INTRODUCTION

Wetlands are among the most important ecosystems on the Earth found on every continent except Antatica and in every climate from the tropics to the tundra. They are enigmatic ecosystem, being neither wholly terrestrial nor aquatic, nor easily classified as ecotone intergrades between the two. They are somehow intermediate between two extremes of conditions, wet and dry. The importance of this kind of ecosystem is reflected in many different issues. In the great scheme of things, it was the swampy environment of the Carboniferous Period that produced and preserved many of the fossil fuels on which we now depend. On a much shorter time scale, wetlands are valuable as sources, sinks, and transformers of a multitude of chemical, biological, and genetic material. (Vymazal, 1995)

Spreading throughout most parts of the world makes wetlands become very high variety which each of them has got its own unique characteristics. And even though being in the same region, due to different surrounding conditions, either natural or human factors, they can still be much different indeed. The only single feature that most wetlands clearly share is soil or substrate that is at least periodically saturated with or covered by water. (Vymazal, 1995) Therefore, working with or related to wetlands, it should be noticed that those wetlands are well-identified, at least to know if they are natural or constructed wetlands and to understand their unique characteristics which any natural damage, such as biological imbalance and water impoundment can then be avoided or limited, and better efficiency of functional work system of wetland can be achieved.

Tropical and subtropical wetlands have been exploited and created to produced rice which feeds more than half of human population. (Etherington, 1983) In developing countries as Thailand, natural wetlands are also often used easily when convenient, either with or without intention, for domestic waste dumping and as wastewater treatment site causing a large scale of the loss for this kind of ecosystem. Eventhough, many wetlands were widely used unknowingly for wastewater treatment in the past, their actual function were hardly recognized. At the present time, due to the energetic growth of industrial estate to serve human needs and wants, many wetlands are now under the stress of overloading with chemicals, nutrients and other pollutants which are drained into them.

Therefore, with the concern of ecological value by being a unique rich biodiversity ecosystem and rich sinks for many elements, and economics value by holding capability of wastewater treatment, many wetlands have been studied especially in America and Europe. However, lots of tropical and subtropical wetlands are still left to face their unpredictable destiny due to the lack of efficient studies.

Rationale

Waste water problem can be counted as one of the front row problems in the world. Since the environmental awareness has taken its root in most societies all over the world, there is now a number of different methods using in waste water treatment and one of the recently applied method is the use of aquatic plants (hydrophytes/ macrophytes) in constructed-wetland. By having the advantage of applying low-technology, low cost of both operating and maintenance while giving out a moderately satisfied output in removing some pollutants from waste water., aquatic plants and constructed-wetland technique is a desirable technology for waste water treatment especially in developing countries.

The application of aquatic plants in this technique can be applied in two main concepts; using the already existed wetlands and adopting constructed-wetland. While lots of information in natural wetlands were studied and accumulated along with field applications of many different designs of artificial wetlands especially in temperate region, unfortunately, such practices are not yet widely adopted and applied for waste water treatment in South-east Asia where most of the nations are normally developing countries. Because of being firstly developed in the temperate area, this aquatic plants -wetland technique might not then successfully work out in tropical areas as South-east Asia due to the differences of their climates and unique characteristics of wetlands. Therefore, there is a real need of proper information, firstly about characteristics of already existed natural wetlands and the understanding about aquatic plants of tropic and subtropics, before the practice of the technique.

After that, data can be collected continuously for the development of a suitable aquatic plant-wetland design of these regions.

This study, therefore, try to be a part of filling up the gap of information by starting at the very beginning. The study adopted the concept of being a pilot study for natural wetland in Thailand concerning with its treatment efficiency of wastewater from agricultural site.

In the past few decades, the fascinating growth of Thailand's economics has led the country to change its international roles especially in commercial issues and politics. Such growth had forced Thailand's image from being agricultural country to one of the upcoming new industrialized one. Many of agricultural practices have been manipulated and changed to suit such image of the country, actually to suit the more needs and wants of people. One major change in agricultural practices is production method which is now mostly concern more about the quantity of the out coming products, such as livestock and related products.

