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PHYTOTECHNOLOGY: FLOATERS AQUATIC PLANT SPECIES AS POTENTIAL PHYTOINDICATOR FOR EUTROPHICATION IN UNHEALTHY AQUATIC ECOSYSTEM

BY

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ABSTRACT

Nitrification and eutrophication are two terms that always associated with excess nutrients of nitrogen and phosphorus. Excess nutrients can trigger undesirable eutrophication, resulting in unhealthy algal blooms, spreading of certain aquatic macrophytes, depletion of oxygen and loss of key species leading to degradation of many freshwater ecosystems. Fertilizers, detergents and organic debris are among the sources of excess nutrients for nitrogen and phosphorus. In phytotechnology only aquatic macrophytes can utilize large amounts of nitrogen and phosphorus and remove it from the water bodies. Therefore aquatic plants are excellent indicators of unhealthy environment because they respond to nutrients, light, toxic contaminants, metals, herbicides, turbidity, water level change and salt. The aim of this study is to explore the capabilities of free-floating aquatic plant species as an indicator for eutrophication either at contamination or pollution level in unhealthy freshwater bodies to enable their future enhancement and potential through landscape ecology approach. The effects of nutrients (phosphate, ammonium, nitrate and nitrite), the free-floating macrophytes and locations have been studied on eutrophication level monitoring in aquatic freshwater bodies ecosystem. All species (*Lemna minor, Eichhornia crassipes, Spirodella polyrhiza, Neptunia oleracea, Salvinia molesta* and *Pistia stratiotes*) were detected with high level of phosphate at level III which is polluted at all localities (Selangor, Pahang and Kelantan). Ammonium concentration at Selangor range from 0.02 ± 0.02 mg/l to 1.14 ± 0.17 mg/l; Pahang range from 0.30 ± 0.10 mg/l to 1.36±0.08 mg/l and Kelantan range from 0.05 ± 0.02 mg/l to 0.54±0.24 mg/l. Ammonium concentration was varied from class I to class III. The best phytoindicator for excess phosphate were *L.minor* > *E.crassipes* > *N.oleracea.* Meanwhile, magnificient phytoindicator for excess ammonium were *L.minor* > *S.polyrhiza* > *E.crassipes.* In addition, good phytoindicator for nitrate were *S.polyrhiza* > *E.crassipes* > *S.molesta.* In conclusion, the most reliable phytoindicator for overall experiment were *L.minor, E.crassipes* and *S.polyrhiza.* Another interesting results was co-existence of *N.oleracea* and *L.minor* in Selangor, *E.crassipes* and *N.oleracea* in Pahang and *S.molesta* and *E.crassipes* in Kelantan. According to localities, Selangor and Pahang are confirmed with high concentration of phosphate and ammonium. In contrast, Kelantan exhibited with high concentration of phosphate but low level of ammonium. This might resulted from different type of soil from distinct localities. Another interesting result was the co-existence of *N.oleracea* and *L.minor* in Selangor, *E.crassipes* and *N.oleracea* in Pahang and *S.molesta* and *E.crassipes* in Kelantan. The ability of these co-existence species indicate eutrophication phenomenon in aquatic ecosystem were greater and efficient as compared to the existence of floating macrophyte independently. In conclusion, every floater aquatic plant species that has been tested was confirmed as potential phytoindicator to detect eutrophication in unhealthy aquatic ecosystem.

Keywords: Floaters aquatic plant species, phytoindicator, eutrophication.

