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**“PRUCYTRUS” AS A COAGULANT AGENT IN WATER  
TREATMENT PROCESS**

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## TABLE OF CONTENT

	<b>ACKNOWLEDGEMENT</b>	<b>4</b>
	<b>ABSTRACT</b>	<b>5</b>
	<b>CHAPTER 1</b>	
<b>1.1</b>	<b>Introduction</b>	<b>6-9</b>
<b>1.2</b>	<b>Background of The Study</b>	<b>10</b>
<b>1.2.1</b>	<b>Background Sungai Gabai, Hulu Langat, Selangor (Sample 1)</b>	<b>10-11</b>
<b>1.2.2</b>	<b>Background Sungai Langat, Hulu Langat, Selangor (Sample 2)</b>	<b>12-13</b>
<b>1.2.3</b>	<b>Background Sungai Kanching, Rawang, Gombak District Selangor (Sample 3)</b>	<b>14</b>
<b>1.3</b>	<b>Research of The Effectiveness of The Organic Ingredients of “PRUCYTRUS” as a Coagulant Agent in Water Treatment Process</b>	<b>15</b>
<b>1.3.1</b>	<b>Project Background</b>	<b>15-18</b>
<b>1.4</b>	<b>Significance of Water Quality Parameters</b>	<b>19</b>
<b>1.4.1</b>	<b>Water Quality Parameter</b>	<b>19</b>
<b>1.4.2</b>	<b>Turbidity</b>	<b>19</b>
<b>1.4.3</b>	<b>Temperature Water</b>	<b>20</b>
<b>1.4.4</b>	<b>pH Value</b>	<b>20</b>
<b>1.4.5</b>	<b>Dissolve Oxygen</b>	<b>20</b>
<b>1.4.6</b>	<b>Color and Taste</b>	<b>21</b>
<b>1.5</b>	<b>Problem Statement</b>	<b>21-22</b>
<b>1.6</b>	<b>Objectives</b>	<b>22-23</b>
<b>1.7</b>	<b>Scope and Significant of Study</b>	<b>23-25</b>
	<b>CHAPTER 2 : LITERATURE REVIEW</b>	
<b>2.1</b>	<b>Introduction</b>	<b>26</b>
<b>2.2</b>	<b>Criteria for Considering Study for This Review</b>	<b>27</b>
<b>2.3</b>	<b>Example of Characteristics and Composition of Solid Waste in Water</b>	<b>28</b>
<b>2.4</b>	<b>Data Collection</b>	<b>29</b>
<b>2.5</b>	<b>Literature Review on Natural Coagulant use as Water Treatment</b>	<b>29-32</b>
<b>2.6</b>	<b>Summary of Chapter</b>	<b>32</b>
	<b>CHAPTER 3</b>	
<b>3.1</b>	<b>Introduction</b>	<b>33</b>
<b>3.2</b>	<b>Flowchart</b>	<b>33</b>
<b>3.3</b>	<b>Process of Prucytrus</b>	<b>34</b>
<b>3.3.1</b>	<b>Using Air Fryer</b>	<b>34</b>
<b>3.3.2</b>	<b>Blender the Coagulant</b>	<b>34</b>
<b>3.3.3</b>	<b>Jar Test</b>	<b>34</b>
<b>3.3.3.1</b>	<b>Procedure Jar Test</b>	<b>36-37</b>
<b>3.3.3.2</b>	<b>Jar Test Concept</b>	<b>38</b>
<b>3.3.3.3</b>	<b>Turbidity Meter</b>	<b>38</b>
<b>3.3.3.4</b>	<b>pH Meter</b>	<b>39</b>
<b>3.3.3.5</b>	<b>Turbidity</b>	<b>39</b>
<b>3.3.3.6</b>	<b>pH Value</b>	<b>39</b>
<b>3.4</b>	<b>Material and Ingredient</b>	<b>40-44</b>

<b>3.5</b>	<b>Conclusion</b>	<b>45-46</b>
	<b>CHAPTER 4 : DATA AND ANALYSIS</b>	
<b>4.1</b>	<b>Introduction</b>	<b>47</b>
<b>4.2.1.1</b>	<b>Liquid Method</b>	<b>48-49</b>
<b>4.2.1.2</b>	<b>Result Turbidity Sungai Gabai Water Sample 1</b>	<b>50</b>
<b>4.2.1.3</b>	<b>Result Dissolved Oxygen Sungai Gabai Sample 1</b>	<b>50</b>
<b>4.3</b>	<b>Powder Method</b>	<b>51</b>
<b>4.3.1</b>	<b>pH Before and After Added PRUCYTRUS</b>	<b>51-52</b>
<b>4.3.2</b>	<b>Turbidity Before and After Added PRUCYTRUS</b>	<b>53-55</b>
<b>4.3.3</b>	<b>Dissolved Oxygen Before and After Added PRUCYTRUS</b>	<b>56-57</b>
<b>4.4</b>	<b>Parameter Turbidity, pH, and DO for Sungai Gabai</b>	<b>58</b>
<b>4.5</b>	<b>Parameter Turbidity, pH, and DO for Sungai Langat</b>	<b>59</b>
<b>4.6</b>	<b>Parameter Turbidity, pH, and DO for Sungai Kuching</b>	<b>60</b>
<b>4.7</b>	<b>Conclusion</b>	<b>61</b>
	<b>CHAPTER 5 : DISSCUSSION, CONCLUSION AND RECOMMENDATION</b>	
<b>5.1</b>	<b>Introduction</b>	<b>62</b>
	<b>Discussion</b>	<b>63-64</b>
	<b>Recommendation</b>	<b>64</b>
	<b>REFERENCE</b>	<b>65-66</b>

