

**EVALUATION AND PERFORMANCE OF GROSS POLLUTANT TRAPS
(GPTs) FOR OPEN CHANNEL FLOW**

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ABSTRACT

Nowadays, water has become a scarce resource due to the water contamination problem. Pollution carried by urban stormwater is considered as one of the significant contributor to the degradation of receiving waters. One way to minimize water pollution is by constructing Gross Pollutant Traps (GPTs) at the point source to treat polluted water prior to being discharged into the river. This study emphasizes on the utilization of GPTs in removing pollutants during dry and wet weather conditions especially during stormwater events in open channel system. The GPTs system is consist of rubbish trap, oil and grease trap, and biofilter which located at Block L50, UTM Skudai. The results indicated that the GPTs system is effective in improving water quality during storm event where the effluent of discharge water of the GPTs system are comply with parameter limit as stated in Standard A and Standard B of Environmental Quality Act (1974). First flush analysis shows that the concentration of pollutants in first flush runoff is found more polluted than the remainder while the values of EMC for TSS, COD, and BOD are higher compared to other pollutants. Despite of functioned for water quality control, the GPTs is also benefit for water quantity control where it provide detention time, storage, and decrease the peak flow of the water flowing through the system.

ABSTRAK

Air telah menjadi satu sumber yang terhad ekoran daripada masalah pencemaran air yang berlaku pada masa kini. Bahan cemar dari air larian permukaan yang dibawa oleh hujan lebat telah dikenalpasti sebagai antara faktor yang merendahkan kualiti air. Satu cara untuk mengurangkan masalah pencemaran air ialah dengan menggunakan *Gross Pollutant Traps* (GPTs) untuk merawat air dari punca pencemaran sebelum dilepaskan ke sungai. Kajian ini menekankan keberkesanan sistem GPTs menyingkirkan bahan cemar semasa cuaca kering dan basah terutama sewaktu hujan lebat di dalam sistem saluran terbuka. Lokasi kajian terletak di sistem GPTs di Blok L50 UTM, Skudai. Sistem GPTs tersebut merangkumi perangkap sampah, perangkap minyak dan gris, dan penapis air biologi. Keputusan menunjukkan bahawa sistem GPTs ini efektif dalam meningkatkan kualiti air di mana 'effluent' dari sistem ini mematuhi had yang ditetapkan oleh Standard A dan Standard B Akta Kualiti Alam Sekitar (1974). Analisis air curahan pertama (*first flush*) mendapati tahap kepekatan bahan cemar adalah lebih tinggi dalam sampel air curahan pertama berbanding sampel air di akhir aliran air manakala nilai *EMC* untuk parameter TSS, COD, dan BOD adalah lebih tinggi berbanding parameter lain. Selain berkeupayaan untuk pengawalan kualiti air, GPTs juga berfungsi dalam pengawalan kuantiti air dengan menyediakan waktu tahanan air, penyimpanan air, dan dapat mengurangkan kadar puncak aliran air.

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CHAPTER 1

INTRODUCTION

1.1 General

Water is the basic element of life; without it life would not exist. It is one of the most important resources for man, and yet it is taken for granted because water is everywhere and it flows freely when we turn on the tap. The usage for water increases as population grows until the demand sometimes overshoots the supply or availability. Although the quantity of water on Earth is same all the time, the quality of the water that is available has drastically changed. Every watershed is affected by what takes place on the land. Once used, water flows out as quickly as it comes, down into the drain and into our rivers. The gunk and grease that is flushed down into the drain unthinkingly every day will ultimately find their way to a nearby river. In other words, we are poisoning the very resource that gives us life.

