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Tandatangan:

Penulis:

Tarikh:

For my beloved family and friends.

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ABSTRACT

Rainwater storage tank is one of the components of systems so called Rainwater Harvesting (RWH). The storage tank is based on construction with cement-based materials instead of having ready made available in market. The advantages of using cement-based material are low initial cost as well as long lifespan. On the other hand, common problems occur having this type of tank are shrinkage and crack. Shrinkage and crack can be reduces while constructing the tank, before and also after the construction. Reinforcement cement storage tank can reduce the cracks and shrinkage. The methods of constructing the tank explained in this project are by using metal rod, chicken wire and also aluminum sheets. The construction is easy as well as simple design so that no need skilled labor in constructing the tank. The quality of rain water can be maintain and treated by some common filter system.

ABSTRAK

Tangki penyimpanan air hujan merupakan salah satu daripada komponen Sistem Penuaian Air Hujan. Tangki yang digunakan dalam sistem ini adalah tangki yang dibina berdasarkan simen dan besi selain daripada membeli yang sedia bina. Kelebihan menggunakan tangki simen adalah kurang mengeluarkan kos permulaan disamping tahan lama. Selain daripada itu, kekurangan yang sering berlaku apabila menggunakan tangki jenis ini adalah penyusutan dan retakan. Penyusutan dan retakan pada tangki simen boleh dikurangkan sebelum, semasa dan selepas membina tangki tersebut. Cara bagi membina tangki jenis simen ini adalah dengan menggunakan batang besi, dawai besi serta kepingan aluminium. Pembinaan tangki ini adalah ringkas dan mudah serta mudah dibina oleh sesiapa sahaja dan bukan hanya memerlukan Pembina yang pakar sahaja. Kualiti air hujan juga boleh dikekalkan dengan penapisan yang sedia ada di pasaran.

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LIST OF SYMBOLS

H	=	Height
d	=	Pipe Diameter
ε	=	Pipe Roughness
L	=	Pipe Length
P	=	Pressure
P_B	=	Pressure at Point B
ρ	=	Density
g	=	Gravitational Acceleration
Z	=	Height of Water Level
V	=	Velocity
H_L	=	Head Loss
K	=	Fittings Constant (K-Value)
f	=	Friction Factors
μ	=	Viscosity
Re	=	Reynolds Number

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CHAPTER I

INTRODUCTION

1.1 Background

Storage tank basically known as container used to store fluid like gas or liquid. Sometimes, manufacturing sites used the term of reservoir to indicate of their storage tanks. Rainwater storage tank is a tank or reservoir that used to store collection of rainwater. The supply of this rainwater storage tank is solely depends upon rainwater. Thus, some review about rainwater pattern should consider in order the best design of rainwater storage tank can be made so that it can provide enough daily water supply for domestic used when there is no rain for some times.

Malaysia is located near the equator of the earth, and so Malaysia is categorized as equatorial which make Malaysia hot and humid which benefits

from a tropical climate throughout the year. Generally, Malaysia's climate features are uniform temperature, high humidity and rarely to have a full day of clear sky even during periods of severe droughts. On the other hand, Malaysia has two general climate monsoon winds seasons which namely southwest and northeast monsoon. Following this, northeast monsoon brings more rainfall compared to the other one which can be as reference to design rainwater storage tank that can collect as much as rainwater during this northeast monsoon before southwest monsoon will arrive. Nevertheless, if this rainwater storage tank will be build inside Malaysia country, the climate will not affect much for collecting rainwater because of Malaysia's benefits which of tropical climate where rarely to have full day of clear sky even though during periods of severe droughts.



Figure 1: Map of Malaysia (Source: www.climate-zone.com/climate/malaysia)

One final point is that the rainwater storage tank that will be built will collect as much rainwater during the northeast monsoon so that the water supply can be used during droughts or some times that rain will not occur.

1.2 Overview of the Study

Mostly, citizen in Malaysia face the same problem when there is water interruption for days from water supply. Sometimes the distribution of water supply is good without any other interruption; however the supplied water being contaminated or even sometimes the water billing highly costs. Thus, this will lead to infection of disease like sore throat and even household used cannot be done perfectly; as for example washing clothes, cooking and even for drink. Then, by reconsidering the old-fashioned of storing water supply, Rainwater Harvesting (RWH) system is best method to provide people with access to an on-site water supply.

RWH is a simple, low-cost production that requires minimum specific expertise of highest skilled craftsmen and even gives many benefits. By using this kind of method, the risk of flood can be reduced as Malaysia's climate of high rainfall distribution throughout the year that can be a cause of flash flood in big cities. Since the rainwater storage tank depends solely upon rain water, thus the catchment should be construct first so that all the rain water can be runs off through the catchment without or small losses.