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## ABSTRACT

Nowadays, chemical agents such as aluminum sulphate (alum), ferric sulphate or sodium aluminate, ferric chloride of polymer is the common coagulant that is used for water purification in water treatment technology. The chemical coagulants have a positive charge to neutralize negative charge of dissolved and suspended particle in the water. The suspended particles vary in source, charge, particle size, shape and density. The research study the potential influencing of soybeans and kaffir lime peels as organics coagulant, alternative to chemical coagulant in water treatment process. The effectiveness of coagulant will produce a floc, heavy and quickly settle out of the water treatment process. Therefore, the level of water turbidity before and after treatment is a main parameter monitoring. This study aims to reduce the rate of water turbidity and to produce organics coagulant agents for treating the water samples collected from Sungai Gabai, Sungai Langat, and Sungai Kancing. In the study, we focused on producing the optimum ratio of coagulant concentration to reduce turbidity. The method used based on experimental laboratory testing, whereas the water samples will be adding with soybean and kaffir lime peels that we called as Prucytrus coagulant. The experiment was carried out for Jar Test, DO,pH, and Turbidity testing with liquid and powder organics coagulants designed. The results showed that the best ratio for the Prucytrus coagulant with 3g/liter in powder base is the most effective coagulant for reduce turbidity in water samples.

# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction

Ground water and surface water contain both dissolved and suspended particles. Coagulation and flocculation are used to separate the suspended solids portion from the water.

Suspended particles vary in source, charge, particle size, shape, and density. Correct application of coagulation and flocculation depends upon these factors. Suspended solids in water have a negative charge and since they have the same type of surface charge, they repel each other when they come close together. Therefore, suspended solids will remain in suspension and will not clump together and settle out of the water, unless proper coagulation and flocculation is used.

Coagulation and flocculation occur in successive steps, allowing particle collision and growth of floc. This is followed by sedimentation. If coagulation is incomplete, flocculation step will be unsuccessful, and if flocculation is incomplete, sedimentation will be unsuccessful.

Coagulation chemicals with charges opposite those of the suspended solids are added to the water to neutralize the negative charges on non-settleable solids (such as clay and color-producing organic substances).

Once the charge is neutralized, the small, suspended particles can stick together. These slightly larger particles are called micro flocs and are not visible to the naked eye. Water surrounding the newly formed micro flocs should be clear. If not, coagulation and some of the particle's charge have not been neutralized. More coagulant chemicals may need to be added.

A high-energy, rapid mix to properly disperse coagulant and promote particle collisions is needed to achieve good coagulation. Over-mixing does not affect coagulation, but insufficient mixing will leave this step incomplete. Contact time in the rapid-mix chamber is typically 1 to 3 minutes.

While flocculation is a gentle mixing stage, increases the particle size from sub microscopic microflow to visible suspended particle. Micro floc particles collide, causing them to bond to produce larger, visible flocs called pin flocs. Floc size continues to build with additional collisions and interaction with added inorganic polymers, called coagulant aids, may be added

to help bridge, bind and strengthen the floc, add weight and increase settling rate. Once floc has reached its optimum size and strength, water is ready for sedimentation.

Design contact times for flocculation range from 15 to 20 minutes to an hour or more and flocculation requires careful attention to the mixing velocity and energy are usually tapered off as the size of floc increases. Once flocs are torn apart, it is difficult to get them to reform to their optimum size and strength. The amount of operator control available in flocculation is highly dependent upon the type and design of the equipment.

The problem of water pollution in Malaysia now becomes serious pollution issues. Industries are the major source of metal pollution in water resources, especially rivers. There has been a growing concern in Malaysia about pollution of heavy metals in water because the heavy metals are known to be toxic and harmful to living organisms. Industries such as electroplating contribute enormous numbers of heavy metals as pollutants to the environment.

Effluents from electroplating industries are reported to contain excessive amounts of heavy metal ions, such as nickel, iron, lead, zinc, chromium, cadmium, and copper (Tripathi & Ranjan, 2015). The General Assembly in its synthesis report 2018 on water and sanitation declares access to clean water and sanitation is a human right. In addition, during the plating process only 30-40% of the metals are effectively utilized while the remaining percentage is contaminating the rinse waters used during the electroplating process (Konstantinos et al, 2011). Thus, it is harmful when the effluents are discharged.

There are several techniques that have been applied for treating wastewater contaminated by heavy metals, including chemical precipitation, coagulation, flocculation, ion-exchange, membrane separation, reverse osmosis, solvent extraction, oxidation/reduction, and electroporation (Lu et al 2015). Among these technologies, coagulation-flocculation is one of the most practiced technologies extensively used on industrial scale wastewater treatment (S.Ghafari et al 2019).

The commonly used coagulating agents are inorganic salts, usually those of aluminum and iron. Although the efficiency of chemical coagulants is well known, their use is associated with high cost and environmental drawback (World Health Organization, WHO 2008). For example, the resulting elevated concentration of aluminum cation residues causes health problems such as Alzheimer's disease in humans (Divakaran and Pillai, 2001; Tech et al 2014) and toxicity to aquatic life. However, locally available, and abundant low-cost coagulant materials from kaffir

lime peel and soybeans that has positive ions that had in coagulant agents such as alumina chlorine. We are trying to reduce the use of chemical products by replacing them with 'PRUCYTRUS' because the chemical product has side effects in the long term and causes cancer. In addition, the manufacturing cost is also quite high.

