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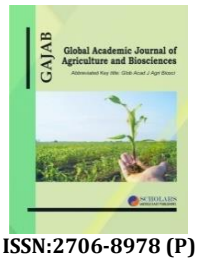

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Original Research Article

Design and Construction of Aquarium for Laboratory Practical Purpose at FCE Gidan Madi, Sokoto State

Ahmad M. B[1], Egwuonwu K. C[2*], Fatima M. D[3], Olalekan Oderinde[4]
[1]Department of Agricultural Education, Federal College of Education Gidan Madi Sokoto State
[2]Department of Biology, Federal College of Education Gidan Madi Sokoto State
[3]Department of Integrated Science, Federal College of Education Gidan Madi Sokoto State
[4]Department of Science Laboratory Technology Umaru Ali Shinkafi Polytechnic Sokoto

***Corresponding Author**
Egwuonwu K. C
Department of Biology, Federal College of Education Gidan Madi Sokoto State

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Abstract: This paper addresses the design and construction of aquaria, emphasizing that financial considerations, dimensions/weight, shape/location, and materials are fundamental architectural aspects to take into account when building aquaria. The ornamental fisheries industry has offered entertainment, jobs, income, and health benefits to governments and individuals in various countries. Thus, it concludes that despite the financial, spatial, and maintenance issues faced by hobbyists, specialists, and teams, awareness and exploitation should be promoted due to the opportunities presented by this niche.

Keywords: Aquarium design, Aquarium construction, Ornamental fisheries, Aquatic architecture, Hobbyist aquariums, Aquarium materials.

INTRODUCTION

An aquarium is a man-made pool designed to house aquatic plants and animals for decorative, research, and breeding purposes. After the invention of glass around 300 BC, the concept of storing fish in glass aquariums emerged. In the course of the Ming dynasty (1368 - 1643), goldfishes kept in earthen and glass vessels provided entertainment for the Chinese. In 1833, the British Association for the Advancement of Science demonstrated that aquatic plants absorbed carbon dioxide and emitted oxygen, benefiting fish and leading to the development of modern-style aquaria.

Nowadays, numerous residences and public spaces feature aquaria constructed from glass as well as Perspex or Plexiglas. Thanks to the creation of heaters and thermostats, as well as aerators and biodisc, it has become possible to keep more exotic fish. It contains gravel, sand, and rocks that create an artificial environment conducive to the survival of fish and plants while enhancing the aquarium's scenic beauty. An aquarium is a vivarium, regardless of its dimensions, that has at least one transparent side and is used for the maintenance and exhibition of aquatic plants or animals. Fish keepers utilize aquaria to house fish, invertebrates, amphibians, aquatic reptiles like turtles, and aquatic plants. English naturalist Gosse coined the term by combining the Latin root aqua, meaning water, with the suffix -arium, which means "a place for relating to".

The aquarium principle was thoroughly developed (Hora, 1992). Thomas H. elucidated in 2005 that if the quantities of animals do not increase excessively, plants added to water in a container would produce sufficient oxygen to sustain them. An aquarist possesses fish or manages an aquarium,

which is usually made of glass or high-strength acrylic. While cuboid aquaria are referred to as fish tanks or simply tanks, bowl-shaped aquaria are known as fish bowls. Sizes can vary from small glass bowls to large public aquaria (Tang, 1999).

The eighteen-gallon rectangular aquarium tank measuring 60 x 30 x 38 cm is the ideal size for home use. Establishing aquaria for decorative, research, or breeding purposes has yielded numerous advantages. Nowadays, many individuals, without professional expertise, have successfully created and managed their own aquaria and profited from them in a manner similar to the entertainment industry. Today, the design and construction of aquaria involve creating high-value, safe aquaria using quality materials that adhere to established standards and reflect individual preferences.

Statement of the Problems

The major concern of Aquarium tank in the LABORATORY today is to harvest rare fish in an artificial way whereas in the absence of natural dwelling of species. Specialized equipment maintains in an appropriate water quality and other characteristics suitable for the aquarium's life are used to raise fry which develop readily for biological practical as a specimen in the Laboratory. Usually aquarium care takers face several problems in maintenance the vitality and health of fishes along with the presentation of the aquarium. At the end of the research, the study would be able to pave way for the government, private organizations and research institutions on the collaboration to create aquarium awareness considering the benefits it can offer. Despite the difficulties of finance, space and maintenance involved, this industry serve as a source of employment and revenue to both the government of different countries and individuals/teams occupying this niche. The essence of this project work is to determine the significance of artificially made (constructed) aquarium tank which support wide life for the purpose of raising fish in the laboratory to aid practical knowledge as prerequisite for NCCE standard.

