CHAPTER IV

WATER TREATMENT AND PURIFICATION IN *FIQH* AND SCIENTIFIC PERSPECTIVES

4.1 Introduction

This chapter reported on the research finding for the first objective and research question. The first research question is about water treatment and purification from *Fiqh* and science perspectives. This chapter discusses and explores the water treatment and water purification method from *Fiqh* perspective, especially using membrane technology and the concept of membrane water treatment based on its characteristics, material, function, type and so on from a scientific perspective.

4.2 Water Treatment and Purification in *Fiqh* Perspective

4.2.1 Purification (*ṭahārah*) in Islam

Water is a synonym for cleanliness or *ṭahārah* in Islam. The Arabic word for purification is *ṭahārah* which literally means purity from an Islamic view. This term refers to a state of cleanliness in which a Muslim must perform certain acts of worship (Abderrahman, 2000). *Ṭahārah* is a specified method of cleansing that is conditional to prayer validity. There are two types *of ṭahārah* (Jabbar, 2005):

i. Cleanliness from *hadath* - invisible impurity

Cleans oneself for performing ablution (*wuḍū'*), bath (*ghusl*) or *tayammum*

ii. Cleanliness from *khabath* – visible impurity

Clean oneself after *istinja'* and remove impurities from the human body, clothes and place of prayer.

Next, things that can be used for cleansing (*muṭahhirāt)* can be divided into four which are clean water, clean soil, clean stone and currying (skin) (Jabbar, 2005). Here, the importance of water can be seen as one of the tools for cleansing in Islam. Water is of profound importance in Islam and all human beings rely on water for life and good health for Muslims and also the water enjoys particular importance for its use in ablution (*wuḍū'*) and bathing (*ghusl*) (Faruqui, Naser et al., 2001).

4.2.2 *Maqāsid Syarīah* in Water Treatment

Maqāsid Syarīah can be defined as the purpose and wisdom behind the enactment of most of the Shariah rulings (Ibn 'Ashur, 2001). It is a purpose in Islam through the Shariah aspects outlined to preserve and create human welfare in this world and the hereafter. *Maqāsid Syarīah* can be divided into three forms or rights, namely *al-ḍarūriyyah* (necessity), *al-ḥājiyyāt* (importance) and *al-tahsīniyyāt* (comfort). All these rights must exist for the benefit and comfort of human beings. However, the matter or right of *al-ḍarūriyyah* is fundamental and should be given attention by human beings because this right is a demand. The matter of *al-ḍarūriyyah* has five forms or things that need to be created and maintained as a demand by human beings, either individually or collectively that have to do with water management, namely:

a) Preservation of religion (*hifz al-dīn*)

Perfect *tawhid* is not through the utterance of faith alone but needs to be strengthened with the proof of faith through good practices, especially in maintaining trust as a Muslim on this earth (Meerangani, 2018). Muslims must take care of the earth and maintain the balance of the earth's ecosystem as a manifestation of faith in Allah. Religion can be preserved by using the *muṭlaq* water for religious purposes such as *ṭahārah*, ablution and bath. *Muṭlaq* water can be accessed with clean and pure water only. Thus, *ṭahārah* with the *muṭlaq* water is the primary condition for worship to Allah, such as praying and supporting the *maqāsid syarīah*. In the context of innovation, human need to try and pursue the best method and invention in order to maintain the water clean and pure such as membrane technology to treat the water.

b) Preservation of life (*hifz al-nafs*)

The management of nature especially water is critical because water is essential to humans. After all, in the human body itself, almost 70% is composed of fluids. Effective water management is vital for humans because water pollution, one of nature's main elements, will affect one's life. Thus, the intake of contaminated water or the reduction of water intake during the day will affect human life itself. So, various filtering technologies are invented to ensure the water cleanliness that can be consume by human and also other creature safely.

c) Preservation of intellect (*hifz al-'aql*)

The intellect is God's gift to mankind that enables them to think and study the reality of a thing. Verses on the demands of caring for the environment and water management are described extensively in the Quran and other Islamic reference sources. Thus, as a human being who has the intellect and can think, understanding the demands of caring for the environment, especially water is very important as a sign of obedience to the Creator. Human also encourages to observe and think about the God's creation including the nature and learned from that. For example, the water is the nature that need to be care and preserve as it is one of the important element for our life.

d) Preservation of property (*hifz al-māl*)

Water is a human property that needs to be cared for and appropriately used because water is an element entrusted by the Creator to human beings. Human greed for development and various activities that affect water resources will damage human beings. Human property can be saved with water saving because treating polluted and contaminated water takes considerable costs to produce clean water. Therefore, the concept of simplicity in water use is fundamental to maintaining the balance of nature and wealth. As the cost for water conservation and water reclamation is not cheap. So, it is better to care rather than cure the water.

e) Preservation of offspring (*hifz al-nasl*)

Our earth, which contains a source of water, needs to be passed on to the next generation in good condition as we once felt it in a clean and balanced condition. Thus, the

preservation of offspring in the aspect of ensuring the care of the environment, especially in managing water so that it can be inherited in a pristine state, is a *ḍarūriyyah* and demand in Islam. Thus, environmental protection by focusing on the element of water is closely related to creating and maintaining the matter and rights of *al-ḍarūriyyat* in the *Maqāsid Syarīah.*

4.2.3 Water Use and Water Usage

Discussion on water use and water usage is crucial to be highlighted because these two subjects are related to water quality. This water quality standard is different and depends on the use and usage of water (Mohd Istajib & Raihanah, 2012). Water is the given and favour from Allah that leads humans to *hasanah* in this world and also *hasanah akhirah* that needs to be appropriately and wisely managed as it will be questioned by Allah later in *akhirah* (Gadot, 2002). So, the wise management and usage of water are critical to be practised because these will affect the water quality. To control the water quality, Islam has taught the believer about the *akhlak* (manner) and ethics towards water usage rationally and reasonably.