These 2 types of organic ingredients can easily find in Malaysia but most of them are used in food processing. There had an experiment that used soybeans and orange peels as coagulant agents, so we came out with an idea to do some innovation using kaffir lime peel because it much cheaper and easy to find on our houses area. Furthermore, kaffir lime rich with alkaloids such as citronellol, nerol, limonene that reacts to kills viruses and bacteria.

Kaffir lime is the common name of *Citrus Hystrix*, a tropical fruit that is native to various parts of Asia, including Indonesia, Thailand and Philippines. Aside from its culinary uses, due to its uniquely tart and pleasant flavor, kaffir lime is also highly respected in herbal medicine due to its possibility of high content of beneficial organic compounds that might positively affect the body's systems. Kaffir lime peels contain polyphenols as natural antioxidant and antimicrobial agent. The oil, leaves, fruits, rind of kaffir limes are all utilized from different purposes. Particularly the leaves, which are frequently utilized in Thai cooking. The leaves and rind are so powerful.

However, this strong flavor might be due to the high concentration of alkaloids from the leaves as well as the leaves themselves can be used for medicinal purposes. The oil is often mixed with shampoos, soaps, salves, fragrances, and other cosmetic products. While the leaves are usually applied topically or orally to induce a specific healthy result. In the countries where kaffir lime was traditionally grown, insect-borne diseases may kill thousands of people each year. For that reason, kaffir limes are often used for their insect repellent properties.

The citronellol and limonene found in kaffir limes may be very unappealing to most insects and when you put a lotion or salve containing kaffir lime juice/oil on your skin, you can significantly decrease your chances of being bitten by bugs whether they may infect you or not.

Although most people do not think of kaffir limes as being particularly useful in aromatherapy, the oil extracted from these powerful fruits might be used aromatically with significant effect. If you suffer from anxiety or various nervous disorders, spending some time inhaling these soothing vapors may calm the body and mind. Other than that, the benefits of kaffir lime are gives relief from anxiety and stress, strengthen immune system, promotes good oral health,

helps to detoxify blood, stimulates digestive system, rich in repellent properties last but not least reduces appearance of age marks, scars and pimples.

Soybean peroxidase (SBP) is an oxidoreductase-class enzyme extracted from soybean seed coats. SBP has been extensively studied in recent years for its role in various biotechnological applications. It has many attractive properties due to its structure, conformational flexibility, activity, and stability under various environmental conditions. This review will focus on the application of SBP in industrial waste and process water treatment.

SBP catalysis oxidative polymerization of a wide range of hazardous aqueous aromatic pollutants which are present in wastewater streams of various industries such as petroleum refining, coal conversion, wood products and preservation, metal casting, pulp and paper, dyes, adhesives, resins, plastics and textile manufacturing. These pollutants can have adverse health effects on human, animal, and aquatic life upon exposure by direct absorption through the skin, ingestion or inhalation. Hence, their discharge is regulated.

The review will cover pollutants investigated with SBP, advantages of SBP over other enzymes, pre-treatment methods to broaden the scope of SBP polymerization, use of additives/surfactants to enhance SBP activity, application of SBP in industrial wastewater, immobilized SBP and its limitations.

## 1.2 Background of study

### 1.2.1 Background Sungai Gabai , Hulu Langat , Selangor ( Sample 1)



The Gabai River is a magnificent multi-level cascade of gushing forest water located about 22km (about 13.67 mi) from the outskirts of Cheras and Ampang. Sungai Gabai is a minor river in the Langat River basin, flows from the 1462-meter-high (4797 ft) Big Ghost Mountain in the state of Negeri Sembilan, Malaysia into the Dipterocarp Forest reserve of the Hulu Langat district in the adjacent state of Selangor. Walk across streams with the aid of wooden and concrete bridges and reach the peak of the multi-cascade waterfalls via a flight of cement stairs located adjacent to the falls.

A cemented path leads from the car park to the lower falls. Along the path several shelters have been built. The upper falls can be reached by trails. Along the way up are gazebos, where picnics may be enjoyed as you are surrounded by the thunderous roars of the gushing water and beautiful sights of the forest. At the top is a cooling reward where another cascade and pool await. Continue past the end of the stairs to follow the river upstream or walk along the forest path just next to the river to find more pools to wade in.

Although Sungai Gabai is smaller compared to Sungai Congkak, it does offer magnificent views making it a good spot for photography.

There is also a small indigenous people village nearby called Kampung Orang Asli Sungai Gabai, as well as the Lepoh Waterfalls about an hour's drive away. Air Terjun Sungai Gabai is managed by the local JKKK (village committee), who charge an entrance fee of RM1.00. Separate vehicle parking charges apply. Sungai Gabai is about an hour's drive from the capital. It is easy to spot signboards to Sungai Gabai as you arrive in Hulu Langat town, which can be accessed via Cheras or Ampang. The waterfalls just ameters from the entrance and carpark area.

Too much information, as we know Hulu Langat is the fifth largest district in Selangor State with an area of 840 square kilometers and the second most populous district with a population of 1,141,880 at the 2010 Census. It is in the southeastern corner of Selangor, between Kuala Lumpur and Neger Sembilan. It is bordered by the state of Pahang to the east and north. Gombak district to the north-east, Federal Territory of Kuala Lumpur and Petaling district to the west, Sepang district to the south-west, a state of Negeri Sembilan to the south. In Hulu Langat, the river descends into a set of waterfalls known as the Gabai Falls, a popular attraction for the locals, but unknown with tourist.

