TREATMENT OF PATIN POND WATER USING ULTRAFILTRATION

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ABSTRACT

Patin fish or the scientific name Pangasius Sutchi is a freshwater fish river that is very popular especially in Temerloh, Pahang. It is known as a bright fish acted as a very high selling prices. The purpose of this study was to examine the water quality and the most important thing is to assess parameters that are present in the nitrogen cycle in aquatic systems. In a closed aquatic system, the cycle begins with the production of hydrogen or ammonia formation. Ammonia will be retained by the waste production of fish and fish food debris uncoupled. Ammonia is produced from aquatic systems can endanger the lives of fish in the slightest. Through the nitrogen cycle, ammonia is then converted to nitrite and finally nitrate. The parameters that must be met to ensure the nitrogen cycle that occurs in the water can be controlled. Parameters of pH, total dissolved solids, ammonia, nitrite and nitrate are the most important parameters considered in this study. Water samples will also be analyzed using Ultrafiltration (UF). UF aims to see its effectiveness in reducing the flux that occurs over the sample under pressure of 1-5 bar and the results show the decline of 20%-40% water quality parameters that occur on samples

ABSTRAK

Ikan patin atau nama saintifik pangasius Sutchi adalah ikan air tawar yang sangat popular terutamanya di Temerloh, Pahang. Ia dikenali sebagai ikan yang berprospek cerah kerana memiliki harga jualan yang sangat tinggi. Tujuan kajian ini adalah untuk mengkaji kualiti air dan perkara yang paling penting adalah untuk menilai parameter yang terdapat di dalam kitaran nitrogen dalam sistem akuatik. Dalam sistem akuatik tertutup, kitaran bermula dengan pengeluaran hidrogen atau pembentukan ammonia. Ammonia yang dihasilkan daripada system akuatik boleh membahayakan nyawa ikan walaupun sedikit. Melalui kitaran nitrogen, ammonia akan bertukar ke nitrit dan akhirnya nitrat. Parameter yang perlu dipenuhi untuk memastikan kitaran nitrogen yang berlaku di dalam air boleh dikawal. Parameter air iaitu pH, jumlah pepejal terlarut, ammonia, nitrit dan nitrat adalah parameter yang paling penting diambil kira dalam kajian ini. Sampel air juga akan dianalisis menggunakan ultraturasan (UF). UF bertujuan untuk melihat keberkesanannya dalam mengurangkan fluks yang berlaku ke atas sampel di bawah tekanan 1-5 bar dan keputusan menunjukkan kemerosotan sebanyak 20%-40% parameter kualiti air yang berlaku pada sampel

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Seventy percent of the earth area is contain of water where the water is one of the natural resources that are most important to humans, animals and plants (Wikipedia, 2013). The fisheries sector is one of the key economic sectors of the country. This sector has played a role as one of the contributors to the protein source. At this time, the fisheries sector contributed by 1.37% to KDNK and providing employment to 89,433 fishermen and 21,114 fish (Jabatan Perikanan Malaysia, 2003).

Freshwater fish is one of the main protein sources of the Malaysian population. Freshwater industry is identified as a major source for increasing fish production in the future as marine resource has reached the maximum exploration (Kosmo, 2013). Some species of freshwater fish that is in high demand is Patin Fish (Sinar Harian, 2011). Patin fish is a freshwater fish that was already known among many Malaysians, especially the community in the state. These fish are the identity of a town in Temerloh, Pahang with livestock and Patin fish dishes as an important industry (Anim Agriculture Technology, 2011). With society's increasing demand for patin , the water quality factors should be considered because it is an important role for the growth of patin.