Table 4.1: The Priority of Use Water in Al-Quran

No.	Water Uses	Surah
1.	Humans and animals drink Nourish the plants	Al-Nahl (16:10) Al-Wāqi'ah (56:17-21)
2.	Physical cleaning agents (self, clothes & shelter) and spiritual	Al-Muddaththir (74:4) Al-Anfāl (9:11)
3.	Nourish nature, greening the landscape & balancing the ecosystems	Al-Nahl (16:65) Al-Rum (30:24) Al-Hajj (22:63)
4.	Source of livelihood through economic activities (agriculture, farming & fishery)	Al-Baqarah (2:22) Al-Jāṭhiyah (45:12) Al-Mā'idah (5:96)
5.	Regional and international communication medium	Al-Luqmān (31:31)

6.	***Development of knowledge***	**Al-Mulk (67:30**

Source*:* (Mohd Istajib & Raihanah, 2012)

According to the table above, it can be shown that the priority is to be given to water uses applications starting with human uses, then for animal uses and lastly for agriculture purposes (Abderrahman, 2000). Next, from the water usage perspective, there are varieties of *naqli dalils* that mention the management of water usage.

حَدَّثَنَا أَبُو بَكْرِ بْنُ أَبِي شَيْبَةَ، حَدَّثَنَا إِسْمَاعِيلُ بْنُ إِبْرَاهِيمَ، عَنْ أَبِي رَيْحَانَةَ، عَنْ سَفِينَةَ، قَالَ كَانَ رَسُولُ اللَّهِ . صلى الله عليه وسلم . يَتَوَضَّأُ بِالْمُدِّ وَيَغْتَسِلُ بِالصَّاعِ.

It was narrated that Safinah said: "The Messenger of Allah used to perform ablution with a Mudd (of water) and bath with a Sa'."

(Al-Hadith. Sunan Ibn Majah. *Kitab Al-Ṭahārah wa Sunanuha*. Book 1, #279)

Next, the dalil from al-Quran also says about the water management:

﴿يَا بَنِي آدَمَ خُذُوا زِينَتَكُمْ عِنْدَ كُلِّ مَسْجِدٍ وَكُلُوا وَاشْرَبُوا وَلَا تُسْرِفُوا إِنَّهُ لَا يُحِبُّ الْمُسْرِفِينَ﴾

Which means, “O children of Adam, take your adornment at every masjid, and eat and drink, but be not excessive. Indeed, He likes not those who commit excess”.

(Al-Quran. Al-A’rāf. 7:31)

This *dalil* from al Quran shows the prohibition from wasting all matters, especially for drinks and food. Allah dislikes excessive or wastage (Ibn Kathir, n.d).

4.2.4 Classification/ Types of Water in Islam

Discussions on water matters in the chapter of purity (*ṭahārah*) have been put at the beginning of the chapters in most of the *Fiqh* books to indicate the importance of water elements as the spiritual and physical uses in Islam. Most of the *fuqahā'* in four *madhhab* have discussed this water element widely and comprehensively. Thus, water can be divided into several categories focusing on Shafie *madhhab* as follows (Al-Hishniyy, 2001):

a) *Muṭlaq* water

Muṭlaq water is pure and purifying and can be used for purification, obligatory bathing, and removing the *najāsah*. Seven types of *muṭlaq* water should be used for purification: rain water, sea water, well water, river water, springs, snow water and dew water.

b) *Musyammas* water

Musyammas water is water in a container made from iron copper or aluminum that is easily rusty and becomes hot as a result of exposure to sunlight in a country that usually has hot weather. This *hukm* of this water is pure and purifying. However, it is *makruh* for use on the body because, from a health perspective, using *musyammas* water can cause skin diseases, and if the hot water is cold, it is no longer *makruh* to be used.

c) *Mustaʾmal* water

Mustaʾmal water refers to the excess water used to purify the *hadas* (purification and obligatory bathing) and remove the *najāsah*. This *hukm* of water is pure but cannot purify others. The issue of *mustaʾmal* water in large quantities and does not change its nature (colour, smell and taste), whether it can be used for purification or not, became a *khilaf* among the *fuqahā'*. According to the strongest opinion in the Shafi'e *madhhab,* it is not

purified. This is based on the argument that the companions of the Prophet never collected excess water to reuse for ablution.

d) *Mutanajjis* water

Mutanajjis water is water contaminated to *najāsah* and the quantity of the water is less than two *qullah (*160.5 litres). Still, it changes one of its properties (colour, smell and taste). Thus, for this membrane water treatment issue, the *musta'mal* water and *mutanajjis* water are involved as the origin of water may consist of the *mutanajjis* water and *musta'mal* water when it takes from ablution usage only.

a) Hanafi *Madhhab*

The Hanafi divided water into two types. First, *muṭlaq* water (pure and purified) maintains its original odour, taste and colour. Second is *muqayyad* water, which is mixed with something pure that changes its characteristics (Al-Kasāniyy, 1998). From that basis, Hanafi then divided the water into five types as follows (Hasan, 1997):

i. Pure water can be purified and not *makruh*

Pure and purifying water is *muṭlaq* water which does not mix with anything that can make it bound to something other than *muṭlaq* water.

ii. Pure water and can be purified and *makruh*

This is pure water, but this water is used by the wild animal to drink such as snakes, eagles and mice and affects the *hukm* of water to be prohibited (*haram*) from being used and not purifiable because these kinds of animals are usually surrounded and touched with *najāsah*.