This kind of agricultural production has then led to another national problem of waste disposal, the vast quantity of unpleasant wastewater discharged from the end of the production lines into surrounding environments. Thai Government has been spending a lot of money to solve the problem of waste and wastewater nationwide, and yet the problem seem to maintain in same level in many regions. Most of the conventional wastewater treatment techniques are quite expensive and requires lots of inputs; high technological knowledge, experienced personnel and specific regular maintenance. Another optional technique for Thailand which is counted as one of developing countries, is biological technique of aquatic plant-wetland. Denny (1997)

has stated in his study that " Artificial and natural wetlands in developing countries have a key place in environmental health, water quality management and biodiversity conservation, their wider use is to be encouraged. Constructed wetlands, particularly in the treatment of domestic wastewater, have enormous potential for local communities." Therefore, the concept of studying the possibility of using wetland as secondary or tertiary wastewater treatment system was also included.

Hypothesis

Owing to the long-term use as restoration pond for effluent, mainly from the biogas unit, without any proper maintenance, **It was firstly expected that the efficiency for wastewater treatment of the studied wetland is low** concerning with the removal of some nutrients and organic matter.

It was also questioned that **what property of the studied wetland, either physical or biological, plays more important role in wastewater treatment.**

Additionally, surrounding conditions of the wetland, due mainly to human activities, were also thought to be related to the wastewater treatment efficiency of the wetland. Such conditions could change the efficiency by either enhancing, limiting or even reducing. Therefore, **it was also hypothesized that these surrounding conditions probably have some effects on the wastewater treatment efficiency of the wetland**, and there is a need of proper maintenance for it.

Objectives

1. To study the profile and vegetation distribution of the studied wetland in order to understand the flow pattern, other influencing conditions and some base-line characteristics of the wetland.

2. To review the information of surrounding conditions of the studied wetland by carrying out literature review, interviews and field observations.

3. To assess water quality in the studied wetalnd, in order to evaluate wetland's wastewater treatment efficiency, measuring some physico-chemical parameters.

Site Description

The studied wetland site is a water hyacinth pond located right below the pig manure biogas unit in the area of Mae Hia Agricultural Research Station and Training Center, within Mae Hia District, to the southwest of Chiang Mai City. The area situated at the elevation of about 310 meters above sea level, near the mountain Doi Suthep. Mean daily temperatures are, in the course of the year, between 20 and 28 °C, and precipitation mainly falls in the monsoon period, i.e. from May to September. (Kloss, 1989)

The studied pond is irregular in shape covered totally by the spreading-out blanket of water hyacinth and fringed around with some other water-tolerated plant and some species of grass which at least one species is now aggressively invading into the northwest part of the wetland. The clear main inlet is on the south-western bank of the pond where the pre-treated effluent from the pig-manure biogas digester regularly enters into the pond. The outlet of the pond is on the north-eastern bank.

Originally, this water hyacinth pond was a natural swamp lining along the natural drainage pattern of the area. It was dug into a deeper pond about 9 years ago in order to be used as a utilizing pond for the effluent from the incoming biogas unit, a cooperated project between Chiang Mai University and GTZ from Germany. The pond was assumed to have some properties of treating such pre-treated effluent.

The pig manure biogas unit, Mae Hia, is now producing biogas from the pig manure drained from the upper pig farm which holding about 800 pigs regularly. The system works by using two types of digester: low rate channel digester (capacity of 100 m^3) and high rate digester (Upflow Anaerobic Sludge Blanket: UASB capacity of 50 m^3 .)

The surrounding area of the studied site is quite opened-area of paddy fields and other demonstrated agricultural farmlands. This agricultural site is belong to Chiang Mai University and was used for training of agricultural student as well as, at the present time, veterinary students.

People in general also have been using this site for aesthetic reason due to its beautiful sun-set view point especially in winter, and many of its lagoons are also impressive looking.

Figure 1. Studied wetland's view from south to north.

(The building in the middle is the office of the Biogas Advisory Unit : BAU.)

Figure 2. Studied wetland's view from northeast to southwest.