1.2 PROBLEM STATEMENT

Patin growth often fail because of factors water quality emphasis (Nugraculture, 2012).Water quality is very important for the growth and survival rate of Patin. Water is not only where the fish live. Its quality directly affects feed efficiency, health, growth rate and the survival of fish's. Most fish kills, poor growth, disease outbreaks, poor feed conversion efficiency and management problems similar directly related to poor water quality. Understanding of the nitrogen cycle (nitrogen cycle) essential for every fish farmers, especially those of fish using a closed system (closed system) such as tank, fibre tank, aquarium or canvas.. What is a closed system is that all the fish wastes are discharged into the water will not go anywhere unless the water in the system changed. Use the filter system (filtration) proper and efficient to keep the fish healthy and always in good conditions Ultrafiltration mechanism in the system can remove nitrates in aquarium wall and can keep their concentration levels lower than this (De Long et al., 2009).

In the present study patin fish were selected as study fish for me because this freshwater fish because this species prefers the deep dark pond or large rivers and lives on a diet of vegetable matter, worms, various grubs, carrion, small fish and freshwater prawns (Aznir 1998). .This study is to describe the water quality that matches the growth of patin fish because of poor water fish facilitate outbreaks of disease (Khairuman and Sudenda, 2002). Therefore, this study is important for characterizing the specific parameters-parameters of the water patin fish to study the appropriate treatment to get clean and safe water

1.3 OBJECTIVE OF STUDY

Generally, this study is to achieve several objectives. Here are some of the objectives to be realized in this study:

1. To characterize the patin pond water quality parameter

2. To determine the effect of applied pressure and the efficiency of UF on treating water.

1.4 SCOPE OF STUDY

Based on the listed objectives, this study is focused on:

1. This study will be conducted in the laboratory on a small scale, but able to give a true picture of the research.

2. This study uses an aquarium tank as a growth area for patin fish.The size of aquarium that will be used is 850 x 650 x 550 mm.

3. The sample needed for this study is taken from the water in the aquarium where patin fish reared behind the Environmental lab, FKASA,UMP.

4. Laboratory experiments were performed using membrane treatment method using the Ultrafiltration (UF)

5. Using cross-flow for evaluation of impurities

CHAPTER 2

LITERATURE REVIEW

2.1 PATIN FISH

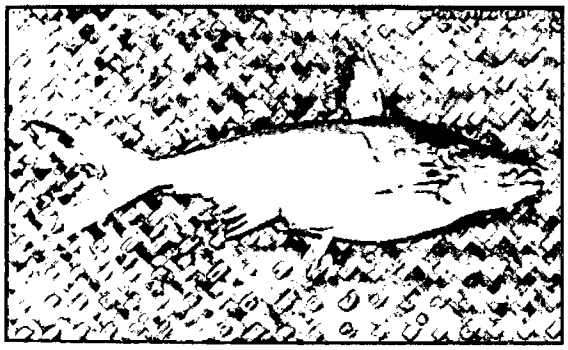
Patin (Pangasius Sutchi) is a freshwater fish that is very famous in the Pahang. Patin is popular freshwater fish used as food in Malaysia (Mohsin &Ambak., 1983). Patin fish or scientific name Pangasius Sutchi and Pangasius hypophthmus are a species of freshwater fish that inhabits the type meserba river areas and the mines. This species is also commonly found in the Amazon River, for example in Russia and in other places in the world usage a different name. But in Bangladesh, Indonesia (Bornean and Jawa), India and Thailand still have the same name, i.e. putting (Fisheries Dept. 2000). According to the taxonomic classification, Patin is belongs to the family of Pangasiidae divided to 3 generate; Pangasianodon (2 species), Pangasius (23), and Helicophagus (3). The presence of the genus Pteropangasius, despite the obvious characters has yet to be proved and requires more detailed study.