### **1.2.2 Background of Sungai Langat ,Hulu Langat ,Selangor ( Sample 2)**



Langat River is located in Hulu Langat, Selangor with 149.3 km long including catchment of 2350 km from Titiwangsa Range at Gunung Nuang the river flows to Straits of Melaka in Kuala Langat . Sungai Langat has categorized as endangered sources of raw water for 7 water treatment plants in Selangor, namely Sg Langat Water Plant, Bukit Tampoi Water Plant, Cheras Batu 11 Water Plant, Salak Tinggi Water Plant, Sg Pangsoon Water Plant, Sg Serai Water Plant and Sg Water Plant Lolo.

The process of modernization and rapid development, especially in Selangor, Sungai Langat is threatened by severe water pollution that contributes to the water crisis. According to the Malaysia Environmental Quality Report 2006 published by the Department of Environment Malaysia, some rivers flowing from the Langat River are already polluted with the Water Quality Index of the rivers is at level III. These rivers are like Balak River, Batang Benar River, Batang Nilai River, Lui River and Pajam River.

On 11 October 2012, the Head of the Environmental Modeling Unit, Environmental Forensic Research Center (Enforce) University Putra Malaysia, Dr Hafizan Juahir stated that only 49.3km of the 149.3km of Sungai Langat were still clean. Another 100 km is contaminated and not suitable for drinking water. 100km of Sungai Langat is already in class 3, 4. If the river water quality is worse than this, it is considered a dead river. The main pollutants of this river are sewage water, domestic waste and garbage that enters the river.

In January 2014, several cases of ammonia waste contamination were reported in Sungai Langat which resulted in the closure of two water treatment plants (LRA) namely Cheras Batu 11 LRA and Bukit Tampo LRA. The closure of these two plants has caused water supply disruption in some areas around the provinces of Hulu Langat and Kuala Langat which receive water from the two plants. Even though the water treatment has been built they cannot control the pollution and natural disaster happened at there. Sungai Langat has also been affected by floods that happened in Hulu Langat make the watercolor murky in December 2021 .

Jabatan Alam Sekitar (JAS) said in Utusan Malaysia ,23<sup>rd</sup> March 2022 , Water Quality Index for Sungai Langat and Sungai Selangor at the level of 86 and 91 until 1<sup>st</sup> March 2022. Lembaga Urus Air Selangor (LUAS) have lunched the ideal incentive to control water pollution through Polluters Pay Principles and zero Discharge Policy to increase the development of economic in water source sector and the environment in commercial areas and municipal activities.

Currently update about Sungai Langat in Berita Harian (Ruwaida Md Zain, 3<sup>rd</sup> January 2022) , has state the water crossed danger level with height of 4.29 meter compared to normal height of 4.20 meter. Thus, Malaysia Environmental Quality Report 2006 by Jabatan Alam Sekitar Malaysia the index quality water of Sungai Langat in phase III which is simply polluted.

### 1.2.3 Background Sungai Kanching , Rawang , Gombak District Selangor for Sample

3



This an authentic river is in Rawang , Gombak District ,Selangor known as Templer Park. The park named after Sir Gerard Templer, the British High Commissioner who as establishment the Templer's Park. The entrance park is a turn off on the right side of North – South Expressway within 20km from city, even the park is near to highway this place popular for their hike including same stretch of the rainforest with Kanching Waterfalls and Commonwealth Forest Park. The length of the river is 2500 m with 4.5 km loop hike before arrived with 1,214 hectares in size. Dedicated by Selangor to serve as a refuge and a sanctuary for wildlife and a meeting place for all who love and respect the beauty of nature (His Highness of Sultan Selangor, Sultan Hishamuddin Alam Shah ,1954)

This forest is reserved of multi-tiered waterfalls, jungle streams and trails, this place is popular with their must to go vacation for released tension including camping. The wildlife was fully with animal including the rare type of animals due the caves in the forest according to the studies by Malaysian Nature Society. Even this park has received a threat from development to make it private property but their losses in the authorities to be unconcerned about steady losses of the forest. Due to the park being so popular the water has become murky because the property does not take care of the area also the trash along the river shoulder has affected the condition of the water.

### **1.3 Research of the effectiveness of organic ingredients of "PRUCYTRUS" as a coagulant agent in water treatment process**

This study was created from the observation of materials that to be used as a coagulant agent during the water treatment process. Alum is a chemical substance which is a coagulant agent that put into the water treatment process to attract small particles that cannot be sediment and suspended on the surface of the water.

PRUCYTRUS is a combination of two organic ingredients used in this study, soybeans and kaffir lime peels which has the characteristic like alum that has a positive ion charge. All this has been discussed to solve some problems that arise with existing products such as alum has side effects in the long term, alum is also a cause of cancer, the manufacturing cost is also quite high, the process of making alum also looks difficult and many orange peels are wasted.

The objective of this study was to produce coagulants from natural ingredients such as soybeans and kaffir lime peel, test the turbidity of water samples using organic ingredients and determine the optimal amount of organic coagulant. For this study process, methodological study is used to plan the project production process by producing a flow chart as a guide for production planning and testing the project.