Objectives of the Study

This work will aim at designing and constructing of mini aquarium. However, it will also allow people to discover and admire the many species that inhibit the marine world and fresh water bodies which are sometimes difficult to observe in their natural environment. Indeed, it is difficult to go around the world to discover the diversity of ecosystems and animals that are hidden there. But this work will offer the best specie that could obtained from our locality.

i. To construct Aquarium Tank for Fry/Fingerlings dwelling for Biology Laboratory practical usage.
ii. To determine the importance of this tank in Laboratory unit of Biology Department of the College.

MATERIALS AND METHODS

Material

i. Aquarium.
ii. Aquarium stand.
iii. Gravel or sand substrate.
iv. Filter
v. Painters tape or Masking or duct tape
vi. Plants and decorations.
vii. Plain glass.
viii. Silicon gun.
ix. 100% silicone sealant

3.4 General Procedure

- Aquarium Height / Sheet Thickness
  1 to 12 inches (2.5 to 30.5 cm) / 1/4 inch
  12–18 inches (30.5–45.7 cm) / 3/8 inch
  18–24 inches (45.7–61.0 cm) / 1/2 inch
  24–30 inches (61.0–76.2 cm) / $^{3}/_{4}$ inch (1.9 cm) are various sizes. I chose to use this measurement.

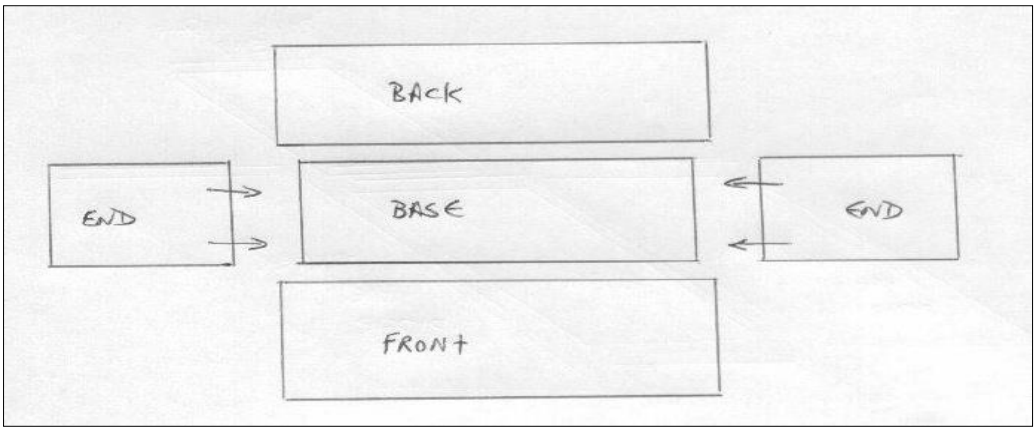
820cm length by 410cm breadth (8.2m by 4.1m).

- 100% silicone sealant
  - Many people say that "aquarium silicone sealant" is the only sealant you should consider. Although it's rather expensive, it is a good choice, partly because it lacks anti-mildew chemicals often in standard silicone sealants that can be toxic to fish over time. Regular household silicone like GE Door & Window clear silicone, Dow-Corning "DAP", and Napa All-Glass 100% clear silicone are also viable options. And if it comes in the size that fits in your caulk gun, even better.
- Masking or duct tape
- A caulk gun
- A few large containers or heavy objects for holding up the glass

3.4.0 Arrange your Glass Pieces in an Open Area

Put the bottom piece of the glass down, surrounded by the front, back, and sides. Remember that the sides should be just shorter than the final measurement so they can snugly fit into the length between the front and back (those will go up first).

- The difference in thickness should be twice the size of the glass. If you have 1/4" inch thick glass, your side pieces should be 1/2" in shorter (to account for the 1/4" on either side).



3.4.1 Prep the Glass

First, use acetone or rubbing alcohol on the sides of the glass. You want all the edges to be clean as can be. Then cut strips of masking or duct tape that is about half the length of one side. Stick half of each strip on the bottom of the bottom pane in *every* direction. The other half of the strip should be lying freely on the table.

- Then when you put up the sides, you'll grab the other half of the strip and tape it on, giving support to each side of the tank.
- You may want three pieces of tape on each side – on the left, right, and center of each pane.

3.4.2 Apply the Silicone

Start with the bottom piece, applying a thin and continuous strip of silicone along the top, about 2mm away from the edge (where the front pane of glass will rest on it). The strip of silicone should be about 3mm in diameter.