However, the water that were drank by a cat are considered pure but *makruh* to be used in religious purposes as purification.

iii. Pure water cannot be purified

The water has been used for bathing or other daily purposes and does not intend to use for purification such as ablution or *ghusl janābah*. In this situation, the water used for bathing changed to *mustaᶜmal* water, but the remaining water in the container is still pure (*muṭlaq* water) unless it is mixed with the water from the bath.

iv. *Mutanajjis* water

This water is mixed with *najāsah* and becomes impure and contaminated if the quantity of water is small. But, if the quantity of water is large, the water remains pure. Hanafi defines a large quantity as when the water in the container flows, and the flow is not reachable at the other side.

v. Water is in doubt of its purity (*mashkuk*)

This type of water does not know of whether it is pure or *mutanajjis* water.

b) Maliki *Madhhab*

Maliki *madhhab* divided water into three types. First is *ṭāhir*, which is further divided into two categories, *ṭāhir muṭlaq* means pure water and water that is purifiable and able to maintain its nature, and *ṭāhir mudaf* means purified water with added pure ingredients that change its character or nature. The second is *mashkuk* which means water

of dubious purity and cleanness. Third is *najas mudaf,* which means water with materials soiled with *najāsah.*

Imam Malik also mentions that water is classified into three types; which are used for religious purposes like *ghusl hadath* and ablution and for daily life purposes like bathing, watering, drinking and so on as follows (Al-Asbahiyy, 1994):

i. Pure water itself and purifiable (*muṭlaq* water)

Pure water means it can fulfil human needs such as eating and drinking. While purifiable means it can be used for ablution *(wuḍū'*) and bath (*ghusl hadath*) and remove the *najāsah*. This type of water is permitted for human use for religious purposes and the use for daily human life as well. This water is not mixed with something that can change the character of *muṭlaq* water. The example of these types of water is as follows:

a. Rainwater: Water down from the sky, including spring water, river water, snow, cold water, dew and so on. These are all categorised as pure water.

﴿ وَهُوَ ٱلَّذِيٓ أَرۡسَلَ ٱلرِّيَٰحَ بُشۡرَۢا بَيۡنَ يَدَيۡ رَحۡمَتِهِۦۖ وَأَنزَلۡنَا مِنَ ٱلسَّمَآءِ مَآءٗ طَهُورٗا﴾

Which means, "And it is He who sends the winds as good tidings before His mercy, and We send down from the sky pure water".

(Al-Quran. Al Furqan 25:48)

b. Sea water:

حَدَّثَنَا هِشَامُ بْنُ عَمَّارٍ، حَدَّثَنَا مَالِكُ بْنُ أَنَسٍ، حَدَّثَنِي صَفْوَانُ بْنُ سُلَيْمٍ، عَنْ سَعِيدِ بْنِ سَلَمَةَ، – هُوَ مِنْ آلِ ابْنِ الأَزْرَقِ – أَنَّ الْمُغِيرَةَ بْنَ أَبِي بُرْدَةَ، – وَهُوَ مِنْ بَنِي عَبْدِ الدَّارِ – حَدَّثَهُ أَنَّهُ، سَمِعَ أَبَا هُرَيْرَةَ، يَقُولُ جَاءَ

رَجُلٌ إِلَى رَسُولِ اللَّهِ ـ صلى الله عليه وسلم ـ فَقَالَ يَا رَسُولَ اللَّهِ إِنَّا نَرْكَبُ الْبَحْرَ وَنَحْمِلُ مَعَنَا الْقَلِيلَ مِنَ الْمَاءِ مَاءِ الْبَحْرِ فَقَالَ رَسُولُ اللَّهِ ـ صلى الله " هُوَ الطَّهُورُ مَاؤُهُ الْحِلُّ مَيْتَتُهُ "فَإِنْ تَوَضَّأْنَا بِهِ عَطِشْنَا أَفَنَتَوَضَّأُ مِنْ . عليه وسلم

Which means, “Abu Hurairah related that a man asked the Messenger of Allah: “O Messenger of Allah, we travel by sea and carry a small amount of water with us. If we use it for ablution, we will become thirsty. Can we perform ablution with seawater? “The Messenger of Allah said: 'Its water is a means of purification, and its dead meat is permissible. (the fish found dead in the sea)".