1.3 Research Methodology

To complete this study, some sort of way to find required related data is crucial. One of them is that by some sort of literature review. Study about what previous researches have done and try to compare with current design so that the best result will occur in order to design or develop rainwater storage tank. Process mapping also needed so that the analyzing and process involved for Projek Sarjana Muda (PSM) 1 and 2 can be done perfectly. As for example, flow chart of PSM 1 and 2 with Gantt chart is required.

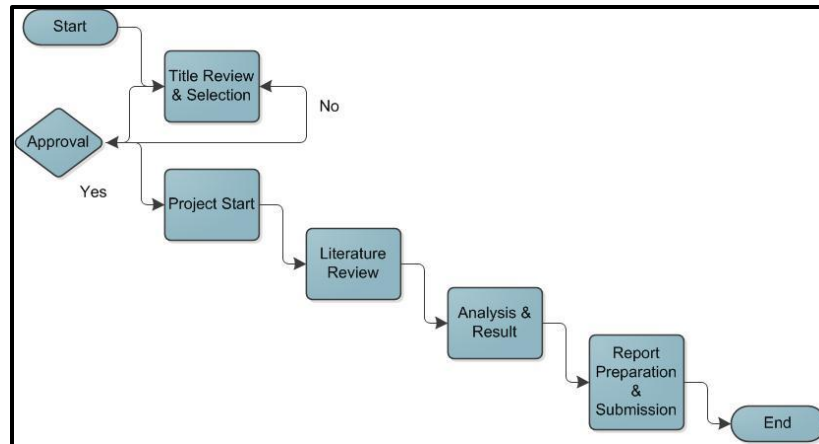


Figure 2: Flow Chart for overall PSM

1.4 Problem Statements

In this age of era, people is about to increase their expenses as increasing annually currency. As goes with water consumption, the increase of population every year will need an extra usage in water supply just to feed themselves. Water supply is finite where 97% of all the water on the earth is covered with water that does not suitable for drinking purpose. The remaining 3% yet is fresh water but only one percent that suitable for drinking while the other two present as ice caps and glaciers. [Wikipedia]

As population grows, more people are tending to use this limited water resources. Based on the problems outcomes, people start to use old-fashioned strategy to gain extra water supply – RWH. One of part of the systems is the storage tanks. Cement-based storage tank yield a lot of problems and the most well-known are cracks, shrinkage and a lot of initial investment and mostly need to have skilled labor to construct.

1.5 Objectives

The objectives of this project are:

1. To investigate problem associated with water storage tank in residential area.
2. Develop design of simple and economical storage tank that can be constructed with semi or unskilled labor.

1.6 Scope

The scopes of studying this Development of Rainwater Storage tank are listed as follow:

- i. The project will only investigate water storage tank build above ground, where all the forces are carried by the tank walls.
- ii. The project will investigate how structural analysis can be carried out to establish the forces in the tank and different types of shrinkage and how they affect cement based materials.
- iii. The proposed design will be introduces based on those analysis.

CHAPTER II

LITERATURE REVIEW

2.1 INTRODUCTION

In North America, rainwater storage tank is known as rain barrel while UK used the term of water butt is a water tank used to store rainwater collection and typically collected from rooftops via guttering and downpipes that connected rooftops to the tanks [Wikipedia – Rainwater Tank]. The using of rainwater collection is to reduce the using of main water supply (in Malaysia, all water is supplied by Jabatan Bekalan Air) for economic purpose. Sometimes, people do not have access to clean water for daily used which is like cleaning, cooking or even washing. Then people start collect rainwater in either way like storing the rainwater inside buckets, tanks and ponds. This is commonly referred as Rainwater Harvesting (RWH).

Rainwater storage tank is one prerequisite part of RWH system. RWH system consists of three basic components which are catchment; usually used of roof surface, delivery system; well-known as guttering and downpipe, and also the last part is that of rainwater storage tank. In order to make this system runs well and provide good alternative water supply option, the whole system need to be design carefully so that the quality of rainwater does not affected by any other influences.

Normally, the most common way of people obtaining their rainwater storage tank is to purchase it ready-made from factory. While looking at this rainwater storage tank from the perspective of rural poor, this may be difficult to them due to financial status and also difficulties in transportation. Nowadays, there are two systems that generally being used. These include Do-It Yourself (DIY) and commercial systems. In order to solve the problem of rural poor case, DIY system is best method for them to have their RWH system. Based on the study by Jason Frey (2005), installation of system is depends on the degree of personal skill and preference, a more basic with regular water tank and piping or more advanced with pressured systems and water treatment system is chosen.

Nowadays, people use RWH as an alternative source of water supply for gardening and any domestic use. Utilization of this rainwater is now acting as best option even though today is on the era of globalization with highest technologies especially in computing as well as other technologies like the increasing of development of conventional water supply.