خلاصة البحث

النترجة والتخثث نوعان من المصطلحات التي ترتبط دائما مع المغذيات الزائدة من النيتروجين والفوسفور. يمكن أن تؤدي إلى التخثث المغذيات الزائدة غير مرغوب فيه، مما أدى إلى ازدهار الطحالب غير الصحية، وانتشار النباتات المائية معينة، ونضوب الأوكسجين وفقدان الأنواع الرئيسية التي تؤدي إلى تدهور النظم البيئية للمياه العذبة كثيرة. والأسمدة، والمنظفات الصناعية والفضلات العضوية هي من بين مصادر المغذيات الزائدة عن النيتروجين والفوسفور. في التكنولوجيا النباتية يمكن أن النباتات ذات الأوراق الكبيرة المائية فقط الاستفادة من كميات كبيرة من النيتروجين والفوسفور وإزالته من المسطحات المائية. ولذلك النباتات المائية هي مؤشرات ممتازة من بيئة غير صحية لأنها تستجيب إلى المواد الغذائية، الضوء، والملوثات السامة والمعادن والأعشاب، والتعكر، والمياه تغير مستوى والملح. والهدف من هذه الدراسة هو استكشاف قدرات التعويم الحر لأنواع النباتات المائية كمؤشر لالتخثث سواء على مستوى التلوث أو التلوث في مسطحات المياه العذبة غير صحية لتمكين وتعزيز مستقبلهم والمحتملة من خلال نهج علم البيئة الطبيعية. آثار من المواد الغذائية (الفوسفات والأمونيوم والنترات والنتريت)، وقد تم دراسة النباتات ذات الأوراق الكبيرة والتعويم الحر والمواقع على رصد مستوى قاصر، *Lemna minor*) التخثث في المياه العذبة المائية هيئات النظام الإيكولوجي. تم الكشف عن جميع الأنواع *Salvinia* نبتونيا، *Eichhornia crassipes, Spirodella polyrhiza, Neptunia oleracea* *molesta, Pistia stratiotes* الزقيم) مع درجة عالية من الفوسفات في المستوى الثالث الذي هو ملوث في جميع المحليات (ولاية سيلانجور، وباهانغ وكيلانتان). تركيز الأمونيوم في نطاق ولاية سيلانجور من 0.02 ± 0.02 ملغم / لتر إلى 1.14 ± 0.17 ملغم / لتر؛ نطاق باهانج من 0.30 ± 0.10 ملغم / لتر إلى 1.36 ± 0.08 ملغم / لتر وكيلانتان مجموعة من 0.05 ± 0.02 ملغم / لتر إلى 0.54 ± 0.24 ملغم / لتر. وقد تباينت تركيز الأمونيوم من الصنف الأول إلى الدرجة الثالثة. وكانت أفضل النباتية مؤشر للفوسفات فائض *L.minor > E.crassipes > N.oleracea.* في هذه الأثناء، كانت النباتية مؤشر الخلاب لالأمونيوم فائض *L.minor > S.polyrhiza > E.crassipes.* وبالإضافة إلى ذلك، كانت النباتية مؤشر جيدة لنترات *S.polyrhiza > E.crassipes > S.molesta.* وفي الختام، كانت النباتية المؤشر الأكثر موثوقية للتجربة الشاملة *L.minor*، *E.crassipes, S.polyrhiza.* وكانت آخر نتائج مثيرة للاهتمام التعايش بين *N.oleracea, L.minor* في في كيلانتان. *E.crassipes* و *S.molesta* في باهانج و *E.crassipes, N.oleracea* ولاية سيلانجور، و بحسب المناطق، وأكد ولاية سيلانجور وباهانج مع نسبة عالية من الفوسفات والأمونيوم. في المقابل، عرضت كيلانتان مع نسبة عالية من الفوسفات ولكن انخفاض مستوى الأمونيوم. وهذا قد نجم عن نوع مختلف من التربة في ولاية *L.minor* و *N.oleracea* من مناطق مختلفة. وكانت نتيجة أخرى مثيرة للاهتمام والتعايش بين في كيلانتان. قدرة هذه *E.crassipes* و *S.molesta* في باهانج و *E.crassipes, N.oleracea* سيلانجور، و الأنواع التعايش تشير إلى ظاهرة زيادة المغذيات في النظم الايكولوجية المائية وكانت أكبر وكفاءة بالمقارنة مع بشكل مستقل. في الختام، وأكد كل أنواع النباتات المائية العوام التي تم اختبارها كما النباتية مؤشر وجود تطفو القدرة على الكشف عن التخثث في النظم الإيكولوجية المائية غير صحية.

كلمات البحث: العوامات أنواع النباتات المائية، النباتية مؤشر، التخثث.

APPROVAL PAGE

I certify that I have supervised and read this study and in my opinion, it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a thesis for the degree of Master of Science (Built Environment).

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Rashidi Othman
Supervisor

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Master of Science (Built Environment).

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DECLARATION

I hereby declare that this thesis is the result of my own investigation, except where otherwise stated. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at IIUM or other institutions.

W Naimatul Asiah Binti W Muhamad

Signature.................... Date...15/8/2012...

