

(ii) Pumping water out of the aquarium tank (as during filtration) and returning it directly into the tank water or spraying it over its surface using spray-bar. In this case processes b and d are involved.

In a small aquarium (home aquarium), agitation of water produced by air-bubbling is more important for oxygenation than air-bubbling itself. The fact is that a bubble takes only a few seconds to rise to surface and burst there. Such a short time of exposure to water does not permit much oxygen diffusion from air to water as it is a slow process. Use of an air stone increases chance of oxygenation as air is broken down into very fine numerous air bubbles. However, air-bubbling is instrumental in oxygenation of water rather indirectly. The agitation and turbulence produces circulation of water – an unending renewal of surface water (most oxygenated) by less oxygenated or oxygen depleted water brought from below with rising stream of air bubbles. The main oxygenation of water takes place at water-air interface at the surface.

[Aeration](#), on the one hand, increase dissolved oxygen concentration in water and, on the other hand, removes equally fast free carbon-di-oxide from it. It also helps in preventing “cold spots” in the aquarium tank which otherwise may develop in still water of large tanks. [Aeration](#) should be looked upon not as a substitute for management but a mere part of it.

4.1.2 Aerator



Aerator is an air-pumping device which is electrically operated. The device consists of a vibratory air pump – a tiny rubber diaphragm. When alternating current (A.C) passes a shaft bearing a magnet vibrates briskly under a magnetic field effect. As the shaft is attached to the diaphragm, the latter is allowed to vibrate up and down like a piston, producing a forceful stream of air. The air flow is then directed into the bed of the aquarium tank using plastic air tubing (thin pipe). At the opening, a diffuser (air stone) may be used to produce tiny bubbles of air. The aerator is a very useful handy device for small home aquarium. They are cheap, long lasting and need little maintenance. However, there are a number of drawbacks too. First, they produce an unpleasant, rather loud, humming sound. Second, they are ineffective in large and deep tank. It must be noted that an aerator does not generate fresh air. On the contrary, it only pumps out into the tubing the air of the surrounding. An aerator is likely to drive any fumes, chemical vapours and so forth alongwith the air into the aquarium tank which may prove harmful to fish. It should therefore not be operated if any such situation exists in the room.

Apart from its role in aeration of tank water, aerator has a role of air-lifting of water for filtration. In undergravel filter, an aerator is used to confine the rising stream of air-bubbles into a narrow vertical tube (the uplift pipe) to bring about air-lifting of water and any suspended particles in it.

4.1.3 Power air-pump

To produce aeration in large and deep aquarium or a battery of aquaria, such as those installed in public aquaria, more powerful electric motor driven piston-pumps or rotary pumps are used. They are more efficient due to high output and noiseless running. However, they are expensive and need care and maintenance more frequently.

4.1.4 Spray bar

The outlet of power filter is fitted with a spray bar to enhance aeration of water as the filtered water is returned to the aquarium tank. The spray bar is a perforated tube which produces a rain of small droplets of water falling on the surface of tank water. The agitation of water produced at the surface by falling water drops helps in better oxygen diffusion at air-water interface.