Lush, beautiful Nature Aquarium™ is created with help of various systems in and around the aquarium such as lighting and CO₂ systems. In addition, planted aquarium products we are using daily, including AQUASKY and Pollen Glass, are equipped with various effects and features.

This article introduces the detailed research data on the systems used for creation and maintenance of aquascape by showing some secrets of healthy growth of aquatic plants and creation of beautiful aquascape with ADA Aquarium System.

Text by Masatoshi Abe / Tsuyoshi Oiwa
There are two types of lighting system for Nature Aquarium: a suspended pendant type such as Solar I and an install-on-the-tank type such as AQUASKY. First, let’s do a research on light distribution of pendant-style lighting.

The lighting system for Nature Aquarium plays the roles of promoting photosynthesis of aquatic plants and enhancing the attractive look of aquascape. Light intensity and color temperature are significant factors for photosynthesis while the brightness and color rendering properties are important to make the aquascape look attractive. Metal halide lamp and twin fluorescent lamp used for the Solar Series provide sufficient light intensity as well as optimum color temperature and color rendering properties to promote plants’ photosynthesis. The light housing unit of the Solar series is basically installed away from the water surface. A research was conducted on the light distribution of each model under this series.

**This is the Key Point**

"Pendant type lighting system adds an open impression to the aquarium."

"The greater the distance between the lighting system and water surface, the more even the brightness becomes."

"It is optimal to install Solar II 10cm away from the water surface of 60cm tank."
The lighting system which is directly installed on the aquarium comprises AQUASKY and its variation AQUASKY MOON. Adopted white LED lights, they provide sufficient light intensity for plant growth. Now let’s do a research on their light distribution.

While LED is relatively new type of light, when aquarium LED lights began to be marketed, there was no product that offers adequate performance for plant growth. At that time, there was even a rumor saying that aquatic plants do not grow under LED lights as they did not provide sufficient brightness and appropriate color temperature for plant growth. However, the circumstance has changed drastically with the advent of AQUASKY, the world’s first LED lighting system developed specifically for planted aquariums. The AQUASKY series are equipped with many high luminosity LEDs that provide appropriate color temperature and achieve enough brightness for plant growth. This section features the research conducted on the light distribution of the major AQUASKY models.

Light distribution of AQUASKY 602

The brightness of AQUASKY 602 overwhelms LED lights from other aquarium manufacturers. Aquatic plants in the entire aquarium grow healthy under AQUASKY 602 offering excellent light distribution.

Light distribution of AQUASKY MOON 601 [without MIRROR UNIT]

AQUASKY MOON 601 features enhanced brightness. By installing the MIRROR UNIT, the light luminosity level at the rear side of the tank (background area) is further increased.

This is the Key Point

“The AQUASKY series achieved sufficient light intensity for plant growth.”

“All you have to do is to place AQUASKY on a compatible tank to install.”

“The brightness is further enhanced by installing the MIRROR UNIT.”
CO2 SYSTEM

Aquatic plants need carbon dioxide (CO2) to perform photosynthesis with light. They grow through photosynthesis and release abundant oxygen (O2) in water. In the condition of insufficient CO2, aquatic plants do not thrive. Now let’s do a research on CO2 in aquarium tanks.

CO2 supplied to the aquarium has the property of lowering the pH level when dissolved in water. When the CO2 level of the water increases, the pH level decreases and the water becomes more acidic. In contrary, CO2 in the water decreases by aeration and photosynthesis of aquatic plants and as a result, the pH level increases and the water becomes more alkali. Based on these facts, there is a close relationship between CO2 and pH levels of water. Using this relationship, it is possible to find out the approximate CO2 level of aquarium water just by observing the pH level easily measured by tools such as pH Kit and Drop Checker. This section discusses the research mainly on the changes in CO2 and pH levels.

Comparison of Changes in CO2 Level

In the aquarium with thriving aquatic plants, the amount of CO2 supply and CO2 absorption by aquatic plants are balanced.

4 months after aquarium setup

1 week after aquarium setup

Bare tank

Newly set up aquarium tends to be subjected to excessive CO2 buildup due to a smaller amount of photosynthesis taken place in the tank.

Bare tank with no aquatic plants shows a strong inverse correlation between CO2 and pH levels.

Changes in Size of CO2 Bubbles and Total Surface Area per 1ml

With the same amount of CO2, the bubbles of smaller size have a larger surface area and thus dissolve readily in water.

CO2 Supply in 60cm Tank

Photosynthesis of aquatic plants slowly becomes active after the lights are turned on and the CO2 absorption also increases accordingly.