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.... 15/8/2012
Signature Date

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CHAPTER 1

POTENTIAL OF FLOATERS AS PHYTOINDICATOR FOR EUTROPHICATION IN UNHEALTHY AQUATIC ECOSYSTEM

1.1 INTRODUCTION

The success in the economic growth and industrialization in Malaysia has led to environmental problems with ever increasing land, air, and water pollution (Ho, 1996). Industrial production without adequate regard for environmental impacts has increased water and air pollution, and has led to soil degradation and large-scale global impacts such as acid rain, global warming, and ozone depletion (Seth, 2003; Ma et al., 2009). Those kind of pollutions led to many environmental impact to living organism especially in human daily life. In 1998, there were a number of projects approved for operations by the Malaysian Industrial Development Authority (MIDA) (DOE, 1998). These projects involved industries that probably released some of the toxic heavy metals. Whether or not contaminants from these probable sources are detected in the sediment samples remains to be ascertained (Yap et al., 2002). Threats from toxic pollutant may release to the air, as well as water that will caused most environmental issues.

Environmental management of natural resources (i.e. water, soil, plant) in a world with ever increasing industrial activities and urbanization has been the focus of extensive research to protect and preserve them for future generations across the globe (Bode and Nusch, 1999; Beck, 2005; Jia et al., 2007). Both natural and anthropogenic factors can impact on the environment by producing polluting components which may enter into the food chain and pose a threat to the ecosystems. However, input from anthropogenic related activities is much greater than natural ones especially in the world's industrial regions (Sultan et al., 2011). Thus, the extensive use of pesticides has resulted in high levels of contamination in every environmental compartment in Malaysia. Reports as early as 1981 found that high levels of widely used pesticides, such as aldrin, dieldrin, DDT, and HCHs, had contaminated river water, sediments, and fish (Abdullah, 1995 and Ibrahim, 2007). Generally, waterbodies play an important roles in our daily lives as well as in our landscape scenario. Physically, lakes and ponds providing an ideal location for recreational activities, preservation of historical value, as a country diplomatic and friendship, apart of luxury lifestyle and modern architecture, eco-tourism and water theme park, habitat of priceless flora and fauna and beautiful national treasure. Nevertheless, waterbodies become threatening issues in these modern technology eras. The importance of water quality always been neglected. Water pollution happens everywhere without precaution from surrounding community.

The following definition of water pollution was adopted by the Geneva Conference of the Council of Europe in 1961 by FAO and WHO and is included in United Nations document E/ECE/311: 'A watercourse is to be considered polluted when the water in it is altered in composition or condition, directly or indirectly, as a result of the activities of man, so that it is less suitable for any or all of the purposes for which it would be suitable in its natural state' (Council of Europe, 1966). The value of this definition is that it clearly implicates the activities of man and these are the activities over which man could be expected to exercise control. Further, it suggests, as the definitions of Klein (1962) state quite clearly, that pollution results from the addition to water of something deleterious, whether it be matter, heat, energy or radiation.

The pollution of aquatic ecosystems in Malaysia has emerged as a major ecological problem coinciding with rapid industrialization and urbanization (Al-Shami et al., 2010). For example, in 1994, the Malaysian Department of Environment (DOE) classified the Juru River Basin in the northwestern peninsular Malaysia as "very polluted" based on the water quality index (WQI) categorization (DOE, 1994). Juru River is one the most polluted rivers in Malaysia, with sediments highly contaminated with non-residual heavy metals, such as Cd, Cu, Pb, and Zn. These contaminants were likely introduced by the discharges from the light and heavy industries in the Prai Industrial Estate that was established in the early 1970s (Mat and Maah, 1994). Aquatic habitat are adversely impacted by urbanization, deforestation, construction, irrigation (including dam construction), drainage of wetlands (particularly of fresh waters and peat swamps), and pollution. Fresh water organisms live continously in the water and respond to all environmental stresses, including synergistic combination of pollutants (Al-Shami et al., 2010). Water pollution is a relatively major problem and arising as a result of unprecedented population growth, urbanization, and industrialization since the 1990s (Chen, 2002). As the urbanization process continues, Water pollution problems have become increasingly evident, and have led to serious ecological and environmental problems. Furthermore, water resources development and management have been disorganized, and there is a lack of public consciousness for the need for environmental protection and a corresponding lack of legal structures to promote this protection. As a result, serious conflicts have arisen; industry competes with agriculture to obtain water, agriculture competes for water with the environment, and upstream areas compete for water with downstream areas (Feng et al., 2000; Ma et al., 2005).