(The lined-up bamboo poles in the middle indicate the boat channel for water sampling.)

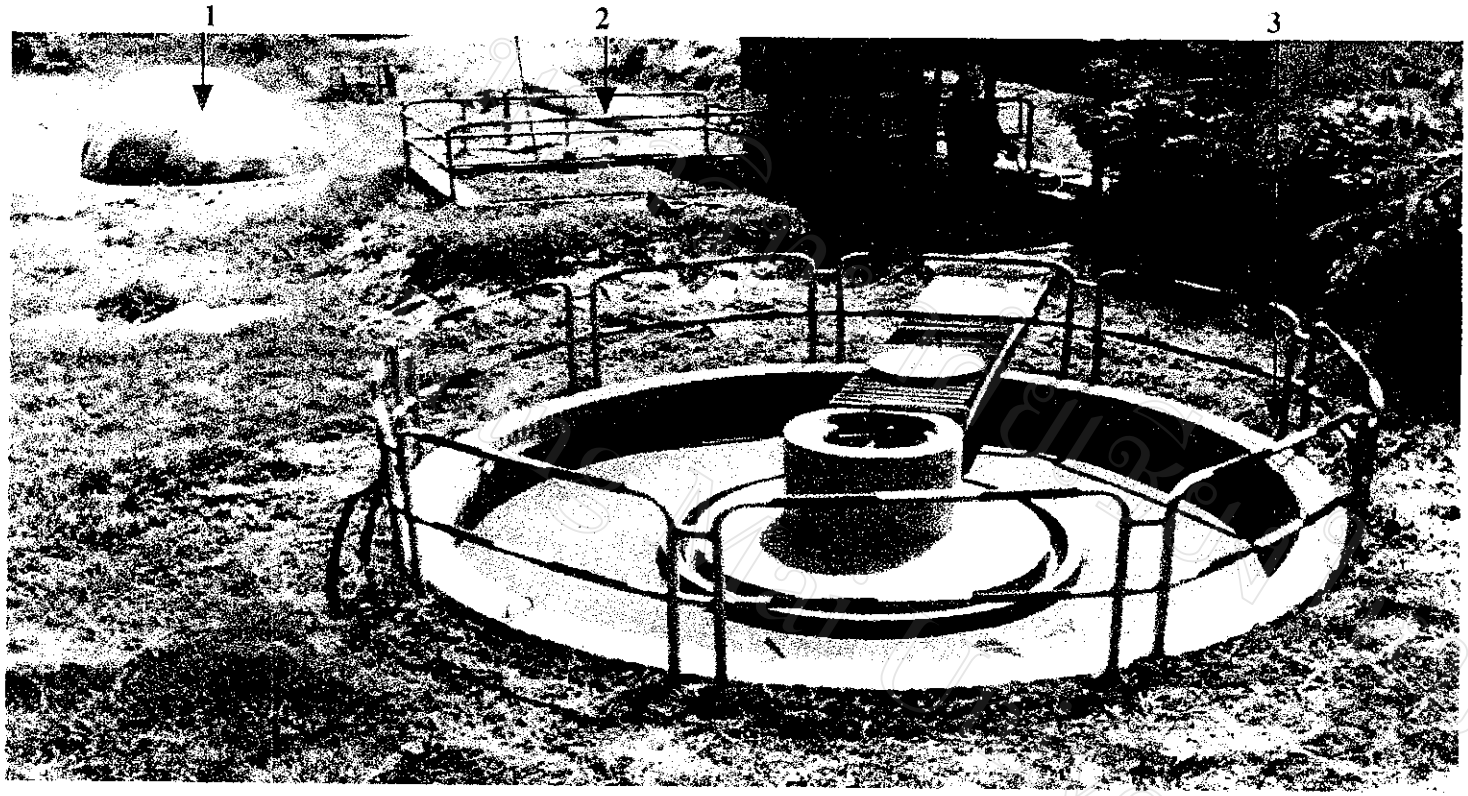

Figure 3. The biogas unit at Mae Hia

(1 : low rate channel reactor, 2 : thickening well, 3 : UASB-reactor)