Development and Conservation Coral Reef with Biorock Technology System in Situbondo

Dirta Marina Chamelia, Suntoyo and Silvianita
Department of Ocean Engineering, Institut Teknologi Sepuluh Nopember,
Kampus ITS Sukolilo, Surabaya 60111, Indonesia

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Abstract: Coral reef condition in Indonesia has degrade into some condition of damage environmental in several areas. In order to prevent this into worsening state, effort must be done to keep our coral environment healthy. Coral planting is one of this effort. The artificial coral also can be functioned as breakwater in shallow water and also reduce beach erosion. One of the many technics in coral transplantation is biorock technology. Regular monitoring of the transplanted coral must be done regularly for years to ensure the development is according our plan. Biorock technology is a development of electro mineral in the sea, as well as called mineral accretion technology. Biorock works by electrolyze sea water. Occurred by located two electrodes in the sea and inject low voltage electric current. Coral reef transplantation program must consider ecological aspect as the program run. The purpose of this research is to develop biorock technology and improving biorock efficiency. Identification of the ecosystem in Batu Lawang to determine correct procedure and technics for biorock application.. With healthy coral and sea environment, local community will have indirect benefit by increasing of maritime tourism.

1 INTRODUCTION

Pantai Pasir putih, is one of the main tourism destination in east java province, sited in Situbondo, located at north side of the island along the main road Surabaya – Banyuwangi. Because of this strategic location, Pasir putih has the easiest accessibility among the beaches in east java. Pasir putih infamous as host of many tourism activities, from fishing until scuba diving.

Those activities done for several years contribute in deteriorating coral live in Pasir Putih. Buildings, over fishing activity, domestic waste and industrial pollutant are the main cause for damaging coral life in this area. Every day, more than ten fisherman boats throw their anchor into sea bed in Pasir Putih, during their pursuit, their boat were also followed, as well as their anchors which were hold on to rocks, coral, anemone or any places in the sea bed. These thing make coral broken, cracked or even worse uprooted.

During International Coral Reef Symposium, in Bali, October, 2000. Presiden Megawati Sukarnoputri stated that 94% of Indonesia coral was heavy damage. Almost 70% coral in east java and Indonesia are in bad condition, and ironically this damaged was created mostly by local fisherman in their areas (Ahmad and Masud, 2013). One bad behavior in the fishing is using detonation to shock the fishes so they can have easy catches, but this destroyed fishing ground and coral life. “In term of money, coral damages cost almost IDR 500 billion/year”, said Saifullah Yusuf, vice governor of East Java. Coral condition in Pasir Putih can be described as follows, teluk Pelita has 50,61% good coral, Karang mayit has 32,92% good coral, Dermaga 1 has 27,59% good coral and Kembang Sambi 22,49%. With condition as above, it needs urgent action to prevent the area of the damaged coral wider, or even better to restore coral life environment. One of the many methods for coral transplantation is Biorock technology.

2 LITERATURE REVIEWS

Coral reefs is one of the natural protector along with seagrass, mangrove forest and dunes. But, only 6,41% Indonesian coral is in very good condition, the rest conditions are 24,3% good, 29,22% and 40,14% damage (Eko, 2011). Comprehensive artificial Coral reefs rehabilitation had been launched in 2003 with

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the funding from ADB and world bank. Called COREMAP (Coral reef rehabilitation management program).

Biorock technology is electro mineral deposit process in the sear, also called Mineral accretion technology (Edwars and Gomez, 2007). Biorock works by sea waer electrolysis process, place two electrodes in sea bed and injecting low voltage electric power, which is save for underwater activity. This electric power allowing mineral in the sea water crystalized in the electrode.

2.1 Biorock Technology

Biorock works by sea waer electrolysis process, place two electrodes in sea bed and injecting low voltage electric power, which is save for underwater activity. This electric power allowing mineral in the sea water crystalized in the electrode. Biorock formed with non galvalume metal as cathodes. Carbon, Lead and Titanium as anode pole. When electric power flows in the structure, structure produce electrolytic reaction which is produce mineral development in cathodes sides. Mineral that formed in the structure are Magnesium hydroxide and Calcium carbonate. These two minerals are very important for coral since those two minerals are basic structure of coral reefs. This deposit also glued biorock structure into sea bed and strengthen the structure.

Figure 1: The making of biorock structure (https://monruw.wordpress.com).

2.2 Coral Reefs

Coral reefs has been played important role in ocean ecosystem, it supplies food source for many creatures in the sea. Coral reefs can contain 300 living species, 200 fish's species, molluscas, crustacean, sponges, algae, dunes and many other species. Coral reef has very importan role for supplying food, living place, breeding place nad natural protection of the beaches (Dahuri, 2003).

Basically coral reefs developed by large number of calcium carbonate (CaCO3) deposit produced by coral developer organism from filum Cnidaria, ordo Scleractinia with another organism whose secreting calcium carbonate (Bengen, 2002). That coral organism is in class Anthozoa, flower shape animal hewan (Antho is flower in latin, ; zoa is animal). Furthermore, Aristoteles classified coral organism as animal plant. In 1723, coral organism classified as animal (Dahuri, 2003).