#### **1.3.1 Project Background**

Kaffir lime (*Citrus Hystrix* D.C) has been used for a long time in folk publications on antifungal effect of KLL especially to *Candida albicans* and *Aspergillus Niger*. Hence, in this study, we are considering the antifungal properties of KLL extracts towards pathogenic otomycosis, particularly *Aspergillus Niger* and *Candida albicans*. Laboratory-controlled prospective study. It was fully conducted under a well-controlled environment in the Medical Microbiology and Pharmacology laboratories in the School of Medical Sciences, University

Kaffir lime (*Citrus Hystrix* D.C) has been used for a long time in folk medicine. Preclinical studies have shown that the phytochemicals compound of kaffir lime leaf (KLL) and fruit have antioxidant activity, free radical scavenging ability, anti-inflammatory activity, antibacterial activity, antifungal activity and anticarcinogenic activity.

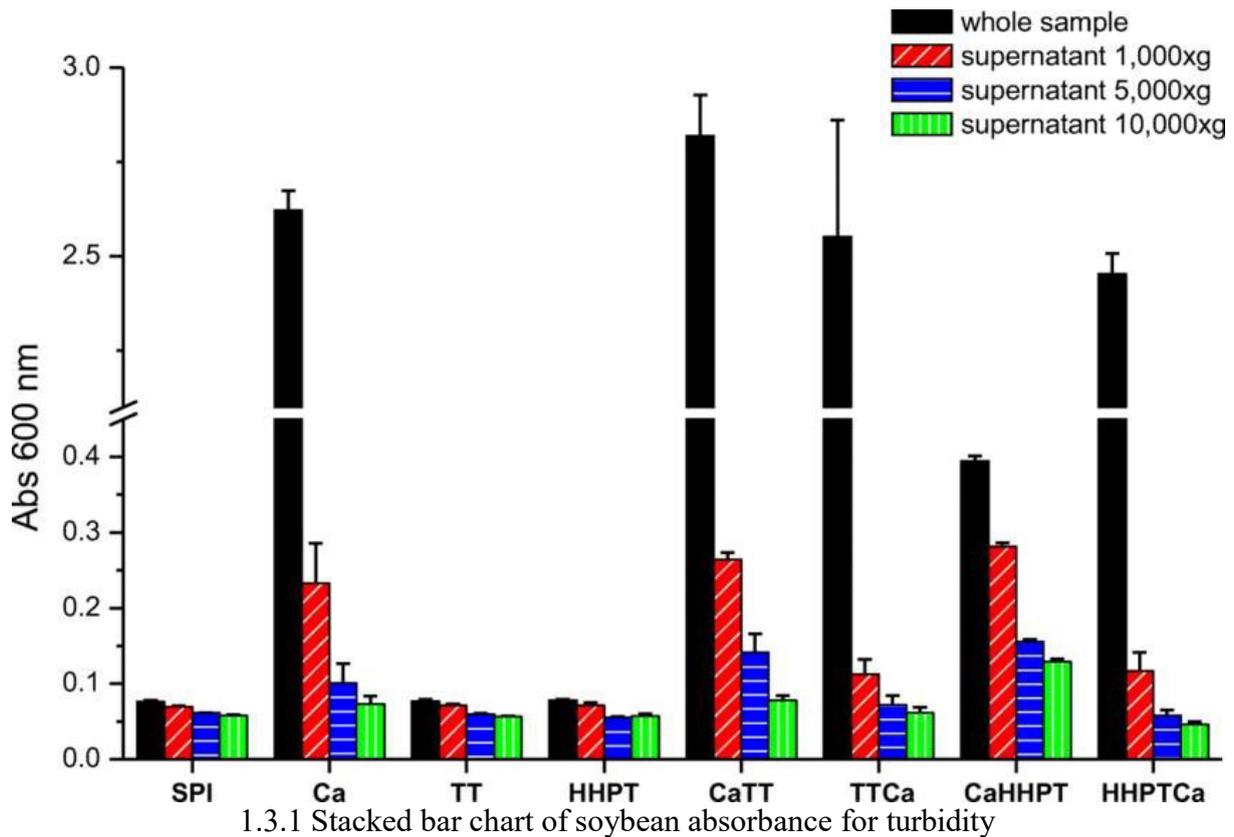
Phytochemical studies have shown that citronellal is the main compound found in kaffir lime leaf. Other chemical compounds include  $\alpha$ -pinene, camphene,  $\beta$ -pinene, limonene, copaene, linalool,  $\beta$ -cubebin, isoeugenol, caryophyllene, citronellic acetate and citronellol. Research shows that citronellal has strong antifungal qualities. Otitomycosis or fungal infection of the external auditory canal can be caused by *Aspergillus Niger*, *Aspergillus fumigatus*, *Aspergillus flavus*, *Candida albicans*, *Mucor* spp. and *Penicillium* spp. Malaysian data on fungal isolates in otomycosis revealed that *Aspergillus Niger* was the most common isolated fungi (71%) and *Candida albicans* was the second most common (23.4%). *Aspergillus Niger* is able to produce several secondary toxic metabolites such as 3-nitro propionic acid and ochratoxin A.

In contrast, cell surface hydrophobicity, biofilm formation and adhesion composite resin process are the crucial factors in the defense mechanism of *Candida albicans*. The importance of this character is a reduced susceptibility to the host immune system and to conventional antifungal drug therapy. Eradication of this entity remains a challenge to medical practitioners, especially otorhinolaryngology. Until today, there has been no standardized treatment for otomycosis.