Many ways have been practiced to reduce the water pollution. One of the ways is to treat wastewater at the source points. This can be accomplished by constructing Gross Pollutants Traps (GPTs) at the source point to treat water prior to discharge into the river. Generally, GPTs are devices that collect large pollutants from waterways, before they enter wetlands and marine waters. They are used in urban water infrastructure such as stormwater drains, urban wetlands, beach fronts, and airports. They generally collect larger items from the water, such as take away containers, leaves, bottles and plastic bags. Smaller pollutants, such as dirt, chemicals, heavy metals and bacteria are not collected directly by the GPTs;

however, some small particles are caught up in the larger items in the trap and thus prevented from reaching the waterway (Hughes, 2004).

1.2 Problem Statement

Stormwater pollutants are generated from urban land-use activities and are transported from street surfaces by stormwater runoff before discharging into receiving waters. Community awareness of the environmental effects of urban stormwater pollution and their expectation that urban aquatic ecosystems are protected from environmental degradation has resulted in an increased emphasis on urban stormwater quality. Many local authorities have implemented stormwater management strategies for the protection of receiving waters. These include major public awareness campaigns to encourage environmental sensitivity and structural methods to physically remove pollutants from stormwater. Such initiatives are essentially focused on visible pollutant impacts and concerned with reducing gross pollutants, particularly litter. However, urban stormwater transports a variety of material ranging from large gross pollutants to fine particulates, all of which impact urban receiving waters and therefore require a waste water treatment device that are capable of removing the various types of the pollutants (Walker et. al., 1999).

Pollution carried by urban stormwater is considered a significant contributor to the degradation of receiving waters. Urban stormwater pollutants include gross pollutants, trace metals and nutrients that are associated with sediments, and dissolved pollutants (Walker et. al., 1999). The generation and transport of pollution in urban systems during a storm event is multifaceted as it concerns many media, space and time scales (Ahyerre et. al., 1998). During the storm event, the concentration of pollutants in first flush runoff is believed more polluted than the remainder due to the washout of deposited pollutants by rainfall.

To preserve the good quality of water resources, it is essential to control the water pollution in river by treating the waste water especially the first flush during

storm event which carries with it concentrations of pollutants that have accumulated during the period of dry weather between storms. An effective system of waste water treatment, such as GPTs is important to cater the various types and size of pollutants.

1.3 Study Objectives

The objectives of the study are summarized as follows:

1. To evaluate the effectiveness of GPTs system in removing pollutants during storm event and dry weather conditions.
2. To investigate the occurrence and the influence of first flush to the concentration of pollutants entering GPTs system during storm events.
3. To obtain hydrologic data and Event Mean Concentration (EMC) for the purpose of the evaluation of GPTs system.

1.4 Scope of Study

This Gross Pollutant Traps (GPTs) system consists of rubbish trap, oil and grease trap, and biofilter. The experimental site will operate at L50 where the stormwater come from nearby catchment area (parking lot and the nearby building).

The scopes of this study are;

- i. An open drainage system at L50 Block, Universiti Teknologi Malaysia, Skudai.
- ii. To improve the design criteria of the existing GPTs system in order to provide a better quality of surface water runoff for the system.
- iii. To study about the first flush runoff phenomenon, in terms of its concentration of pollution load compared to normal runoff pollution load.

- iv. To investigate the capability of the GPTs system in treating the first flush pollution load.
- v. To determine the relationship between the reductions of the first flush runoff pollution load by the GPTs system and the total rainfall amount.
- vi. To come out with hydrograph for stormwater events.
- vii. Determination of water quality parameters such as pH, Suspended Solid (SS), Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), Dissolved Oxygen (DO), and Ammonia Nitrogen (AN).
- viii. The maintenances of the GPTs system to ensure the cleanliness of the experimental site and that there are no overflow of the system occur as the result of any blockage by the rubbish.

1.5 Location of study

The Gross Pollutant Traps (GPTs) system is located at L50 Block, Universiti Teknologi Malaysia (UTM), Skudai. The compartmentalized GPTs consist of several compartments of Rubbish Trap, Oil and Grease, and Biofiltration. The UTM river in this study is the tributaries of the Sungai Skudai, as shown in Figure 1.1. Figure 1.2(a) and 1.2 (b) illustrated the location of study area at UTM Skudai.