(Hadith. Sunan Ibn Majah. *Kitāb al-Ṭahārah wal Sunanuha*. Book 1. #417)

c. Springs and wells

عَنْ أَبِي سَعِيدٍ الْخُدْرِيِّ، قَالَ قِيلَ يَا رَسُولَ اللَّهِ أَنَتَوَضَّأُ مِنْ بِئْرِ بُضَاعَةَ وَهِيَ بِئْرٌ يُلْقَى فِيهَا الْحِيَضُ وَلُحُومُ الْكِلاَبِ وَالنَّتْنُ فَقَالَ رَسُولُ اللَّهِ صلى الله عليه وسلم " إِنَّ الْمَاءَ طَهُورٌ لاَ يُنَجِّسُهُ شَيْءٌ "

Which means, “It was said, 'O Allah's Messenger! Shall we use the water of Buda‘ah well to perform ablution while it is a well in which menstruation rags, flesh of dogs and the putrid are dumped?" Allah's Messenger said: 'Indeed water is pure, nothing makes it impure.'"

(Hadith. At-Tirmidhiyy. *Kitab Taharah*. Book 1. #66)

ii. Pure water itself but does not purifiable (*musta*ᶜ*mal* water)

iii. Impure Water (m*utanajjis* water)

It is water that impurities (urine, faeces and so on) have changed one of its three characteristics; odour, colour or taste. This water has become impure, and its usage is prohibited for religious purposes.

وَلِلْبَيْهَقِيِّ: اَلْمَاءُ طَاهِرٌ إِلَّا إِنْ تَغَيَّرَ رِيحُهُ, أَوْ طَعْمُهُ, أَوْ لَوْنُهُ; بِنَجَاسَةٍ تَحْدُثُ فِيهِ

Al-Bayhaqiyy reported: "Water is pure unless any impure thing is added which changes its smell, taste and colour".

(Hadith. *Bulugh al-Marām. Kitāb Ṭahārah*. Book 1. #4)

c) Shafie *Madhhab*

Seven water sources can be used for purification: rain, sea, river, well, spring, snow and dew. The quality of these water sources may be divided into two categories: water from the sky such as rain, snow and dew and water from the earth, such as water from well, rivers and seas (Abi Zakaria, 1980). From these sources, water can be categorised as follows: (Mustofa Al-Khin & Asy-Syarbajiyy, 2011).

i. *Muṭlaq* water (pure water and purifiable)

This type of water is categorized as water that has its original nature and does not change with other and original causes. This *muṭlaq* water remains pure, although it has changed due to long idle, moss, soil and stagnant or flowing sites containing sulphur.

ii. *Mushammas* water (pure water and purifiable but *makruh* to be used)

This is pure and purifiable, but *makruh* to be used is hot water due to the rays of sunlight (*mushammas* water). It *makruh* to be used when fulfilling the following three conditions:

a) It is in warmer or hot weather countries.

b) Water is placed in containers made of gold and silver, such as iron, copper and all minerals that can be forged.

c) The water is used in the human body, even in the corpse or in animals susceptible to mumps like horses.

Imam Shafie narrated Sayyidina Umar RA's views that it is not good bathing in the *mushammas* water, and he said: "I do not like *mushammas* water because of health concerns." Then Imam Shafie narrated that water can cause pulmonary disease. This is because the sharpness of the sunlight will fizzle on the surface of the water, and if exposed to the body when it is still hot, it can be harmful and cause pulmonary disease.

iii. *Mustaᶜmal* water (pure water but is not purifiable)

The little water is used for obligatory washing like *ghusl* (bath) and *wuḍū'* (ablution). It is called *mustaᶜmal* water. There are three types of this kind of water:

a) Little quantity of water that has already been used for cleansing.

b) *Mukhallit* water

Water has changed entirely because it has been mixed with something pure, which is not an integral part of water, nor is it lying nearby like sugar and honey.

c) *Mujawir* water

Water that has been mixed with something pure such as moss and affects the water's nature (odour, taste and colour)

iv. *Mutanajjis* water (impure water)

Water which is an impure thing, falls into it. This water is divided into two categorised:

i. Little water, which is less than two *qullah.*

This water becomes impure because *najāsah* drops into the water a little bit and does not change the water's nature in terms of colour, smell and taste. Two *qullah* are 500 cisins of Baghdad, equivalent to 192,857 kg or 1 ¼ casta cubics.

ii. A lot of water is enough for two *qullah* or more.

This water does not become impure by only drops or *najāsah* touches, but it becomes impure when it changes one of its nature; colour, taste or smell.

d) Hanbali *Madhhab*

The Hanbali *madhhab* divided water into two categories known as *ṭahīr* (pure) and *najāsah* (contaminated water). *Ṭahir* is further divided into two types: *ṭahīr ṭahūr* (pure and purifiable) and *ṭahīr ghayr ṭahūr* (pure but not purifiable). According to Hanbali *madhhab*, water also can be classified into three categorised as follows (Abu Bakr, 2008):

1) Pure water and purifiable

2) Pure water but cannot be purifiable

3) Impure water (*mutanajjis*)

As the conclusion based on the views of the four main *madhhab* above, water can be classified into three groups as mentioned in the table below:

Table 4.2: Water Characteristic of its Classifications

Classification of Water	Nature/Characteristics of Water	
	Pure in nature	Can be used for purification
Ṭahūr	Yes	Yes
Ṭahīr	Yes	No
Najas	No	No

Source: (Taymiyyah, 1987)