Minimal data is available regarding safety of use of ototopical medication especially in presence of tympanic perforation. In the case of perforated tympanic membrane, the topical antifungal can readily reach cochlea by diffusion through the round window. If the agent has ototoxic property, temporary and permanent electrophysiology changes within inner ear or morphological injury to stria vascularis, hair cells and supporting cells of organ may occur.

This situation can lead to ototoxicity and sensory neural hearing loss. When choosing the correct topical antifungal drugs, certain factors should be considered such as water-soluble, low risk of ototoxicity, low allergic effect, a broad-spectrum antimicrobial drug, suitable for application on pediatric patients, and commercially available. There were very limited publications on antifungal effect of KLL especially to *Candida albicans* and *Aspergillus Niger*.

Hence, in this study, we are considering the antifungal properties of KLL extracts towards pathogenic otomycosis, particularly *Aspergillus Niger* and *Candida albicans*.



Turbidity of soybean protein dispersions determined by absorbance at 600 nm. Without centrifugation (black bars) or the supernatant of samples centrifuged at different accelerations (1000 g, red-diagonal lines bars; 5000 g blue-horizontal lines bars; 10,000 g green-vertical lines bars). Values shown are mean and standard error

The effects of thermal treatment (TT) and high and high hydrostatic pressure treatment (HHPT) on calcium-added soybean protein 1% (w/w) aqueous dispersions at pH 7.0 were compared. High hydrostatic pressure, but not thermal treatment, improved protein solubility and colloidal stability. Despite the fact that glycinin solubility is more affected by calcium than that of  $\beta$ -conglycinin, glycinin could remain in dispersion in the presence calcium when denatured by HHPT (calcium added before or after treatment) but not when denatured by TT or without denaturing treatment. Thus, polypeptide composition of soluble aggregates depended on the type of treatment. Colloidal stability and molecular weight than when calcium was added after treatments. After freeze drying and re-dispersing at higher protein content (10% w/w) calcium-added dispersions subjected to HHPT formed cold-set gels that were transparent and exhibited excellent water holding capacity.

The results provide the basis for the development of ready-to-use functional ingredients. The incorporation of calcium to vegetable foodstuff represents an interesting topic due to several conditions such as allergies, veganism and tolerance to lactose that limit the consumption of foods naturally rich in calcium. Soybean is an inexpensive source of protein used to prepare many products. The addition of calcium to soybeans proteins induces changes in structural and functional properties. Food processing involves treatments.

### 1.3.2 Objectives Project

In water treatment, coagulation-flocculation involves the addition of compounds that promote the clumping of fines into larger floc so that they can be more easily separated from the water. coagulation is a chemical process that involves neutralization of charge whereas flocculation is a physical process and does not involve neutralization of charge. The coagulation-flocculation process can be used as a preliminary or intermediary step between other water or wastewater treatment processes like filtration and sedimentation. Iron and aluminum salts are then the most widely used coagulants but salts of other metals such as titanium and zirconium have been found to be highly effective as well. It also explains that why we chose to replace the chemical ingredients is to reduce the uses of alum because it has a harmful effect for long term to human.

Based on its source, water can be divided into ground water and surface water. both types of water can be exposed to contamination risks from agricultural, industrial, and domestic activities which may include many types of pollutants such as heavy metals, pesticides, fertilizers, hazardous chemicals and oils. Water quality can be classified into four types of potable water, palatable water, contaminated (polluted) water and infected water. The most common scientific definitions of these types of water quality are as follows:

- To validate the effectiveness of the two organic ingredients (soybeans & kaffir lime peels) in water treatment process.
- To reduce the applications of chemical ingredients in water treatment process
- To compare the specific water quality parameters of water samples from Sungai Gabai, Sungai Langat and Sungai Templer using organic ingredients according water quality table which is include temperature ,turbidity, pH value and dissolved oxygen.

## **1.4 Significance of water quality parameters.**

### **1.4.1 Water quality parameters**

Water quality parameters include chemical, physical and biological properties and can be tested or monitored based on the desired water parameters of concern. Parameters that are frequently sampled or monitored for water quality include temperature, dissolved oxygen, pH, conductivity, ORP and turbidity. However, water monitoring may also include measuring total algae, ISEs (ammonia, nitrate, chloride) or laboratory parameters such as BOD and DO. In addition, as we know the incidents that happened in Hulu Langat recently, it happened to be a flash floods in Sg Gabai areas. It caused the increases of water turbidity in those areas that has a rubbish, clay, an unwanted thing that can harm the water quality. Meybeck and Helmer (1992) say the health of the river depends on the quality of its water which is influenced by the presence of pollutants ; thus, the quality of water is generally assessed by a range of parameters, which express physical, chemical and biological compositions of water. This research deals with specific water quality parameters of the Sungai Gabai which is include temperature ,turbidity, pH value , dissolved oxygen and bio-chemical oxygen demand .

### **1.4.2 . Turbidity**

Turbidity is the cloudiness of water. it is a measure of the ability of light to pass through water. it is caused by suspended material such as clay, silt, organic material, plankton and other particulate materials in water. Suspended materials can clog or damage fish gills, decreasing its resistance to diseases, reducing its growth rates, affecting egg and larval maturing and affecting the efficiency of fish catching method. Suspended particles provide adsorption media for heavy metals such as mercury, chromium, lead, cadmium and many hazardous organic pollutants such as polychlorinated biphenyls, polyclic aromatic hydrocarbons and many pesticides. The amount of available food is reduced because higher turbidity raises water temperatures in light of the fact that suspended particles absorb more sun heat. Consequently, the concentration of the dissolved oxygen (DO) can be decreased since warm water carries less dissolved oxygen than cold water.