- If you're not used to using a caulk gun, practice beforehand making even lines on something else, like newspaper or cardboard.
- When you go to cut the top of the tube, aim for a 3mm opening to control the size of your output.
- Be sure to work quickly; silicone sets in 2-3 minutes

3.4.3 Put the Front Pane in Place

With the strip of silicone along the front edge of the base, place the front piece of glass into place, pressing it down firmly but gently. Hold it there briefly, adheres the rest of the tape up the sides, and it should stay up. If you're worried about it falling over, you can prop it up with a large container filled with water or some other heavy object.

- Don't wipe off the excess silicone just yet. You can take care of it after it's cured.

3.4.4 Begin Assembling the Sides

With your caulk gun in hand, run another thin line of silicone (again, 2mm from the edge), along the sides. Then repeat along the inside edge of the front pane (remember: the side pieces are fitting not only into the bottom, but sandwiched in between the front and back).

- Press the first side piece into place, firmly but gently. You should now have one corner of your aquarium put together it.
- Try to avoid realigning the piece – if you do, you could create bubbles in the silicone, leading to leaking later on.
- Repeat this for the other side, too.

3.4.5 Finish with the Back pane of Glass

Now that you're getting the hang of the caulk gun, run your last 3mm-wide lines of silicone along the edge of the bottom pane (2mm from the edge) and along the inside edges of the back panel.

- Press it firmly, yet gently, into place. Lift up the tape to support and prop as needed.

3.4.6 Allow the Silicone to Dry and Set

Most types of silicone dry within 24-48 hours. It will harden even more as time goes on, so if you can resist, don't fill it with water for a good week or so.

3.4.7 Test the Seals

Before you go about assembling a masterpiece in your aquarium, it's best to see if your craftsmanship holds up. Fill the tank with a few inches of water. Let it sit a minute. If it doesn't leak, continue on with assembly.

- If it does leak, empty the aquarium immediately. Let it dry, and then reseal the problem areas. You may also want to assume there are problems near the top too, and fix those as well.

3.4.8 Set up a Filter System if Need be

If you're dealing with freshwater fish, you'll need a filtering system. The most common choices

are undergravel filters or power filters and they're easily hung on the back of the tank.

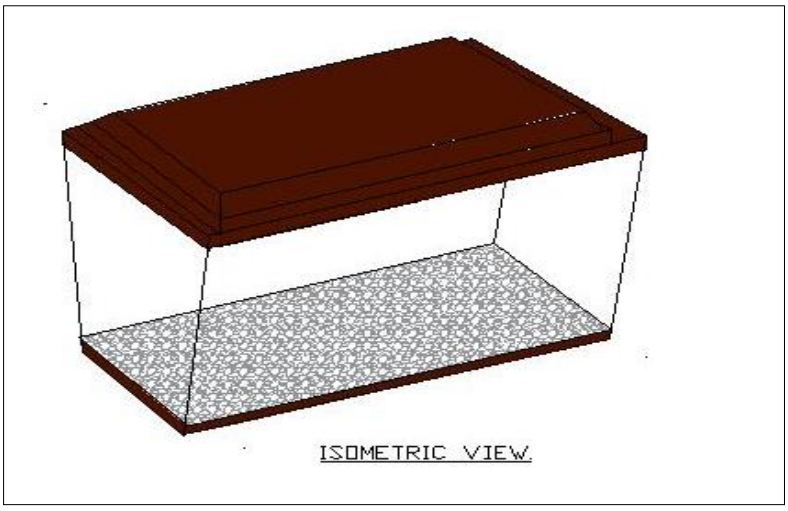
- If you're using an undergravel water filter, keep in mind the size of your aquarium. A large aquarium requires a large filter. The air pump needs to work for the entirety of the tank; not just the area it's immediately place in.
- A power filter should circulate 5 gallons (18.9 L) of water per hour [gph] and per gallon of your tank's capacity. An 8 gallon (30.3 L) tank would need a power filter that can handle 40 gph.
- Follow the specific instructions on your filter's packaging. Regardless of your model, do not turn it on until the tank is filled with water and ready to go.