Muṭlaq water is *ṭahūr* (pure) in nature and can be used for cleansing like rainwater, sea water, dew water, well water and snow. The quantity of this water is not taken into account if it is in the original place, but it should exceed two (2) *qullah* if it has been used or stagnant. The aspects of nature changes and the application of water are as follows:

Table 4.3: *Muṭlaq* Water Classification

***Muṭlaq* Water Classification**	**I**	**II**	**III**
Water Quantity (Amount)	No water quantity is determined if taken from seven *muṭlaq* water sources.	More than two (2) *qullah* if water has been used or stagnated	Little in quantity
Water Characteristic Change	Water retains its original nature and has no change in smell, colour and taste.	There is a change, but it maintains its nature (*ṭahūr*).	There is no change in the nature of water, whether in smell, colour or taste, but animals have drunk it
Water Application	*Najāsah* purification Eliminate the *najāsah*. Utilized for all uses		The *hukm* of its use is *makruh tanzih* if there is another alternative

Source: (Mohd Istajib & Raihanah, 2012)

Mustaᶜmal water is also included in the category of pure water in nature but cannot be used for cleansing. This water refers to the water used for purification, such as ablution, *ghusl* and cleanses of *najāsah* in quantities not up to two (2) *qullah. Mustaᶜmal* water is classified into three as below:

Table 4.4: *Mustaᶜmal* Water Classification

Types of Water	***Mustaᶜmal***	***Mustaᶜmal Muqayyad***	***Mustaᶜmal Mukhalit***
Water Quantity (Amount)	Less than two (2) *qullah* or used water		
Water Characteristic Change	No change in smell, colour and taste, but the water has been reused for purification of *najāsah*, cleaning and so on	Change on one smell, colour or taste when the water is mixed with the pure element and can be consumed like syrup or tea	Change in one smell, colour or taste when the water is mixed with the non-essential element and cannot be consumed
Water Application	Remove the *najāsah ḥaqīqiyy* only and not *najāsah ḥukmiyy*. Not allowed to use for religious purposes		

Source: (Mohd Istajib & Raihanah, 2012)

While *mutanajjis* water is classified as below:

Table 4.5: *Mutanajjis* Water Classification

Water Quantity (Amount)	Less than two (2) *qullah*	More than two (2) *qullah*
Water Characteristic Change	No change in odour, colour and taste	change in odour, colour and taste
Water Application (Purpose)	*Haram* and not allowed for ibadah (religious) purposes and also daily purposes like cooking and washing *Harus* and allowed for agricultural and farming purposes and also for extinguishing a fire	

Sourcer: (Mohd Istajib & Raihanah, 2012)

Thus, most scholars applied the definition from the Shafie *madhhab*, which divided water into the following three categories and sub-categories (Al-Hasan, 1988; Al-Sharbiniyy, 1997; Mustofa Al-Khin & Asy-Syarbajiyy, 2011):

1) *Ṭahūr/muṭlaq* (pure and purifying water)

This water can be used for religious purposes as well as for non-religious purposes

2) Ṭahīr

i. *Ṭahīr muṭahhir/musyammas* (pure and purifying water but not recommended for use (*makruh*)

ii. *Ṭahīr ghayr muṭahhir/mustaᶜmal* (pure but cannot be used for purifying).

This water can be used for other daily purposes but not for religious purposes.

3) *Najas/mutanajjis* (polluted and cannot be used for either daily purposes or religious purposes)

To understand how water quality is controlled in Islam, the classification of water according to its various degrees of purity needs to be discussed first. Water falls into several categories; from there, water's purity can be identified, and the capacity to cleanse or purify also can be determined (Farooq, S. & Ansari, 1983). This standardisation method is based on several significant factors or principles that regard the water as pure or clean for as long as it is not affected or contaminated by anything that changes any one of its parameters such as its smell, taste and colour (Abderrahman, 2000).

4.2.5 Discussion of Two *Qullah* among *Fuqahā'*

There are several definition of two *qullah* which is derived from Arabic word (قُلَّة). In fact, the measure or level of water of two *qullah* presented by the *fuqahā'* is *taqribi*, not *tahdidi* or accurate. Al-Zuḥailiyy (2010) defines two *qullah* as 500 kati of Baghdad, equal to 192.857 kg or 1 ¼ cubic cubits. He also mentions the value as follows:

i. In terms of weight, that is 446 3/7 kati of Egyptian, 81 kati of Syam (1 kati of Syam equals 2.5 kg. therefore, 2 *qullah* equals to 195,113 kg).

ii. In terms of measuring 10 tins (some say 15 tins or 270 litres).

iii. In terms of measurement 1 ¼ cubits of the rectangle in length, width and depth based on a medium cubit. As for the round container, such as a well of 2 cubits deep and 1 cubit wide. According to Hanbali scholars, the measurement is 2 ½ cubits deep and 1 cubit wide.