Turbidity is measured by an instrument called nephelometric turbidimeter, which expresses turbidity in terms of NTU or TU. A TU is equivalent to 1 mg/L of silica in suspension. Turbidity more than 5 NTU can be visible to the average person while turbidity in muddy water, it exceeds 100 NTU. Groundwater normally has very low turbidity because of the natural filtration that occurs as the water penetrates through the soil.

### **1.4.3 Temperature Water**

Temperature plays a significant role in affecting physical, chemical and biological processes in the water bodies including the flowing waters like rivers and thus concentration of many variables ( ANZECC 1992) . as the temperature increase , it will activate the rate of chemical reactions with effect to evaporation and the solubility rate of gases in water such as oxygen is decrease. Metcalf and Eddy 1991 said excessively high-water temperature may lead of unwanted growth of water plants and wastewater fungus. In general , the temperature of surface water varies within the range 0 Celsius to 30 Celsius.

### **1.4.4 pH value**

The pH value is used to read the acid balance of a solution and the scale ranges is from 0 to 14 ( very acidic to very alkaline ) , thus pH 7 indicates a neutral condition but if the pH stuck in 6.0 to 8.5 it could be affected by chemicals entering the waterways .Extremely high or low is very dangerous especially for aquatic life it can reduce the availability of nutrients such as calcium and magnesium .

### **1.4.5 Dissolved Oxygen**

Without DO in the water the aquatic life become dangerous because the function of DO is measures the amount of gaseous oxygen dissolved in water . Mainly DO appear as diffusion from the atmosphere and the photosynthesis of aquatic plants . Besides that , DO measurement to determine the level of pollution cause by oxygen demanding substances such as biodegradable organic matter and nutrients ( Masters 2004 ) . The DO is very interrelated with biochemical oxygen demand ( BOD ) and chemical oxygen demand in the water.

#### **1.4.6 Color and taste**

Materials decayed from organic matter, namely, vegetation and inorganic matter such as soil, stones, and rocks impart color to water, which is objectionable for aesthetic reasons, not for health reasons. Color is measured by comparing the water sample with standard color solutions or colored glass disks. One color unit is equivalent to the color produced by a 1 mg/L solution of platinum (potassium chloroplatinate ( $K_2PtCl_6$ )). The color of a water sample can be reported as follows:

Apparent color is the entire water sample color and consists of both dissolved and suspended components color. True color is measured after filtering the water sample to remove all suspended material. Color is graded on scale of 0 (clear) to 70 color units. Pure water is colorless, which is equivalent to 0 color units. Taste and odor in water can be caused by foreign matter such as organic materials, inorganic compounds, or dissolved gasses. These materials may come from natural, domestic, or agricultural sources.

The numerical value of odor or taste is determined quantitatively by measuring a volume of sample A and diluting it with a volume of sample B of an odor-free distilled water so that the odor of the resulting mixture is just detectable at a total mixture volume of 200 ml.

#### **1.5 PROBLEM STATEMENT**

There are several contaminants in wastewater with organic pollutants playing the major role. Many kinds of organic compounds such as pesticides, herbicides, phenols, polycyclic aromatic hydrocarbons, aliphatic and heterocyclic compounds are included in the waste water and industrial and agricultural production as well as the people living could be the source of organic waste water endangering the safety of the water resource. The waste water of the farmland may contain high concentration of pesticides or herbicides.

The waste water of the chemical industry may contain various heterogeneity compounds. While the waste water discharged by the food industry contains complex organic pollutants with high concentration of SS and BOD and the municipal sewage contains different type of organic pollutants such as oil, food, some dissolved organic and some surfactants. These organic pollutants in water can harm the environment and also pose health risks for humans.

The organic pollutants in the waste water could be divided into 2 groups according to their biological degradation abilities. The organic pollutants with simple structures and good hydrophilicity are easy to be degraded in the environment. These organic pollutants such as acetone and methanol could cause acute toxicity when existed in waste water at a high concentration.

On the other hand, the persistent organic pollutants such as PAHs, PCBs and DDT are very slowly metabolized or otherwise degraded. Some of them for example the pesticides were widely used for several years. Although their concentration as well as the toxicity in the waste water is lower than the soluble organic pollutant. They can be sequestered in sediment and exist for decade and transport into the waste water and then the food chains. The POPs are lipid soluble and many of them mentioned above are carcinogenic, teratogenic and neurotoxic. Since they are persistent, long way transported and toxic, these organic pollutants draw more attentions.

## **1.6 OBJECTIVES**

### **Objective 1: To compare the parameter of water samples using organic materials according water environment (EIA)**

By using PRUCYTRUS (natural-based) we can compare the effectiveness of using chemical ingredients and organic materials even though it did not show a better results but as we know, chemical coagulants such as alum and iron can be affect in our life bit by bit through out our life if we used it for a long time or in a big amount. Hence, by creating a new plant-based coagulants we can decrease the harmful and save the earth and people's life. By using these chemical ingredients, we might considered these transformation as a success without think about the impact in our life. Even the turbidity has a very little chance to decrease, the turbidity still can happened in a long term maybe in 24 hours make the water clearer than real results. The data show the coagulant can be use by changing the properties of kaffir lime to less acidic and find the suitable water sample to achieve good National Quality Index Malaysia by Department of Environment for water.