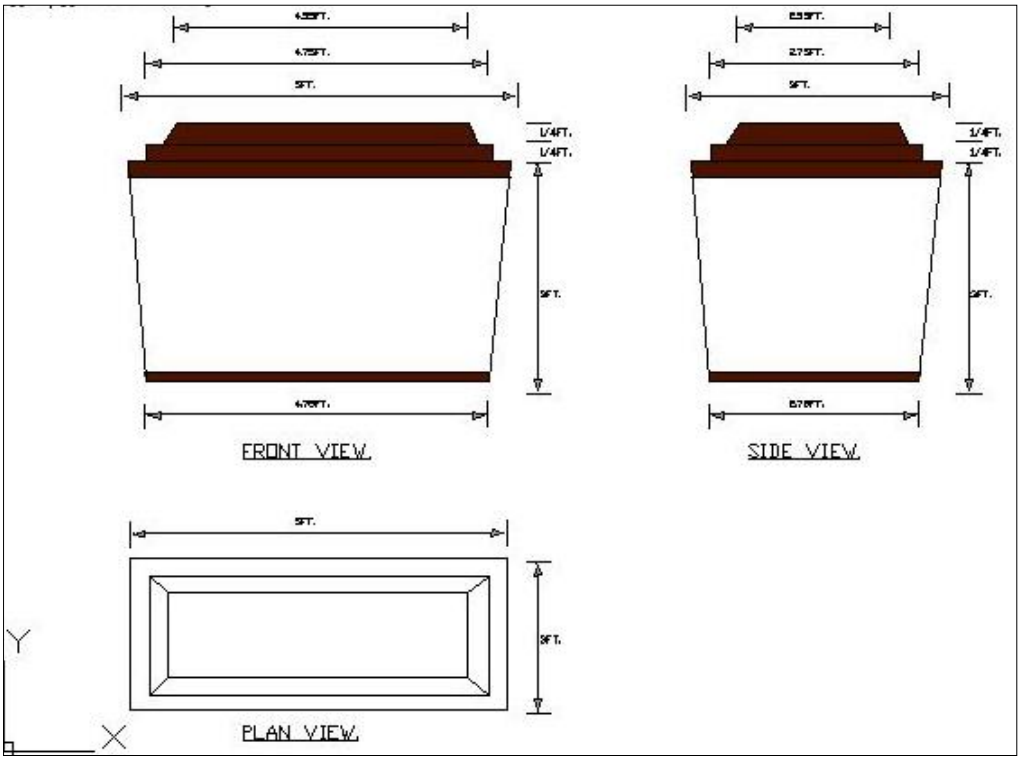
3.4.9 Fill your Aquarium with Gravel, Sand, or Whatever your Creatures Require

Most fish will be good with either gravel or sand, and any pet store will offer you a plethora of choices when it comes to texture and color. Whatever you use, 2–3 inches (5.1–7.6 cm) should be plenty.

- Gravel does need to be washed before placing it into the aquarium. It has a tendency to acquire dust, which is something you do not want in your water.

Proposed Drawing of the Equipment (Orthographic Drawings)





RESULTS

Installing the Aquarium Tank

Steps to Take:

a. After testing for leakages, wipe out the tank using a clean, damp cloth and place it on it stand
b. Cover the bottom with a layer of clean sand (about 2.5 cm thick)
c. The Aquarium measured 30inches in height, 11inches in weight and 20inches in bright.
d. Add the aquarium gravel and smooth it out with the air wall tubes and hose covered
e. Add various rocks on the bottom which enhance the aquarium and also give fish a place to hide
f. Add the water by placing a small bowl on the gravel and pour the water into the bowl. Let it run over the sides, filling the tank without disturbing the gravel or rocks
g. When the aquarium is full. Test the water with pH meter before adding live aquarium plants and fishes
h. Float the fishes, which are still in oxygenated water-bags or containers from the store into the tanks
i. Put the cover in place to prevent the fish from jumping out.

Benefits of Aquaria

a. The aquarium is a source of employment and income for individuals/companies of different countries involved with it design, construction and distribution.
b. Some aquaria fishes aid in the environment control of mosquitoes.
c. It is used for research and decorative purposes as it aid study and add to scenic beauty of environment.
d. Aquarium viewing certainly reduces stress and subsequently lowers blood pressure as well aid in controlling Alzheimer's disease as shown by a study in the 80's and a Purdue study in 2009.

CONCLUSION

The design and construction of aquaria demand a level of expertise that only a handful of teams worldwide are attempting to offer. Though it is catered to by only a handful of teams, it has developed into a niche industry with international recognition and standards. With foundational knowledge of aquarium design, construction, and system management, you can either buy or create your own aquatic garden. This industry, despite the challenges related to finance, space, and maintenance, provides employment opportunities and revenue for government entities in various countries as well as for individuals and teams operating within this niche.

Recommendations

Due to the advantages it can provide, the government, private organizations, and research institutions should work together to raise awareness of aquariums.

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