According to al-Zuḥailiyy (2010) also, the rate of two *qullah* is approximately (200) kg of water or 200 Liter. There is half a view of two kolahas equal to (204) kg, and some others determine the rate 192.85 kg. That is the rate of two *qullah* according to the most views close to accuracy. While according to Ibn al-Naqib (2007) what is meant by the measure of two *qullah* is the area equal to one cubit 1/4 of the length, width and depth. Al-Rayyashiyy (2013), the water measurement rate of two *qullah* today is equal to 216 liters. While according to 'Alī Jum'ah, the measure follows the weighing/weight rate is as follows; 1 *qullah* equals 250 kati of Baghdad [Iraqi]. 1 kati of Baghdad equals 382.5 grams. 1 *qullah* (250 kati) x 382.5 grams = 92,625 grams / 92.625 kg. So the sum of two *qullah* (92.625 kg) x 2 = (+/-) 191.25 kg. While in terms of liter measurement, it is equal to 191.25 kg x 1.04 Liter (1 kg = (+/-) 1.04 liters) = (+/-) 198.9 Liters. So, this study is used the measurement of two *qullah* as 270L as stated by the al-Zuḥailiyy (2010) and preferable by the Al-Hawariyy in *al-Kafi li al-Fatāwi* (Mufti Office of Federal Territorry, 2019).

4.2.6 *Najāsah* (Impurities) Concepts from *Fuqahā'* Views

Ṭahārah emerges when the presence of *najāsah. Najis* or *najāsah* is defined as something dirty and disgusting (Al-Qaradawiyy, 2001; Standards Malaysia, 2009). Then, if Muslims come into contact with *najāsah*, the cleansing process must be done before

proceeding to religious duties such as prayer (Halim et al., 2014). According to Islamic law, products and foods are considered *najāsah* if contaminated or come directly or indirectly in contact with *najāsah* (Standards Malaysia, 2009). Categories of *najasāh* and the cleansing methods are shown as follows:

Table 4.6: The Classification of *Najāsah* and the Cleansing Method

Classification	Example of *Najāsah*	Cleansing Method
Light *(Najis Mukhaffafah)*	The urine of boy infants or toddler aged less than two years old and fully breastfed	Remove *najāsah* and sprinkle water over the contaminated area
Medium *(Najis Mutawassiṭah)*	Apart from the heavy and light *najāsah* like vomit, blood, urine, and so on	Remove *najāsah* and wash with free flow clean water until achieving absence of appearance/colour, odour and feel
Extreme/ Severe *(Najis Mughallaẓah)*	Dogs and pigs that also include any liquid and object discharged from their orifices, descendants and derivatives	Remove *najāsah* and seven times of rinsing with clean water; - one of which is water that is mixed with the soil/clay. This cleansing method is called *sertu*.

Source: Halim et al. (2014)

a) Hanafi *Madhhab*

Hanafi *madhhab* divided *najāsah* or impurities into two types, which are first type is *najis mughallaẓah* and *najis mukhaffafah* and second type is *najis ʻayniyyah* and *najis ḥukmiyyah*. However, the use of this term differs from the term used in the Shafie *madhhab.* The types of *najāsah* are as follows (Al-Jaziriyy, 1990):

i. First Type: *Mughallaẓah* and *Mukhaffafah*

Najis mughallaẓah is *najāsah* which the *hukm* is *thabit* and *dalil qaṭʿiyy* which is *dalil* or nas is clear mentioned in al-Quran or al-Sunnah such as flowing blood, stool, urine from the *haram* animals, alcohol, stool from the wild animals and their saliva and all the

action and things that abolish ablution such as *manī, mazī* and blood from human body (al-Siwāsiyy, 1970). *Najis mughallaẓah* is forgiven in prayer if its size of the impurity is as large as one dirham coin or less than that (al-Siwāsiyy, 1970). The size of one dirham coin is as big as the palm of the hand if according to *sahih* opinion because the size is difficult to determine. In comparison, *najis mukhaffafah* is *najāsah* which the *hukm* is *thabit* from the *dalil non qaṭᶜiyy* such as urine from the animals, which is not permissible to eat like insects. This type of *najāsah* is forgiven if the rate is only one over four from the contacting area (al-Siwāsiyy, 1970).

ii. Second Type: *ᶜAyniyyah* and *Ḥukmiyyah*

Najis ᶜayniyyah is the *najāsah* that can be detected with human senses like eyes through colour, odour and taste like stool and dried blood. The cleansing method eliminates the *najāsah* by washing it once until the nature of *najāsah* (colour, odour and taste) disappears (Al-Zuḥailiyy, 1989).

While, *najis ḥukmiyyah* is the *najāsah* that is disappear but is believed to exist before such as the dried urine. The *najāsah* unable to be detected with the human senses like colour, odour and taste. The cleansing method of this type of *najāsah* is by washing the contacting area until believed it is clean and pure.

According to Hanafi *madhhab*, semen or *manī* is *najāsah* (Al-Sāwiyy, 1952). So, if the cloth is contacted or exposed with *manī*, it is obligatory (*wajib*) to wash when the *manī* is still wet. When the *manī* on the cloth is dry, just scrub to eliminate it. Thus, according to Hanafi *madhhab*, the method of cleansing the *najis mughallaẓah* is by cleansing the *najāsah* with water for maybe once or several times until the odour, taste and colour of the

najāsah is disappear and absent if the *najāsah* is visible (*ᶜayn*). If the *najāsah* is invisible, the cleansing of the *najāsah* should follow *al-ẓann* (strong suspicion that the *najāsah* is disappeared) three times (Al-Kasāniyy, 1998).

b) Maliki *Madhhab*

According to Maliki *madhhab, najāsah* are divided into two categorises; *najāsah* that are agreed for the *najāsah* and *najāsah* that are not agreed for the *najāsah* (Al-Zuḥailiyy, 1989).

