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Separation of Deleterious Materials in Waste Water using Conventional and Recent Method through Adsorption Process: A Review

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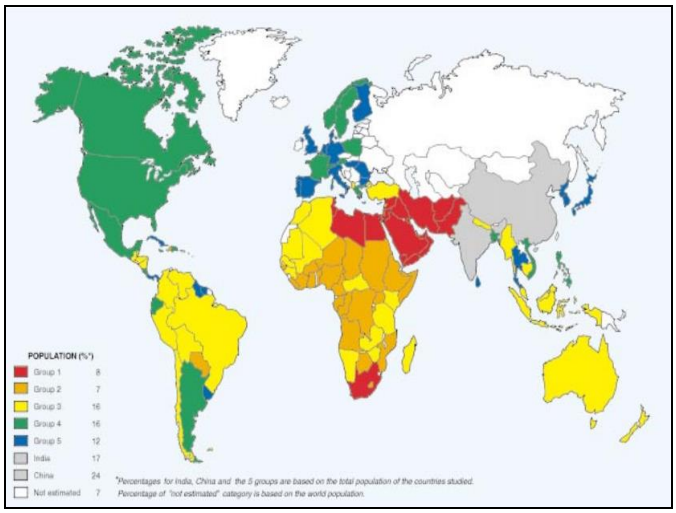
Abstract – *Pollutions around the world contribute to the water scarcity in clean water distribution. Clean water is very crucial for domestics and industrials activities. Purification through adsorption is one of the ways to produce clean water for consumption to meet the needs of the industries whether domestic or industrial necessity. Several purification techniques have been explored and adopted to meet the standard before distributed to the consumers. The adsorption technologies have been paid attention for the longest period due to its practicality and potential values which provides many advantages throughout the adsorption process. This review emphasized on the gravity separation, dissolved air floatation and membrane bioreactor system to remove deleterious materials includes chemical contaminants, particulates and suspended solids in domestics and industrials waste water.*

Key Words: Separation, deleterious material, adsorption, waste water treatment, conventional method, recent method.

1.INTRODUCTION

The world economy has been undertaking mega projects and built more infrastructure facilities to develop and increase the productive capacity of the economy. It is obvious that the infrastructure capacity of the local economy is expanding the clean water supply curve indirectly, which has been pushed further and further out to the right. These rapid development has led to a several issues on the environmental perspectives that cause unsustainable ecosystem [1], [2], [3] such as water scarcity due to depleting water resources and climate changes, resulting in prolonged droughts and floods.

These issues impact negatively on the sustainability of clean water sources. It reduces the availability of clean and safe water sources and indirectly higher the maintenance cost in treating polluted areas. However, in some areas, treating polluted water considerably too costly and in some instances, polluted waters are not treatable for clean water supply. There are many aspects from which pollution originates, such as heavy and light industries, domestic waste, scheduled and clinical waste and other types of disposals. Industrial wastewater typically contains deleterious material, free and emulsified oils, chemical contaminants, particulates and suspended solids. There are a variety of processes to treat contaminated wastewater. Environmental technologies primarily treat wastewater to separate deleterious materials from the waste water stream before being discharged to sewers and river systems [4], [5].



LEGEND:

Group 1consists of countries that are water-scarce by both criteria. These countries, which have 8 percent of the population of the countries studied, are mainly in West Asia and North Africa. For countries in this group, water scarcity will be a major constraint on food production, human health, and environmental quality. Many will have to divert water from irrigation to supply their domestic and industrial needs and will need to import more food. The countries in the four remaining groups have sufficient water resources (AWR) to satisfy their 2025 requirements. However, variations in seasonal, interannual, and regional water supplies may cause underestimation of the severity of their water problems based on average and national water data. A major concern for many of these countries will be developing the large financial, technical, and managerial wherewithal needed to develop their water resources.

Group 2 countries, which contain 7 percent of the study population and are mainly in sub-Saharan Africa, must

develop more than twice the amount of water they currently use to meet reasonable future requirements.

Group 3 countries, which contain 16 percent of the population and are scattered throughout the developing world, need to increase withdrawals by between 25 percent and 100 percent, with an average of 48 percent.

Group 4 countries, with 16 percent of the population, need to increase withdrawals, but by less than 25 percent.