**Objective 2: To reduce the rate of the water turbidity of PRUCYTRUS by comparing the results of 3 different sources by using Jar Test.**

The results shown includes the initial and residual reading in the aspect of pH and turbidity of the water sample of 3 different lakes which are Gabai river, Langat river and Kanching river. Different rivers has different properties and characteristics, therefore, the first objective is utmost important in order to determine its features precisely. Appertaining to the previous statement, those 3 water samples indicates pH level within the range of 6-8 which it is classified as natural state after the treatment is carried out. Next in the matter of turbidity, kaffir lime peels and soybeans as a conventional coagulant shows results in turbidity removal up to 88%. To determine the optimum dosage of the kaffir lime peels and soybeans by using Jar Test. For the Jar Test process, various dosages of kaffir lime peels stock solution were used in order to observe maximum reduction of colloids in the water sample. Therefore, optimum dosage is a vital element in order to examine the turbidity removal at higher proportion. From the results, stated that 3g of orange peel stock solution was defined to be the optimum dosage in the treatment process for those 3 lakes. This is because 3g dosage was applicable and utilizable which shows a great turbidity reduction compared to the highest dosage used which is 13g.

**Objective 3: To produces coagulants agents from the natural ingredients from kaffir lime peel and soybeans.**

To compare the effectiveness of PRUCYTRUS as a natural coagulant. Both coagulant used which are kaffir lime peels and soybeans presents an effective results in turbidity removal and pH balance. Both of these combination demonstrated tremendous outcomes which resulting of 88% of turbidity removal. However, as mentioned in statement of problem, it proves that by using chemical based of coagulant will leads to many downsides such as detrimental effects on the human health (Simate et al., 2012). Even though, kaffir lime peels and soybeans does not presents the results of turbidity removal as high as chemical ingredients such as alum, but it still effective and well worked in turbidity reduction resulting greater than 1% which it removes 88% of colloids throughout the treatment. Therefore, a prominent solution by using PRUCYTRUS (natural-based) as coagulant is accepted while not leading to adverse impact to the consumers where it is safe and environmental friendly.

## 1.7 SCOPE AND SIGNIFICANCE OF STUDY

Regardless of their disciplines, waste water management involves scientist, managers and engineers. All these people have expertise in the scientific, technical and other various aspects of the water waste treatment. Drinking water and water waste treatment by physical, chemical or biological means including research at the interface of these approaches.

New materials and process technologies for water and waste water treatment including membranes, advanced oxidation, nano-enabled materials and processes. Other than that, desalination of ground water, rivers and non-traditional wastes like municipal and industrial waste water for recycling or reuse. Software and hardware innovations related to reliable and efficient clean water distribution and supply including machine learning, internet of things and big data analyses are needed in water treatment process.

In the present scenario, environmental laws have become stringent towards health, economy and reduction of pollution. The pollution is a result of discharge of various organic and inorganic substances into the industrial water. The sources of pollution include domestic agricultural and industrial water. Conventional techniques such as chemical precipitation, carbon adsorption, ion exchange, evaporations and membrane processes are found to be effective in treatment of waste and sewage water.

Recently, biological treatments have gained popularity to remove toxic and other harmful substances. The objective of the paper is to make comprehensive review including the performance of each technique in treatment of waste and sewage water. The research directions are also suggested based on the review.

### 1.1 Significance of the be made for this research

#### I . Water pollution happen in waterfall area due human activities and natural disaster .

- Human activities in waterfall areas are very hard to control and maintain especially during the holiday seasons due the family bring their family to release tension or for picnic also including hiking activities . An irresponsible attitude from people come to visit it become out of control because not have any watchman make the rivers piling with trash such as food container, solid waste in to water streams make the clog happened, releasing the harmful chemicals and oils while washing tupperware, littering and others. Besides that, natural disaster cannot be avoided ,it difficult to anticipate due to climate change. The water easily become murky due landslide near the river and the rubbish easily mix the water chemistry . The uphill river can reduce by natural process especially for the color and odor, the river easily become clear but the process up to 3 months to 6 months until the river become clear at Hulu Langat.

II. This study to identify using “ PRUCYTRUS” as a coagulant agent can follow the parameter water.

- The mix between kaffir lime and soybeans has develop idea to made as coagulant from past research , as the coagulant been created, we want to identify if this coagulant can reach the parameter been set by the Department of Environment ( DOE) following National Water Quality Standard Index with 3 different sample .

III. Using organic item such as kaffir lime peel and soybean to avoid using chemical only agents can reduce water turbidity

- Past research has shown using the organic coagulant also able to terminate the turbidity for 50% - 80% without using any chemicals in the water treatment . Thus, by using the natural coagulant it can keep the environment clean and not affect the condition of the river water.

IV. Focusing on performance in removing the turbidity , suspended solids and pH change in water sample of Sungai Gabai, Sungai Langat and Taman Rimba Templers

- PRUCYTRUS has created as a new coagulant based on the experiment; it can reduce the turbidity even the process takes a long time to get a clear water. So, the process not only looking for reducing turbidity by it also to achieve a good pH , without any suspended solid and a great dissolved oxygen in the water if coagulant mixed together to avoid from effect the environment.

## 1.2 Summary of Chapter 1

This chapter will briefly on the experiment to get a data by focusing on the objective aspects of the study and significance of study . PRUCYTRUS coagulant able use as a natural coagulant in water treatment without using any chemical . The result not only help the water treatment also it can help the environment not only at waterfall but it also can apply at the home .