CHAPTER III

THEORETICAL BACKGROUND

3.1. Bamboo Petung

Bamboo is a fibrous plant with a cylindrical stem and has varied in diameter from the base to the top, has a cavity, hard, and has a very fast growth (Xaverius, 2013). Bamboo is widespread in the territory of Indonesia and is widely used by the Indonesian people as a raw material for furniture and construction materials as a substitute for wood (Sukma, 2018). Bamboo has several advantages, including, bamboo can grow quickly and can grow in many places so that it can be harvested in a short time, bamboo can be produced in abundance, bamboo can resistant to high load strength, can reduce environmental pollution, besides that, bamboo has a relative price cheap compared to other building materials (Leelatanon, Srivaro, and Matan, 2011).

One type of bamboo that can be used as a building material is petung bamboo (*Dendrocalamus asper*) because bamboo petung has a stem size that is larger than other bamboos and has thick walls (Sukma, 2018). Petung bamboo has morphological characteristics, including has a segment length of 39.4 - 45.8 cm at the base, 46 - 49 cm at the middle, and 46.4 - 57 cm at the tip; a stem diameter of 6.69 - 9.25 cm at the base, 5.79 - 8.32 cm at the middle, and 5.06 - 7.99 cm at the tip; for the stem wall, it has a thickness of

1.62 - 2 cm at the base, 1.16 - 1.57 cm in the middle, and 0.85 - 1.09 cm at the tip (Wulandari, 2019). In addition, petung bamboo also has an average tensile strength of 226.39 MPa (Priyo and Yasin, 2019).

3.2. Coal Tar

One of the bamboo coating materials used in this study is coal tar. Coal tar is a protective polymer used for surfaces that experience highly corrosive environments, coal tar is a surface protection polymer with black color. Coal tar is a mixture of various epoxy resins and coal tar. Coal tar is usually used as a coating or paint to provide moisture protection for underground systems, in addition, coal tar is also used in the industrial waste disposal and the prevention of microorganisms.

Following are the properties of coal tar obtained from its use as a paint or coating:

1. Forms a smooth coating
2. Adhesives well with oily surfaces
3. Forms good moisture sealing for coatings
4. Produces a coating with abrasion, thermal shock, impact, and chemical resistance; suitable for continuous immersion in brine or freshwater
5. Provides maximum corrosion protection
6. Protects against ground pressure

3.3. Araldite

Araldite is also one of the surface coating materials used in research. To make araldite adhesive, it is done to mix 2 components, namely epoxy resin and hardener. This adhesive has resistance to water, heat, corrosion, and most chemicals. Araldite is also suitable for all surfaces such as stone, metal, ceramics, glass, wood, and others.

Here are the advantages of araldite as an adhesive:

1. Excellent mechanical strength
2. Fast handling strength
3. Suitable for bonding metals, composites, plastics, concrete, and other substrates
4. High chemical and water resistance
5. Wide variety of temperature and curing speeds
6. Improved product performance and durability

3.4. Epoxy Resin

Epoxy resin has strong mechanical properties against chemicals and has high adhesive properties. When the curing process is carried out, the epoxy resin requires an additional curing agent, usually called a hardener.

Here are the advantages possessed by epoxy resin:

1. High strength

2. Moisture resistance, chemical resistance, and impact resistance
3. Low shrinkage during treatment
4. Increased mechanical strength and fatigue
5. Long shelf life

Besides having advantages, the epoxy resin also has disadvantages, it is the price is relatively more expensive compared to other surface coatings.

3.5. Compressive Strength

Compressive strength is the maximum compressive stress by giving a load gradually to a particular solid material and applying the same opposite load to the test material. The load will be applied until the sample fractures or is deformed.

The fracture material is at the limit of compressive strength, it can cause material damage in the form of ductile failure or brittle failure. Concrete usually has a much higher compressive strength than materials that have high tensile strength

3.6. Tensile Strength

Tensile strength is the maximum tensile stress in a material that can be received before fracture or permanent deformation. The tensile strength determines the change in material from elastic to plastic deformation.

Tensile strength is of 3 types:

1. Yield strength: the stress that can show the material without permanent deformation
2. Ultimate strength: the maximum stress that a material can withstand
3. Breaking strength: stress coordinates on the stress-strain curve at the breaking point.

Tensile failure produced by the limit state of tensile stress/tensile strength:

1. Ductile failure - yield as the first stage of failure, some hardening in the second stage, and damage after a possible "neck" formation
2. Brittle failure - suddenly breaking into two or more pieces under low-stress conditions

3.7. Modulus of Elasticity

The modulus of elasticity is the measured value of a material's resistance to elastic deformation, that is, its flexibility. Only applies to non-permanent deformations when under pressure. The greater the modulus, the stiffer the material, or the smaller the elastic strain that results from the applied stress. Meanwhile, more elastic material has a lower modulus of elasticity.

3.8. Flexural Strength

Flexural strength, also known as bending strength or modulus of rupture is the maximum stress in the material just before yielding in a flexural test. At the within of the bend, the stress are going to be at its maximum compressive stress, while at the other side the stress are going to be at its maximum tensile stress value.

There are two standard test methods for determining the flexural strength of concrete beams:

1. Center point loading test: in this method, all loads are concentrated at the midpoint of the length of the beam span. The resulting flexural strength will be higher than the bending strength under third-point loading.
2. Third-point loading test: in this loading, half the load is applied to every third of the span of the beam. The resulting flexural strength is lower than the flexural strength in the center point loading test.