Growth Comparison of Wabi-Kusa with and without CO2 Supply

With CO2 supply (after 1 week)

Without CO2 supply (after 1 week)

CO2 / Plants, glass, one bubble per 30cm, CO2 Bubble Counter, Lighting, NA lamp 25W, X (18 hour/day)

CO2 / No CO2 supply, Lighting, NA lamp 25W, X (18 hour/day)

Growth of aquatic plants significantly differs between aquariums with and without CO2 supply. Of course, aquatic plants grow better and greener and red leaves become more vivid with CO2 supply.

This is the Key Point

“There is a close relationship between the amount of CO2 supply and pH level.”

“CO2 dissolves better in water if bubbles are smaller.”

“Aquatic plants grow faster with CO2 supply.”
Filtration system cleaning Nature Aquarium water consists of the combination of filter unit and various types of filter media. There are two different types of filter media: biological and chemical media. Now let’s do a research on the characteristics of each filter media from a micro point of view.

There are various types of filters to clean aquarium water. For Nature Aquarium, which is to grow aquatic plants, we mainly use external filter that offers high filtration capacity and retains CO2 supplied in the aquarium. The Super Jet Filter series is the external filter specifically developed for Nature Aquarium and available in many different models which are suitable for respective aquarium sizes. Each type of filter media offer different level of filter bacteria colonization and contaminant absorption due to their different surface structures. In this section, we look into the research on the Super Jet Filter series and the features of each type of filter media.

<table>
<thead>
<tr>
<th>Product name</th>
<th>Flow Rate (L/min)</th>
<th>Carbon Capacity</th>
<th>Suitable Aquarium Size (Total Water Content)</th>
<th>Water circulation per hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES-400</td>
<td>5.2 L/min</td>
<td>6 L</td>
<td>W100×D45×H60cm tank (Approx. 60 L)</td>
<td>~5.0 times per hour</td>
</tr>
<tr>
<td>ES-400 EX</td>
<td>5.3 L/min</td>
<td>7 L</td>
<td>W100×D45×H60cm tank (Approx. 70 L)</td>
<td>~5.0 times per hour</td>
</tr>
<tr>
<td>ES-600</td>
<td>5.6 L/min</td>
<td>12 L</td>
<td>W100×D45×H60cm tank (Approx. 120 L)</td>
<td>~5.0 times per hour</td>
</tr>
<tr>
<td>ES-600 EX</td>
<td>5.6 L/min</td>
<td>12 L</td>
<td>W100×D45×H60cm tank (Approx. 120 L)</td>
<td>~5.0 times per hour</td>
</tr>
<tr>
<td>ES-1200</td>
<td>16 L/min</td>
<td>18 L</td>
<td>W100×D45×H60cm tank (Approx. 180 L)</td>
<td>~3.8 times per hour</td>
</tr>
<tr>
<td>ES-1200 EX</td>
<td>16 L/min</td>
<td>18 L</td>
<td>W100×D45×H60cm tank (Approx. 180 L)</td>
<td>~3.8 times per hour</td>
</tr>
<tr>
<td>ES-1200 EX2</td>
<td>16 L/min</td>
<td>18 L</td>
<td>W100×D45×H60cm tank (Approx. 180 L)</td>
<td>~3.8 times per hour</td>
</tr>
<tr>
<td>ES-2400</td>
<td>27 L/min</td>
<td>24 L</td>
<td>W100×D45×H60cm tank (Approx. 240 L)</td>
<td>~2.5 times per hour</td>
</tr>
<tr>
<td>ES-2400 EX</td>
<td>27 L/min</td>
<td>24 L</td>
<td>W100×D45×H60cm tank (Approx. 240 L)</td>
<td>~2.5 times per hour</td>
</tr>
<tr>
<td>ES-2400 EX2</td>
<td>27 L/min</td>
<td>24 L</td>
<td>W100×D45×H60cm tank (Approx. 240 L)</td>
<td>~2.5 times per hour</td>
</tr>
</tbody>
</table>

Pump flow rate differs depending on the power supply frequency.

There are countless fine pores on the surface of NA Carbon, a high-performance active carbon.

Absorption capacity of active carbon
- Microorganisms such as bacteria
- Organic compounds

We can find countless numbers of bumps, dents and tiny pores on the Bio-Rio and Bamboo Charcoal surface when observed with an electron microscope. Filter bacteria colonize in these areas.

Relationship between filter media shape and flow rate

“Select the model suitable for tank size.”
“Water flow rate differs depending on filter media’s structure.”
“NA Carbon also functions as biological filter media.”