1.2 PROBLEM STATEMENTS AND ISSUES

Excess nutrients

Nutrients are the main agricultural pollutants in Malaysia. Nitrogen and Phosphorus are nutrients that brings threat to ecosystem while exceed its limit. Drainage ditches, irrigation channels, ponds and other waterways are polluted by agricultural runoff from fertilizer rich land such as vegetable farms, fruits and flower nurseries, golf courses and animal farms. More than 63% of the rivers in Malaysia are classified as moderately to highly pollute. They received urban runoff polluted with domestic sewage discharges and livestock excreta, as well as from agricultural uses and wastewater from factories. The river waters have high concentrations of biological oxygen demand, nutrients and pathogens, resulting in a risk to public health for bathing and fishing, particularly in areas of poor or impoverished human population and water recreational areas (Sima et al., 2008).

Nutrient is one of the most important elements needed for the growth of organism. However, excessive nutrient concentration in water bodies will cause eutrophication which stimulates excess plant growth resulting in depletion of dissolved oxygen and aquatic organism kills. Eutrophication of inland waters is currently one of the most prevalent environmental problems in lakes all over the world including Malaysia (NAHRIM and NRE, 2011). Eutrophication is the most crucial water pollution in Malaysia. Eutrophication is associated with excess nutrients. According to Academy of Sciences, Malaysia (ASM) and the National Hydraulic Institute of Malaysia (NAHRIM), in the year 2005, it was reported that about 62% of 90 major lakes in Malaysia that were studied were nutrient-rich or eutrophic while the balance was considered mesotrophic. This deterioration of water quality is a matter of serious concern. To reflect overall eutrophication status, the lakes are graded as good, medium or bad based on Vollenweider's 1976 allowable nutrient loadings.

Table 1.1
Trophic State Index (TSI) for eutrophocation level.

Grading	TSI (Trophic State Index)
Good	**< 37.4**
Medium	**37.4 < TSI < 47.4**
Bad	**< 47.4**

Environmental Quality (sewage) Regulations 2009 have guidelines of acceptable conditions of sewage discharge to any inland waters or Malaysian waters. This guideline stated acceptable condition of sewage discharge to any inland waters in Malaysia for Ammonical Nitrogen (river) should not exceed than 20mg/L, Nitrate – Nitrogen (river) <50mg/L, Nitrate – Nitrogen (enclosed water body) <10mg/L, phosphorus (enclosed water body) <10mg/L. Nevertheless, the most applicable guideline can be referred to Interim National Water Quality Standards for Malaysia (INWQS) for excess nutrients (table 1.4). Realizing the importance of water in life, local responsible bodies had established standard for effluents discharge to protect natural water.

The prevention of eutrophication or excess nutrients and the restoration of eutrophic lakes and reservoirs require proper planning and management of associated watersheds. Therefore, sound management strategies require an understanding of the relationship between nutrient sources and degree of eutrophication.

Leachate

Traditionally, Malaysia had been relying on its agriculture productions as a source of wealth and had developed as a leading agricultural country in the world. Being an agricultural based economy, Malaysia was involved in the crops cultivation, rearing of livestock and fishery. However, changes in the lifestyle of the people, as a result of urbanization and higher level of income, have resulted in changes in eating habits, food purchasing and consumption patterns (Kamruddin et al., 2007). The changes are reflected in the population, the economy activities (which contribute to economy sector) and energy demand, which had a positive impact on the GDP (Gross Domestic Product) of Malaysia. According to Department of Statistics, the population in Malaysia has raised from 27.17 million to 28.31 million in 2009 (Mekhilef et al., 2011). Power generation from agricultural wastes seems to be very attractive due to bio-resource sustainability, environmental concerns and economic reflection. Malaysia is a leader as one of the foremost agricultural countries in the world. It is main agricultural crops are oil palm, rubber, cocoa, rice and coconut; however, 2 major agricultural resources are oil palm and rubber with combine acreage of over 330,000 km2 (Goh et al., 2010), hence Malaysia government has targeted to generate energy from by-product and residues of 362 palm oil mills in the country. Malaysia, as the first palm oil producer in the world, is processing 71.3 million tonnes/year of fresh fruit bunch. The result derivation is about 19 million tonnes/year of crop residues consist of empty fruit bunch, fiber and shell. Hence, it is undeniable that fertilizer has been applied a lot to guarantee those agricultural products are in a good quality. Normally, fertilizer contains of nitrogen, phosphorus and kalium to ensure health growth of the crops. Yet, leachate of those inorganic pollutant has caused nitrifiaction and eutrophication to the neaby water sources.