i. *najāsah* that are agreed upon the *najāsah* by all *fuqahā'*

Najāsah, which is agreed upon the *najāsah* by all *fuqaha* is 18 types such as human urine and stools, *mazī*, *wadī*, carcass, pig and its bone, pig skin, carcass skin before being tanned, all the body parts that are separated during life except the fur or body hair, pig milk, intoxicating water, urine, *manī* and stools from the animal that is impermissible to eat and large amount of blood and pus (Al-Sāwiyy, 1952).

ii. *najāsah* that are not agreed upon the *najāsah* by all *fuqahā'*

Najāsah that are not agreed upon the *najāsah* by all *fuqahā'* are also have 18 types which are urine of boy infants or toddler aged less than 2 years old and fully breastfed, the urine of animals that undesirable (*makruh*) to eat, tanned animal skin, the skin of slaughtered animal that forbidden (*haram*) to eat, the meat, the bone, carcass ashes, elephant tusk, the blood of whales and flies, a little menstrual (*hayḍ*) blood, a little blood pus, dog saliva, animals milk that forbidden (*haram*) to eat except pig, pig fur or hair and wine that hasn't turned into vinegar (Al-Zuḥailiyy, 1989).

Najāsah that is obligatory (*wajib*) to purify is when the *najāsah* contacted or exposed to body, clothes, place of worship and so on. The original tool to purify the *najāsah* is *muṭlaq* water. So, the method of cleansing the *najāsah* in Maliki *madhhab* are as follows:

i. The visible *najāsah* or *najāsah ᶜayniyyah* is purified by eliminating the *najāsah* even with one wash until the nature of *najāsah* (odour, taste and colour) disappears. While the out-of-sight *najāsah* by the human sense, either by colour, odour or taste, is washed until the *najāsah* has been cleaned from sight, smell, and taste (Al-Zuḥailiyy, 1989).

ii. The *najāsah* is contacted or exposed to absorbing materials like cloth or fabric, so the materials must be washed and squeezed if the absorbing materials are a piece of cloth (Zaydan, 1993).

iii. The clothes that touches the earth contaminated with *najāsah* will be pure when it's touched with the earth several times because the earth can purify each other. But, if the *najāsah* is not disappearing with the touch, it is forgiven if the *najāsah* is in small quantity and the *najāsah* needs to be washed if in large quantity (Al-Jazīriyy, 1990).

iv. The shoes that stepped on the *najāsah* are purified when scrubbing the dirty shoes to the land or ground hardly until the *najāsah* disappears (Abu Tayyib, 1990).

v. *Manī* or semen is *najāsah*, according to Maliki *madhhab* (Al-Sāwiyy, 1952). So, if the cloth is contacted or exposed to *manī*, it is obligatory (*wajib*) to wash it when it is wet. When the *manī* on the cloth is dry, it must be scrubbed until it is clean from sight, smell and taste.

vi. The urine of boys and girls aged two years or less is the same and considered *najāsah* and must be washed (Zaydan, 1993).

vii. The place contaminated with *najāsah* that is not absorbing materials like glass and metal containers such as knife or semi absorbing material like body is purified by eliminating the *najāsah* either sweeping with cloth, paper, hand or so on (al-Siwāsiyy, 1970).

viii. The earth or ground contaminated with *najāsah* can be purified by pouring a lot of water onto the ground until the *najāsah* disappears (Zaydan, 1993).

Najāsah is not clean, meaning that it is a mandatory (*wajib*) on every Muslim to cleanse and purify from *najāsah* and wash the affected part of the *najāsah.* There are two categorised of *najāsah* (al-Zuhayliyy, 1989):

i. Ḥisiyyah ḥaqīqiyyah

Examples are urine and blood.

ii. Ḥukmiyyah (Iᶜtibariyah)

Like *hadath kabir (ghusl janābah)* and ablution to eliminate the *hadath saghīr*.

c) Shafie *Madhhab*

Najāsah is antonym to *ṭahārah* and it is divided into two types (Al-Zuhayliyy, 2013):

i. *Najāsah Ḥaqīqiyyah ᶜayn* (obvious)

Something that prevents the validity of prayers such as blood and urine.

ii. *Najāsah Ḥukmiyyah/ Maᶜnawiyyah* (*Iᶜtibariyyah*: existing as assumption only)

It prevents the validity of prayer and they are abrogating ablutions and the obligation of *ghusl hadath*. This type of *najāsah* is purified by doing ablution or doing *ghusl hadath*.

Next, (Jabbar, 2005; Mustafa al-Khin et al., 1989) also divided *najāsah* into three categorised as follows:

i. Mughallaẓah

Examples of this group are dogs, pigs, their saliva, mucus and sweat. Methods of cleansing *najāsah mughallaẓah*, according to Shafie *madhhab* is by washing seven times towards the object which is polluted by *najāsah*; six times with pure water and one time with pure clay water after removing the *najāsah*.

ii. Mutawassiṭah

There are two types of *mutawassiṭah:*

a. Ḥukmiyyah

It is impurities that does not have any shape, taste, colour or smell like the urine other than from the urine of boy infants and toodlers under two years old and fully breastfed when it dries and leaves no sign. Methods of cleansing *najāsah mutawassiṭah hukmiyah* are to wash the place or object polluted by this impurity. It will be regarded as pure when it is washed, even once with clean water.