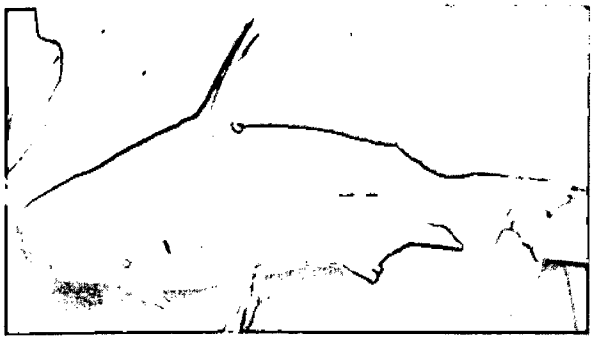
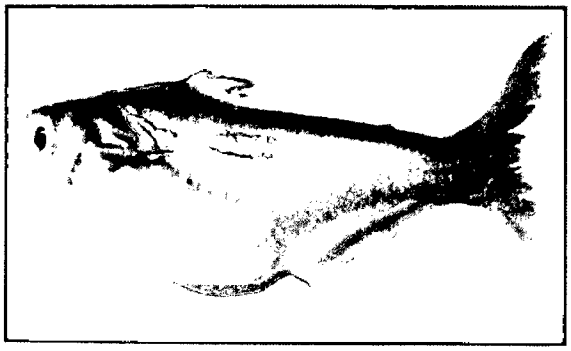
This species prefers dark pools in large rivers and lived on a diet of vegetables, worms, various caterpillars, carrion, small fish and freshwater prawn (Aznir 1998). The environment in which they are grown influences the properties, fish. Due this reason, the difference in composition Patin excepted from country to country and eventually lead to differences in the shelf-life of fish from various countries. Its physical form is a

sting in the two sides and one on the back, not scaly, and tender. Its size can reach 1 meter in length and can reach a weight of 20kg. Patin fish have a high commercial value and reared in ponds and cages. Patin fish, fishing is not choosing where food diet is fish fry, fruits, rivers, shrimp and animal carcasses

2.2 TYPE OF PATIN FISH

There are various types of patin fish in Malaysia, but only a few types dominate and occupy most of the ponds, rivers and mines as follows:

Types	Features
1) Fruit Patin fish - Pangasius Nasutus 	• Have a more rounded body • Distended belly and big • His head is round

2) Patin fish Spout - Pangasius hypophthmus **(Most Popular in Malaysia)** 	• Having a body length • His head is shaped tapered • Having a lean body • A little red in the fins and tail
3) Patin fish Champion - Pengasius Micromenus 	• Having a rounded body and short • Having a body that is small compared to other types of catfish • His head is round
4) Lawang Patin fish - Pangasius Sutch 	• Having a long and rounded body • Having a body like catfish fruit • His head is round • Can grow up to 20 kg • A little red in the fins and tail

Sources: Kolambuyut.blogspot.com

2.3 WATER QUALITY PARAMETERS

Good water quality should be maintained at all times in a fish tank circulation to maintain optimal growth and health of fish. Regular water quality testing is important and can be done using the equipment available in the Environmental Laboratory, Faculty of Civil Engineering, UMP.Parameter most need to be considered to determine the quality of water is oxygen concentration, temperature, pH, and nitrogen from ammonia, nitrate and nitrite.Nitrogen in the form of nitrate and nitrite is usually no problem of water quality in the aquarium for nitrite quickly converted to nitrate and nitrate itself is only toxic to fish at very high levels (300-400mg / L). Ultrafiltration mechanism in the system also removes nitrates in aquarium well and can keep their concentration levels lower than this (De Long et al., 2009). Thus the most important parameters for water quality is temperature, dissolved oxygen and other factors ammonia. Other factors that influence the quality of the fish tank water, including density of fish stocks, their growth rate, the quantity of food given to the fish, the volume of water in the system and environmental conditions (Diver, 2006).

2.3.1 Physicals Characteristics

2.3.1.1 Temperature

The optimum water temperature for the life of patin fish between 28^{0}C - 32 ^{0}C. Patin fish prefer deep with low temperature fluctuations. Life was disrupted if the patin fish water temperature drops to 14^{0}C to 15^{0}C or up to 35^0 C. Patin fish activity ceased in waters where the temperature is below 6^{0}C or above 42^{0}C (Djariah,2001). The lower temperature allows the dissolved oxygen content is higher, as the solubility of oxygen in water decrease with increasing temperature (De Long et al., 2009). A sudden change in temperature in the aquarium can cause a heat trauma and will cause interference in

the cardiovascular and nervous system, reduce their enzyme activities, decreased function of the body or death (Post, 1983).