Domestic waste management is a burning issue in Malaysia. The government of Malaysian is planning to build a large solid waste incineration plant in Broga, south of Kuala Lumpur which has a proposed capacity of 1500 tons day_1. However, the initiative has met with opposition from local communities and several non-governmental organizations (NGO) (CAP, 2005). Open dumping is commonly practiced and more often than not, leachates have been found to seep into the nearby rivers where drinking water is sourced from Landfill fires are quite common sights which would definitely release PCDD/PCDF into the atmosphere. Other sources of PCDD/PCDF are widely practiced open burning of domestic wastes and frequent forest fires from neighboring countries (Ibrahim, 2007). A major haze episode in Southeast Asia occurred in 1997 where it was estimated that 60 Tg of forests and vegetation were burned, producing thick smoke covering the whole of Malaysia and neighboring countries (Liew, 1998). Beside PCDD/PCDF, large amount of PAHs are also released during forest fire.

Waste water

In most cities with water scarcity, urban and industrial wastes are generally disposed of without adequate treatment; urban discharge of domestic sewage and industrial wastewater discharge are increasing, exacerbating foreseeable water shortages (Ma et al., 2009). Shortage of water caused many side effects, especially in our routine life. Municipal Solid Waste (MSW) in Malaysia is disposal of 98% of total wastes mainly as household wastes, industrial and commercial wastes. These wastes are capable of producing landfill gas (LFG) comprising of methane (CH_4), carbon dioxide (CO_2) and greenhouse gases (GHG) (Yip et al., 2008).

Currently there are over 261 landfill sites in Malaysia (Oh et al., 2010). Municipal solid waste (MSW) generation had increased from 16,200 tonnes in 2001 to 19,100 tonnes in 2005 or at an average of 0.8 kg per capita per day. It is projected to be 30,000 tonnes by 2020 (Siwar, 2008). Basically, solid waste management can be defined as a discipline to co-ordinate the control and disposal of solid waste. Despite the drastic economic development in Malaysia, solid waste management is relatively poor. Waste minimization in Malaysia strives to achieve the UN Agenda 21 in relation to control the strategy (Mekhilef et al., 2011).

More than half (60%) of the total amount of municipal solid waste (MSW) generated by the households in Kuala Lumpur city is organic waste (Kathirvale et al., 2003). Since waste is not segregated at source, most of the putrescible fraction will end up in the landfills. In a landfill, under an anaerobic condition, the organic nitrogen in the waste such as proteins is hydrolyzed into amino acids before it is further fermented to the other compounds including ammonia. The anaerobic hydrolysis of MSW containing proteins is slower than that of carbohydrates resulting in a slow release of the soluble nitrogen, i.e. ammonia (Jokela and Rintala, 2003). Thus, a high concentration of ammonia and a lower C/N are common features of the stabilized MSW landfill leachate (Fan et al., 2006; Chen, 1996) which requires a long-term after care with the ammonia removal for the landfill (Yusoff et al., 2010).

1.3 TYPES OF WATER POLLUTANT

Water pollution consist of organic and inorganic pollutant as below:

i. **Organic pollutant**

Organic pollutants are organic compounds of natural or anthropogenic origin that possess a particular combination of physical and chemical properties such that, once released into the environment, they remain intact for exceptionally long periods of time as they resist photolytic, chemical and biological degradation (Buccini, 2003). Compounds of this nature are highly resistant to degradation by biological photolytic and/or chemical means (El-Shahawi, 2010).

Organic pollutants present in water include pesticides, pharmaceuticals, dyes, personal care products, surfactants, different other organic compounds from chemical industry, etc. Many of them are chemically, photochemically and/or microbiologically stable and have been found in wastewaters all around the world (Kolpin et al., 2002; Chernigoj et al., 2007). Chemicals are classified by families and in most of these families contains tens or hundreds of different compounds, for instance polychlorinated biphenyls (PCBs) such as dioxin; polycyclic aromatic hydrocarbons (PAHs) such as benzoapyrene; nitroaromatics such as trinitrotoluene (TNT); and linear halogenated hydrocarbons such as trichloroethylene (TCE). Many of these compounds are not only toxic and teratogenic, but also carcinogenic (Meagher, 2000).

ii. Inorganic pollutant

Inorganic pollutants include nitrate, phosphate, per chlorate, cyanide etc; trace elements essential to plants when present in excess such as viz., B, Cu, Fe, Mn, Mo and Zn; trace elements require for animal nutrition when present in overload like As, Co, Fe, Mn, Zn, Cr, F, Ni, Se, Sn and V and the most toxic trace elements like Cd, Hg and Pb which are not essential by any organisms. Trace elements essential for human nutrition are identical to animal nutrition with the exception of As and V.