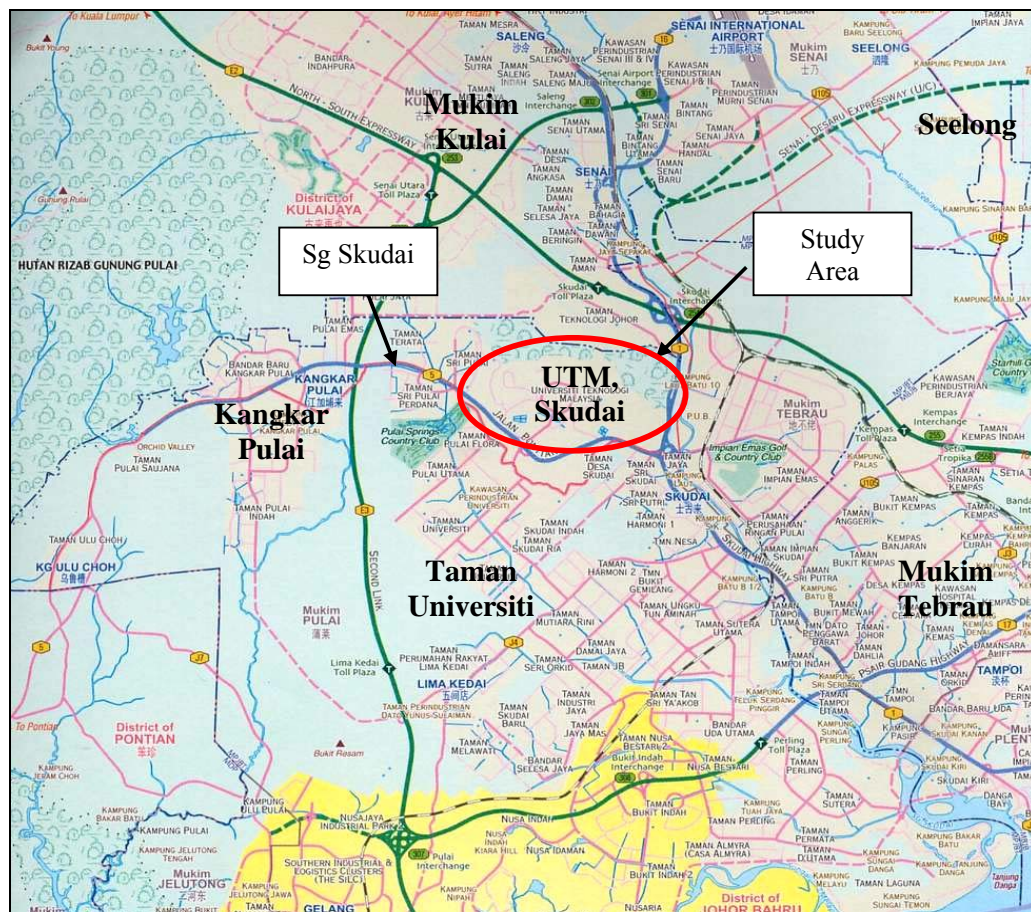


Figure 1.1: Location of study area



(a)



(b)

Figure 1.2: Location of study area (a) plan and (b) Google Image plan at UTM Skudai

1.6 Significance of Study

GPTs is a device that has a good potential in removing water pollutants. Nowadays, there are various types of GPTs available in market, such as Baramy Trap, Continuous Deflective Separation (CDS) Trap, HumeCeptor, and Cleansall Trap. However, most of the GPTs systems are only concentrated in removing large pollutants mainly rubbish. There are still lack of GPTs systems that include the function of removing small size pollutants such as oil, grease, and bacteria available in market. Hence, a development of GPTs system that consists of compartments that will function in removing both large and small size of pollutants is essential in order to produce an effective water pollution treatment system. Moreover, most of the available products of GPTs are from overseas, mainly Australia. The study on GPTs in Malaysia is significant in order to produce our local GPTs' product.

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