2.3.1.2 Total Suspended Solids

Total Suspended Solids (TSS) is a measurement to measure water lucidity. This test is performed to measure the amount of suspended solids consisting of soil particles, microorganisms and so that there may exist in the water. These particles will be retained on the filter. TSS can be done by conducting research on guidelines set by the APHA (1998).

The quantity of suspended solids can be determined by filtering and then weigh the remaining particles on the filter paper. High content of suspended solids indicates that the water is contaminated. If the content is too high TSS in the flow system, this will result in lowering the quality of the water that can cause health problems to aquatic life and humans. The presence of suspended solids in the lake that much can cause turbidity, odour and taste unpleasant (Hill, 2004)

2.3.2 Chemical Characteristics

Chemical water quality that will be covered in this topic are chemical oxygen demand (COD), pH, ammoniacal nitrogen (AN), nitrate, and nitrite.

2.3.2.1 Ammoniacal Nitrogen (AN)

Ammonia is a waste product of fish and can be highly toxic to fish when it has accumulated in the water. Nonionized ammonia (NH_3) is highly toxic to fish and other aquatic life, and the ammonium ion (NH_4^+) has similar toxicity (De Long et al., 2009).

In a system aquaculture pH 7, the majority of ammonia nitrogen in the form of ammonium ions. The high pH value increases the rate of ammonia nitrogen in the form of toxic ammonia is ionized (Droste, 1996). Ammonia is suitable for patin fish is 1 ppm (0.1- 0.3 ml / litre of water.). The test is conducted by using a DR5000 spectrophotometer. Figure 1 below illustrates the influence of pH and temperature on the levels of unionised ammonia (NH3) present in water.

Figure 1: Proportion of Total Ammonia in the NH3 form at different varying pH and Temperatures

PH	Temperature °C						
	8	12	16	20	24	28	32
7.0	0.2	0.2	0.3	0.4	0.5	0.7	1.0
8.0	1.6	2.1	29.	3.8	5.0	6.6	8.8
8.2	2.5	3.3	4.5	5.9	7.7	10.0	13.2
8.4	3.9	5.2	6.9	9.1	11.6	15.0	19.5
8.6	6.0	7.9	10.6	13.7	17.3	21.8	27.7
8.8	9.2	12.0	15.8	20.1	24.9	30.7	37.8
9.0	13.8	17.8	22.9	28.5	34.4	41.2	49.0
9.2	20.4	25.8	32	38.7	45.4	52.6	60.4
9.4	30.0	35.5	42.7	50.0	56.9	63.8	70.7
9.6	39.2	46.5	54.1	61.3	67.6	73.6	79.3
9.8	50.5	58.1	65.2	71.5	76.8	81.6	85.8
10.0	61.7	68.5	74.8	79.9	84.0	87.5	90.6
10.2	71.9	77.5	82.4	86.3	89.3	91.8	93.8

Sourced from Boyd.,1998

2.3.2.2 pH

The growth rate of fish was the best at pH 7.5 - 8.0. For best Patin fish growth rate of 5 - 7, however the place is ideal function is pH 6. pH should be maintained in the range of 6.5- 7 for the perfect cycle (Nelson, 2008). The low or high pH causes stress and damage to the skin and gills of fish, an inability to absorb oxygen, and capillary damage the fins and skin while there are negative side effects of other (Post, 1983). It is important to note that the pH of the tank water also affects the solubility of other substances in the environment such as fish and some of this ammonia is toxic to fish.

Table 1:Acceptable pH range of Patin Fish

Range	User
5.0 – 9.0	Domestic water supply
6.5 – 9.0	Freshwater aquatic life
6.5 – 8.5	Marine aquatic life

2.3.2.3 Chemical Oxygen Demand

Chemical oxygen demand (COD) is a measure of the oxygen equivalent of the organic matter in water samples are susceptible to oxidation by a strong chemical oxidant. COD measures the oxidation of organic materials and inorganic in bodies of water and effluent from sewage and industrial plants. It can not distinguish the present organic and inorganic in water bodies (Chapman et al, 1996). Chapman, 1996 also stated that since some organic compounds are not oxidized by the dichromate method in which a number of inorganic compounds are oxidized, COD cannot show the amount of organic carbon present. COD test is to have more advantages than the BOD test because the results are available for short periods of time and have the ability to measure organic compounds that are resistant to biological decay.

