

APPARATUS FOR PURIFYING WATER IN AN AQUARIUM

FIELD OF THE INVENTION

The invention relates to an apparatus for purifying water in an aquarium.

BACKGROUND ART

5 The following discussion of the background to the invention is intended to facilitate an understanding of the present invention only. It should be appreciated that the discussion is not an acknowledgement or admission that any of the material referred to was published, known or part of the common general knowledge of the person skilled in the art in any jurisdiction as at the
10 priority date of the invention.

Known water purification in aquariums typically uses simple mechanical filtration or biological filtration to maintain water quality and to remove waste material build up in the tanks. Such waste material includes, but is not exclusive to ammonia (NH_3), ammonium (NH_4), nitrite (NO_2) and nitrate (NO_3).

15 Mechanical filtration includes passing water through filter pads, but such filter pads require regular change to maintain the water quality. In addition, the size of the mechanical filters is required to be adapted according to the size of the aquariums.

Biological filtration generally involves bacteria or microbes, such as
20 nitrosomonas bacteria and/or other microorganisms that are involved in nitrifying and denitrifying process in the aquarium which break down the nitrogen-based waste materials. However, such biological filters may be unreliable because they are highly sensitive to water parameters such as temperature, pH level, phosphate level, dissolved oxygen level water
25 hardness level (both general hardness and carbonate hardness) etc. In event where the water parameters are not conducive for the survival of the microbes or bacteria, they may further contribute to the waste materials instead of breaking down the waste materials.

As waste accumulates in aquariums, high nitrogen concentration in water which is toxic to fishes is often overcome by water change or having a very big filtration unit (which comprises of mechanical/biological filtration) to breakdown the waste materials. Water change is a tedious manual process which requires manpower and time, while the breakdown of waste materials into less toxic forms using mechanical/biological filtration typically takes a long time and is dependent on the flow unit, type of bio-filter media and also the strains of bacteria present for the filtration.

Accordingly, both the described solutions do not ensure the constant quality of water. Fluctuation in water quality which occurs due to negligence, change of water and/or variation in water parameters are harmful to fish due to waste accumulation.

It is thus an object of the invention to mitigate at least one of the above mentioned problems.

15 SUMMARY OF THE INVENTION

The invention is related to the breakdown of waste materials in an aquarium, specifically nitrogen based compounds which includes:

Ammonia (NH_3), which is primarily released into aquariums from fish waste, uneaten food, or a fish that dies in the tank. This is particularly dangerous as it leads to ammonia poisoning which could kill fish;

Ammonium (NH_4), while less harmful than NH_3 , turns into NH_3 when the water pH is higher than 7;

Nitrite (NO_2) is created when the poisonous NH_3 is broken down. NO_2 is a toxin and can kill the fish not kept under control; and

Nitrate (NO_3) are the product of NO_2 being broken down in the aquarium. NO_3 , while less toxic, may still harm the fish. NO_3 may be eventually broken down and converted into Nitrogen Gas (N_2).

In accordance with a first aspect of the present invention, there is provided an apparatus of purifying water in an aquarium comprising an electrochemical flocculation reactor; the electrochemical flocculation reactor comprising titanium-based electrodes operable to convert ammonium, ammonia, nitrite and/or nitrate into nitrogen gas in the aquarium.

Advantageously, the electrochemical flocculation reactor further comprises carbon-based catalyst suitable for generating hydroxyl radical.

Preferably the operable voltage for the electrochemical process is between 5 to 24 volts. More preferably the operable voltage is between 5 to 9 volts.

Suitably, the electrodes are placed at a distance of 5 to 10 centimetres between each other.

Preferably, the operable current is about 0.5 milli-amperes.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Fig. 1 is a schematic representation of the purifying apparatus in accordance with an embodiment of the present invention.

DESCRIPTION OF EMBODIMENTS OF THE INVENTION

In accordance with a first embodiment of the invention there is an apparatus for purifying water in an aquarium comprising an electrochemical flocculation reactor 12 as shown in Fig. 1. The electrochemical flocculation reactor comprises a plurality of electrodes 14. Electrodes 14 are made of at least one type of titanium alloy.

Prior to use, the following parameters of the electrochemical flocculation reactor have to be tuned/determined as follows:

Distance between the electrodes 14 – 5 to 10 centimetres.

Operable voltage range – 5 to 24 Volts

5 Operable current range – 0.5 milli-amperes

The apparatus 10 will next be described in the context of its operation.

For an aquarium size of water capacity of about 80 to 200 litres, a user switches on the apparatus 10 to about 5 volts. The anodes 14a are made of titanium alloy. The cathodes 14b are made of titanium alloy. In the preferred
10 embodiment the anodes 14a and cathodes 14b are the same titanium alloy, but it will be appreciated by a skilled person in the art that the anode and cathode may be different titanium compounds.

Upon switching on the apparatus 10, electrolysis begins and the chemical oxidation process of any ammonium compound in the water is detailed in
15 equations (1) to (6) as follows:



The electrochemical flocculation reactor may comprise catalyst 20 to assist in the electrochemical process. The catalyst is suitably a carbon-based compound targeted to produce hydroxyl-radicals having an oxidation potential

of +2.8 V. The amount of catalyst used may be between 10 grams to 50 grams. In addition, the catalyst suitably maintains an effective balanced ecosystem within the aquarium.

- 5 It is to be appreciated that while equation (5) includes the formation of NO as an intermediate species may not be easily picked up by typically methods such as temperature programmed reaction spectroscopy (TPRS), electron energy loss spectroscopy (EELS) and low energy electron diffraction (LEED) due to ambiguities of the NO frequency spectrum.
- 10 It is to be appreciated that the combination of the various parameters such as voltage range, type of electrodes, distance between electrodes, catalyst type and quantity assist in the generation of an effective amount of hydroxyl radicals for achieving the desired purpose.

Variants

- 15
 - Direct or alternating electrical current and voltage of varying strength to electrodes may be applied.

The Claims Defining the Invention are as Follows

1. An apparatus of purifying waste water in an aquarium comprising an electrochemical flocculation reactor; the electrochemical flocculation reactor comprising titanium-based electrodes operable to convert ammonium, ammonia, nitrite and/or nitrate into nitrogen gas in the aquarium.

2. The apparatus according to claim 1, wherein the electrochemical flocculation reactor further comprises carbon-based catalyst suitable for generating hydroxyl radical.

3. The apparatus according to claim 2, wherein the operable amount of carbon-based catalyst is between 10 to 50 grams.

3. The apparatus according to any of the preceding claims, wherein the operable voltage for the electrochemical process is between 5 to 24 volts.

4. The apparatus according to any of the preceding claims, wherein the electrodes are placed at a distance of 5 to 10 centimetres between each other.

6. The apparatus according to any of the preceding claims, wherein the operable current is about 0.5 milli-amperes.