a) Nutrients

Aquatic plants need two essential nutrients to grow which are nitrogen (N) and phosphorus (P). In a healthy fresh water bodies the amount of nutrient is small. In contrast, large amount of nutrients in fresh water bodies cause to main water pollution. Ammonium (NH_4), nitrite (NO_2) and nitrate (NO_3) are the most common ionic (reactive) forms of dissolved inorganic nitrogenin aquatic ecosystems (Wetzel, 2001; Rabalais, 2002). These ions can be present naturally as a result of atmospheric deposition, surface and groundwater runoff, dissolution of nitrogen-rich geological deposits, N_2 fixation by certain prokaryotes (cyanobacteria with heterocysts, in particular), and biological degradation of organic matter (Wetzel, 2001; Rabalais, 2002). Concentrations of inorganic nitrogenous compounds (NH_4, NO_2, NO_3) in ground and surface waters are hence increasing around the world, causing significant effects on many aquatic organisms and, ultimately, contributing to the degradation of freshwater, estuarine, and coastal marine ecosystems (Smith et al., 1999).

b) Heavy metals

Heavy metal is categorized in inorganic pollutant. The term heavy metal is imprecise. For reasons of ease, we will broadly define it here as meaning any element that has metallic properties (ductility, conductivity, density, stability as cations, ligand specificity, etc.) and an atomic number >20. A more biologically relevant but complex classification of metals based on ligand-forming properties has been proposed. Heavy metals that are considered essential for at least some forms of life include V, Cr, Mn, Fe, Co, Ni, Cu, Zn, and Mo. Heavy metals required by plants include Mn, Fe, Cu, Zn, Mo, and, possibly, Ni. The phytotoxicity of such relatively common heavy metals as Cd, Cu, Hg, and Ni is substantially greater than that of Pb and Zn. Hexavalent Cr is much more toxic to plants than trivalent Cr.

1.4 EUTROPHICATION

A brief history of eutrophication, The German wetland scientist C.A Weber coined the term eutrophic in 1907 to refer to the rich wetlands in areas of Europe that received nutrient runoff from surrounding lands. The term was applied to lakes by Einar Naumann, roughly a decade later. It became widely used by scientists who study lakes to describe the complex sequence of changes in aquatic ecosystems caused by an increased rate of supply of plant nutrients to water. Eutrophication is the word used by scientist to describe the overfertilization of Lakes with nutrients and the changes that occur as a result. It is derived from the German word *eutrophe*, which is in turn taken from the Greek word *Eutrophia.* Ironically, it means "healthy or with adequate nutrition or development", which we shall show is far from our current understanding (Schindler and Vallentyne, 2008).

Eutrophication is the process by which a body of water acquires a high concentration of nutrients, especially phosphates and nitrates. These typically promote excessive growth of algae. As the algae die and decompose, high levels of organic matter and the decomposing organisms deplete the water of available oxygen, causing the death of other organisms, such as fish. Eutrophication is a natural, slow-aging process for a water body, but human activity greatly speeds up the. Smith et al., 1999; Sherwood and Qualls, 2001 also quoted that eutrophication, associated with discharge of nitrogen and phosphorus into water from point- and nonpoint-sources, has become a severe water pollution problem in many countries. Somehow, the contaminants from effluent plume are removed by natural transformations such as oxidation and nitrification, decay, sorption to soil, microbial antagonism, chemical reactive, dilution and plant uptake (Charles et al., 2003). Eutrophication can happen at anywhere, anytime. Since long decade, eutrophication is a slow-aging process for water body yet the effects has threatened the surrounding environment especially the aquatic ecosystem. Excess nutrients can trigger undesirable eutrophication, resulting in unhealthy algal blooms, spreading of certain aquatic macrophytes, oxygen depletion and loss of key species, resulting in widespread degradation of many freshwater ecosystems (Smith et al., 1999). In fact, eutrophication is the most widespread water quality problem in the world.

High ammonia concentrations can stimulate excessive aquatic production, toxic to aquatic life and indicate pollution. Excess nitrogen in lakes can contribute to accelerated eutrophication. Nitrogen can enter the water when bacteria called blue-green algae convert or “fix” nitrogen gas into ammonia for use in their tissues. Because of this bacterial “fixing” capability, there is an unlimited supply of nitrogen to aquatic systems (Ruhul Izzati et al., 2008).