2.3.2.4 Nitrite

Nitrite is toxic to fish when absorptions are high. Nitrites can be termed as an invisible killer fish as it oxidizes hemoglobin to methemoglobin in the blood, making the blood and brown gills and hamper respiration also damage the nervous system, liver, spleen and kidneys of fish. Long-term concentration of 0.3 mg / L NO_2 is lethal to fish. Rolf C. Hagen stated that, nitrite produced when nitrifying bacteria such as Nitrosomonas oxidize ammonia. High concentrations of nitrite may exist in an extremely compact as an area of newly formed or in the early season before the biological filter is turned on.

2.3.2.5 Nitrate

Nitrate containing compounds in the soil are generally soluble and readily migrate to ground water. Water naturally contains less than 1 milligram of nitrate-nitrogen per litre and not the main source of exposure. Higher levels indicate that the water was contaminated. Common sources of nitrate contamination include fertilizers, animal wastes, septic tanks, municipal sewage treatment systems, and decaying plant debris. Meck (1996) suggested that the concentration of 0-200 ppm is acceptable in ponds and fish is generally low toxic to some species and marine species especially sensitive to its presence. According to Stone and Thomforde (2004) nitrate is quite toxic to fish and do not cause any health hazard except at very high levels (above 90 mg L-1).

Figure 2:Acceptable Concentration Ranges in Aquaculture Pond Waters

Element	Form in water	Desired concen
Oxygen	Molecular Oxygen (O_2)	5 – 15 mg/l
Hydrogen	H^+ [-log(H^+) = pH]	PH 7 – 9
Nitrogen	Molecular Nitrogen (N_2)	Saturation or less
	Ammonium (NH_4^+)	0.2 – 2 mg/l
	Ammonia (NH_3)	< 0.1 mg/l
	Nitrate (NO_3^-)	0.2 – 10 mg/l
	Nitrite (NO_2^-)	< 0.3 mg/l

Sourced from Boyd.,1998

2.4 ULTRAFILTRATION

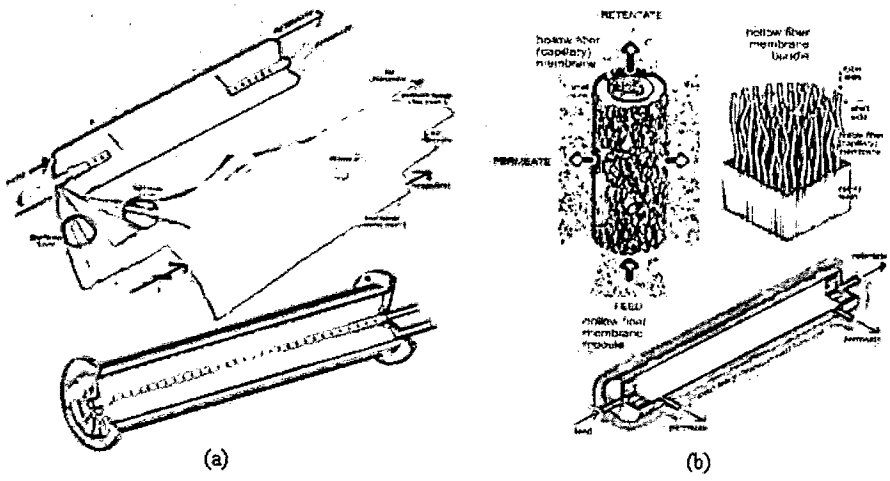
Ultrafiltration (UF) membrane filtration method is the most commonly used. It is produced by the pores of different sizes. It allows water and dissolved substances are very small molecules to pass through, but retain a large, tacky material and suspended matter.