3 METHODOLOGY

3.1 Identification

Identification as initial step hold very important basis to ensure the correctness of coral type, location and structure shape in order to produce best growth.

3.1.1 Data Gathering

Data gathering obtained by scuba diving in several location to have various data and comparison. Data obtained during scuba diving are:

1. Coral transplantation location
2. Coral types (sample)

3.1.2 Data Analysis

1. Water

During data gathering, each location will analyze its temperature at the depth where coral will be planted, degree of coral reefs condition, salinity, sunlight intensity and seabed pictures.

2. Coral Transplantation

Transplanting coral is using healthy coral, cutting at its tip then transfer that piece into our location. According Dr. Soekarno in Coralmap, below criteria must be considered to get optimum result in transplanting coral:

a. A specimen must be taken from location which have minimum 40% healthy coral that covering the area of coral reefs, must have similar depth and similar current with transplantation location.
b. Specimen must be planted within 1 hour.
c. Specimen must be cut the edge of coral, not the colony to avoid greater damage in the future.

3.2 Transplantation

1. From several literatures about coral transplantation, the best result is in Pemuteran beach – Bali with biorock application. A team assembled from professional scuba divers and did the survey in Pemuteran to have view on biorock structures and technology application
2. Biorock technology application is designed according to transplantation location. Using solar panel to generate electric instead of shore

connection is chosen due to the security and geographical aspects.

3. Plant the Structure
   Structure was assembled underwater by knock down technology. Structure shape consider the beneficial for water activity in the area, so economical aspect also impacted instead of environmental only.
4. Maintenance
   The main factor to get optimum growth in coral transplantation is maintenance. Maintenance is very important to ensure that no sediment is covering the coral. Also with routine maintenance, evaluation can be generate more accurate since the subject of this research is located 7 m underwater. Maintenance is done by scuba diving, cleaning the sediment every two weeks

4 RESULT AND DISCUSSION

4.1 Dimensional of Structure

Structure of the biorock is made from cast iron as main frame, and CACO3 as a medium to plant the specimen. The main structure took half hemisphere to get more strength than straight shape, as drawn below

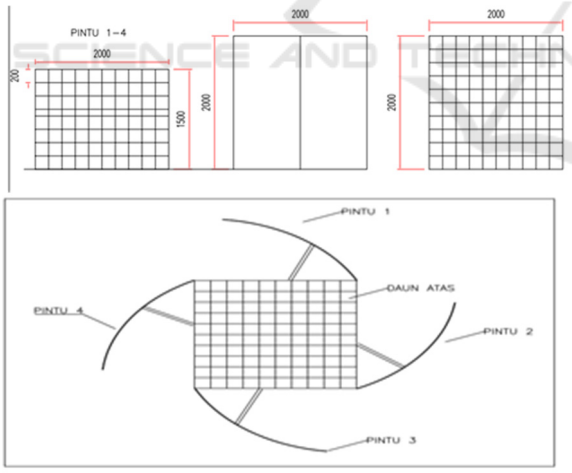

Figure 2: Main structure detail specifications.

Table 1: Structure data.

Name		Remarks
Structure and Material	:	Cast iron
Diameter	:	10 mm
Anchor	:	concrete
Joint	:	Welded and screwed
Plant medium		
Material	:	Mixture of cement and CACO3
Composition	:	1:4
Dimension	:	50mm x 100 mmx 250mm

Medium of planting was made of cement and CACO3 mixture to get more CaCO3 in the structure. Electrical power supplied in the structure is planned 5Volt DC current for 9m².

4.2 Location

Location for transplantation environmental data

Table 2: Environmental data.

Data		Remarks
Depth	:	4 m
Current	:	2 m/s
Salinity	:	33 $^{0}/_{00}$
Temperature	:	28 °C

Location chosen for having vast opening seabed to place the structure with n3 – 7 m depth which is optimum depth for coral environment. Also this place only took 30 minutes sailing from the location of specimen, less than maximum time 60 minutes as described before.

4.3 Transplant Medium

Plant medium was casted from mixture of cement and CACO3 with specification as described in table 1. Before placing the main structure under water, structured was assemble at surface to determine and describe clear job description for each diver who will install this structure underwater. Clear briefing must be delivered to have efficient works underwater.

Figure 3: Habitat for Coral Reef.

Figure 4: Medium and main structure.

Main structure then dismantle and loaded onboard in pieces. This pieces will be assembled together underwater by the divers. After main structure assembled complete, specimen of coral transplantation can be plant in the CACO3 medium. Each specimens planted have 10 cm length.

Figure 5: Transplantation process.

4.4 Transplant Result

Result of the transplantation reported as consideration for any stake holder to continue this research to save coral reefs and create better sea environment.

Figure 6: Coral growth process 1.

Figure7: Coral growth process 2.

5 CONCLUSION

Transplantation of coral was executed based on characteristic of the coral reefs and environment. The type of the coral used as specimen is Acropora, planted in the artificial CACO3 mediums which are hang in the main structure. From 89 mediums, 60 mediums have shown coral growth in healthy condition. The main cause of the dead coral is covered by sediment, sand that carried by sea current, developed sediment in the coral body. To avoid this happen in the future, continuous maintenance must be carried out for at least 3 consecutive years to ensure that no sediment developed in the transplanted coral.

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