Group 5 countries, with 12 percent of the population, require no additional withdrawals in 2025 and most will require even less water than in 1990.

Fig -1 IWMI indicator of relative water scarcity [6]

The treatment of waste water is dependent on the characterisation of it especially in physical and chemical aspects. The process of ultrafiltration of chemical separation is generally to break down the emulsified oil which is usually found in the industrial waste. The filtration process is more favourable and widely used around the world due to its lower cost of maintenance and operational is commonly used as separation of deleterious materials or suspended solid in waste water before being treated. These pollutants are usually found in the domestic waste. Whereas for scheduled and clinical waste water is refers to the category of toxic and hazardous water which generated from daily operational at many care centres, clinics and hospitals. The waste generated by the care centres, clinics and hospitals was increasing approximately 6 per cent in 2012 as compared to 2011. Any clinical waste was defined as any waste consists of wholly or partly human tissues, blood, or body fluids, excretions, drugs and pharmaceutical products. Apart of mentioned kind of waste, the pollution is also originates from, sewers, run off water, and other origins. The importance of distributing clean water to the consumer has been investigated previously and nowadays, the conventional method in treating waste water is still popular.

2. CONVENTIONAL AND RECENT WASTE WATER SEPARATION PROCESS

Conventional process of treating oily wastewater includes gravity separation, dissolved air floatation and membrane bioreactor treatment system.

2.1 Gravity Separation

Gravity separation is the most popular and has been widely used all over the world to remove deleterious materials completely. It is considered the most favourable conventional method to remove unnecessarily matter in waste water before further treated. A primary gravity separator owns a simple design and serves multiple purposes [7] [8]. It can remove a considerable amount of water to make the effluent corresponds to the inlet specification of the subsequent steps [1]. In addition to performance as a separator, the primary separator also provides a safety volume for suspended solid and must provide sufficient time for operators systems to shut down the system.

2.2 Dissolved Air Floatation

This treatment is primarily used to separate floatable deleterious materials from waste water. The mechanism of this conventional method is the flotation is poured into the waste water in the form of bubbles [9]. The adhesion of deleterious material or suspended solid particles would suspend in the water because generally the floating density of deleterious material is less than waste water [10]. Since flotation device processing capacity is producing lesser sludge and has separation efficiency advantages, the heavy and light industrial, domestic waste and clinical waste treatment have great potential. Recently, the most common used method is dissolved air floatation and jet impeller flotation methods. However, jet flotation method able to save a lot of energy, but the small bubbles, are cannot be removed [11]. Hence, in a way to improve floatation the addition of floatation agent need to be done. Colloidal particles will gather together as white bubbles floating. In addition, the cell structure of floatation can be reduced by a square rounded corner to eliminate dross or overflow weir [9]. Previous research shown that the efficiency of removal depends on the COD value, pH value and gas flow rate. Furthermore, the interfacial area obtained from the bubble hydrodynamic parameters and velocity is the important parameters to control the overall performance and operation cost of whole floatation process.

2.3 Membrane Bioreactor Treatment System

Membrane bioreactor is one of the important and novel technologies to treat waste water. First MBR system was built and developed commercially in 1969 to treat waste water. The improvement of MBR system recently has combined the both activated sludge process with a filtration process [12]. The bioreactor is operated similarly to the conventional system. There is no secondary clarification step such as filtration to separate deleterious material from waste water. Membrane bioreactor configuration has many advantages as compared to the conventional method such as gravity separation where the duration of treatment is crucial to produce cleaner waste water to the stream [13]. Highly improved effluent would allow for water reuse. It also able to eliminate the requirement for clarifying basins to settle the biomass hence allows the system to be more compact [14].

However, fouling membrane would be a serious problem which affecting membrane bioreactor system performance. The problem will leads to higher energy consumptions and effluent flux [1] [12]. On the other hand, various techniques have been developed to minimize the membrane fouling such as aeration of membrane [12]. Previous researchers found out that air bubble would prevent the deposition on the membrane surface thus the fouling of the system would rectify.

3. CONCLUSION

High adsorption of deleterious materials in waste water can be achieved by using suitable adsorbent. However, the increase of the operational and maintenance costs limits the larger scale application of such treatment techniques. Thus, the the application of new advancement and improved technology is important to be looked at.

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