UF membranes used in pore sizes from 0.1 to 0001 microns. Pore size indicates the minimum size of molecules that can pass through. It also applies hydraulic pressure to push water through it. But UF is a membrane process that uses relatively low pressure. This causes it is often used in the experiment. This process is also found to improve application methods of waste treatment and housing and industrial areas. UF has proved to be a valuable technique or method and effective removal process efficiency.

Ultrafiltration (UF) is a low-pressure operation of the transmembrane pressure off, typically 0.5 to 5 bars. Two main types of UF modules available on the market, example, hollow fibre (capillary), and spiral wound

Figure 3: Major types of UF modules

(a) spiral wound **(b) hollow fiber**



UF membrane operation can be done in two different service modes, namely, dead-end and cross-flow stream. Dead-end flow mode of operation is similar to the filter cartridge where there is only one feed stream and the flow of filtrate. Usually dead-end flow approach enables optimal recovery of feed water in the 95-98 range, but is usually limited to feeding low suspended solids (<1 NTU). Different cross-flow mode with a dead-end mode where there is an additional flow of feed stream and the flow of filtrate (permeate), which is condensed. Cross-flow mode operation typically results in lower recovery of feed water, ie, 90 to 95 range [Bates, 1999].

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

The methodology of the study is that the study will discuss the design of the study, the instrumentation that will be used throughout the study, study procedures and data collection related to the study made.

3.2 METHODS OF IMPLEMENTATION STUDY

Experiments will be conducted to find out the quality of water available in the water patin fish reared among these are temperature, pH readings, ammonia nitrogen (NH3), BOD, COD, Nitrite, and Nitrate. The analysis of the parameters is carried out in the Laboratory of Civil Engineering, UMP. Water treatment will be performed in a laboratory where the filtering is done by using membrane treatment method using the Ultrafiltration (UF) with the cross flow method. All experiments and tests will be performed using equipment that has been provided in the relevant laboratories.

3.3 DATA COLLECTION

Data for all parameters such as ammonia, pH, temperature, nitrite, nitrate, total suspended solids, chemical oxygen demand taken two days interval starting from 27 February 2014, 3 March 2014, and 7 March 2014.

3.4 PREPARATION OF CONDUCTING STUDIES

Here are the steps to carry out the study:

1. Sorting products and tools that will be used in studies such as the aquarium, the oxygen

2. Water and catfish that have roughly the same size is inserted into the aquarium. The number of fish used in this study, is 4-5.

3. Farmed fish are fed 1-2 times a day to ensure smooth growth

4. Studies of ammonia nitrogen content, pH, water temperature, chemical oxygen demand, nitrite, nitrate, total dissolved solids taken 3 times at approximately 5 days.

3.5 RESEARCH INSTRUMENTS

From data collection for this study, there are several instruments to be used and arranged in the proper method. An aquarium intended to be used for growth of Patin fish.

3.6 IN-SITU TEST

In-situ tests can be used in parameters such as dissolved oxygen (DO), pH and temperature. In this study, only pH and temperature are considered. In-situ made to ensure the accuracy of the data collected. Samples may experience inaccurate samples. The temperature can be changed or because of improper handling of samples if the samples are taken back to the lab for testing.Laboratory experiments.

3.6.1 pH and Temperature

Parameters that can be obtained without conducting laboratory tests are dissolved pH and temperature. This test is performed by inserting a probe directly the electronic instruments into the water. The investigation will be fully immerged in the middle water in aquarium to get a more accurate reading. Probe needed to be rinsed with distilled water and thereby avoid residues trapped in the probe. Electronic instruments to test pH is a pH meter (Consort C536 models).The water temperature in the aquarium should be in the proper range. And should be controlled in the range specified. This is because the temperature can affect fish growth rate and can cause death if the temperature too low or too high. The pH value should also be maintained in an appropriate range. If the pH value of the water at a high or low value, this will cause the fish uncomfortable and disturbed. Water that is too acidic pH can cause the fish to die.

3.7 LABORATORY TEST

The parameters that need to be tested in the laboratory are, Total Suspended Solid Chemical Oxygen Demand (COD),Nitrite,Nitrate, and Ammonical-Nitrogen (NH3-N).