Bio Cube features superior colonization of filter bacteria but it easily clogs. On the other hand, Bio-Rio hardly clogs.
Substrate where aquatic plants spread their roots is the most important element of Nature Aquarium. In view of this fact, we have been making research on the materials used for substrate over many years and developed substrate materials such as Aqua Soil. Now let's do a research on the difference between Amazonia and other substrate materials.

Unlike the present time with advanced technologies in growing aquatic plants which has made the thriving planted aquarium a common sight, there was once a time when it was very hard to grow lush aquatic plants within an aquarium. Following the development of CO2 systems and effective lighting system such as NA Lamp which has enabled aquatic plants to grow in aquarium, the development of Power Sand and Aqua Soil has brought great innovation to planted aquarium. Especially thanks to Aqua Soil-Amazonia, the growing of aquatic plants has become a lot easier and even the beginner hobbyists can now easily create a planted aquarium entirely covered with lush aquatic plants. This section features the research on the characteristics of Amazonia and other substrate materials.

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**Comparison of properties of substrate materials**

- **Comparison of pH level**
  - Aqua Soil-Amazonia
  - Amazonia Normal Type
  - Company B
  - Top water
  - Low pH level

- **Comparison of NO3 level**
  - Aqua Soil-Amazonia
  - Amazonia Normal Type
  - Company B
  - Top water
  - Low NO3 level

- **Comparison of NH4 level**
  - Aqua Soil-Amazonia
  - Amazonia Normal Type
  - Company B
  - Top water
  - Low NH4 level

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**Growth difference of foreground plants by substrate material**

- **Coconut sand**
  - After 10 days

- **Aqua Soil-Amazonia**
  - After 10 days

Foreground plants grow vigorously in nutrient-rich Aqua Soil-Amazonia. In contrast, the plants hardly grow in coconut sand.

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**Buffering effect of major substrate materials to prevent change in pH level**

- **Amazonia Normal Type**
- **Coconut sand**
- **Aqua Soil-Amazonia**

Compared to other substrate materials, Aqua Soil-Amazonia has a good property in preventing changes in pH (pH buffering capacity, even when acid or alkali is added).

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**This is the Key Point**

- "Aqua Soil-Amazonia lowers the pH level and has a superior buffering capacity."
- "Aquatic plants grow well with rich nitrogen content."
- "Natural organic nutrients are safe for fish and shrimp."
It is advisable to supply potassium and trace elements needed for healthy growth of aquatic plants by using liquid fertilizer. It is effective to supply nutrients that often become insufficient in an aquarium on a daily basis as these elements are quickly absorbed by aquatic plants. Let’s do a research on what is provided by the liquid fertilizer.

In addition to CO₂ used for photosynthesis, nutrients including nitrogen, phosphorus, and potassium and trace elements such as iron are necessary for growth of aquatic plants. Although these elements are supplied by the substrate and produced by fish waste products, the absolute amount of potassium and trace elements are small. Thus these elements tend to be scarce in planted aquarium. That is why daily application of liquid fertilizer is important. With liquid fertilizers, potassium and trace elements are directly supplied into aquarium water and absorbed through the plant leaves, which provide instant results. This section reviews the research on the changes in planted aquarium with application of liquid fertilizers.

**Each liquid fertilizer features different main nutrients.**

Leaf color of aquatic plants is enriched with minerals of desalinated deep seawater.
Scissors are the tools essential for creation and maintenance of meticulous layouts. There are many different types of scissors available for use in different approaches of trimming for different types of aquatic plants. Let’s do a research now to find out the features of each scissors.

In Nature Aquarium, various types of tweezers and scissors are used for creation and long-term maintenance of meticulous layouts. Among the layout tools, scissors, in particular, are available in a variety of size and shape options to cater for various situations of layout creation and maintenance. Some of the scissors like Pro-Scissors Wave and Spring used for Nature Aquarium have unique shapes which are significantly different from ordinary scissors. How are these scissors specifically different? This section features the research on the opening angle and usability within the aquarium for each type of scissors.

- **Comparison of opening angle of scissors**

  - **The type of wide trimming range**
  - **Pro-Scissors Wave**: Approx. 10cm
  - **Pro-Scissors Short Straight type**: Approx. 10cm
  - **Pro-Scissors Force**: Approx. 10cm

**This is the Key Point**

- “Use the scissors with different shapes for their respective suitable areas and purposes.”
- “The scissors with long handles are best suited for intricate layouts.”
- “The scissors with wide opening angle are efficient for trimming of foreground plants in a wide area.”