b. ᶜayniyyah

This impurity takes shapes in, taste, colour or smell such as stool, dung, blood, pus, vomit, intoxicant liquor, *mazī, wadī,* all types of dead carcasses except man, fish and grasshopper, milk of any unlawful alive animal and the portion separated from the body of any living animal except man, fish and grasshopper. Methods of cleansing *najāsah mutawassiṭah ᶜayniyyah* are by washing with clean water until the *najāsah* removes entirely from the place or object which is polluted by *najāsah*. No matter if the trace of *najāsah* remains on the place or clothes, it can hardly be removed.

iii. Mukhaffafah

It is the urine of a boy infants or toodlers ages less than two years old and fully breastfed. The method of cleansing *najāsah mukhaffafah* is by sprinkling with water until the place polluted by this *najāsah* gets clean in sight, smell and taste (Al-Sharbiniyy, 1997).

According to Shafie *madhhab*, semen or *manī* is pure and not *najāsah*, just like any other waste, such as coming from the nose, can be cleaned by throwing the impurity away (Al-Zuḥailiyy, 1989). Cloth contaminated with *najāsah* from the urine of boy infants and toodlers under two years old and fully breastfed is purified by sprinkling water on it (Al-Sharbiniyy, 1997). However, the urine of girl infants under two years old and fully breastfed still needs to be washed.

Syafie *madhhab's* opinion towards cleansing the *najāsah* on the earth or ground is by pouring water on it until it gets absorbed by the land. Though, for the hard ground or non-absorbing land, the cleansing method is by drying the *najāsah* first or wiping the physical (ᶜ*ayn*) of the *najāsah* then pouring the water on it even one wash (Al-Jaziriyy, 1990).

d) Hanbali *Madhhab*

According to Hanbali *madhhab*, semen or *manī* is pure and not *najāsah*, just like any other waste from the nose and phlegm. It is *sunnah* to clean it only (Al-Zuḥailiyy, 1989). Cloth contaminated with *najāsah* from the urine of boy infants under two years old and fully breastfed can be purified by sprinkling water. But, the urine of girl infants under two years old and fully breastfed still needs to be washed (Al-Sharbiniyy, 1997).

According to one *riwayah* in the Hanbali *madhhab* said that dog is the *najāsah ᶜayniyyah.* All the body of the dog is considered *najāsah.* The pig is also *najāsah ᶜayniyyah* for the whole body of the pig. The cleansing method of this type of *najāsah* is by washing seven times with one wash of clay water (Ibn Qudamah, 2004).

4.2.7 *Al-Muṭahhirāt* (The Purifier)

Based on the purification methods that have been discussed, it can be concluded that several objects can be used to eliminate the *najāsah* as below (Muhammad Jawad, 2000):

i. *Muṭlaq* Water

It is *ṭāhir* (pure) and *muṭahhir* (purifiable) by consensus.

ii. Other liquids

According to the Hanafi *madhhab* only any *ṭāhir* liquid, like vinegar and rose water, is *muṭahhir*.

iii. Ground

Hanafi *madhhab* provided it is walked on the *najāsah* is rubbed on the ground and the actual *najāsah* is removed.

iv. Sun

The Hanafi *madhhab* states that drying purifies the ground and trees irrespective of whether it's being achieved by the sun or the wind. The Shafie, Maliki and Hanbali *madhhab* concur that the ground is neither purified by the sun nor the wind; instead, it requires the pouring of water over it. They differ concerning the manner of its purification.

v. *Al-Istiḥālah* (transformation)

It is changing one substance to another, like changing deer's blood into musk. It results in purification by consensus.

vi. Fire

The Hanafi *madhhab* says that burning *najāsah* by fire purifies, provided that the actual *najāsah* disappears. They consider *najāsah* clay as *ṭāhir* when turned into fired clay and *najāsah* oil *ṭāhir* when made into soap. The Shafie and Hanbali *madhhab* observe that fire is not among the *muṭahhirāt.* They hold an extreme position in this regard and consider even the ash and smoke of a *najāsah* object as *najāsah*. At the same time, the Maliki *madhhab* regards the ash as *ṭāhir* and the smoke as *najāsah*.

vii. Tanning

The Hanafi *madhhab* observes that tanning purifies the skin of a carcass and every other *najāsah* animal except pig skin. As to a dog's skin, it becomes *ṭāhir* by tanning and fit to be prayed on it. Shafie says the tanning is *muṭahhir* except for the dog and the pigs' skin. The Maliki and the Hanbali *madhhab* do not consider tanning as *muṭahhir*, although the Hanbali *madhhab* allows the use of a *najāsah*-tanned skin where liquids are not involved, so that its use does not lead to the spread of *najāsah.*

viii. Carding

The Hanafi *madhhab* said that cotton is purified on being carded.

ix. Disposition

According to the Hanafi *madhhab*, when a part of wheat and the like becomes *najāsah*, if a part of it equal to that which had become impure is disposed of by being eaten, gifted or sold, the remainder will be purified.

x. Rubbing

The Hanafi *madhhab* says that semen, if removed by rubbing, does not require water because *ṭahārah* is achieved by rubbing.

xi. Wiping

The Hanafi *madhhab* observe that an object with a polished surface like iron, copper and gold becomes *ṭahīr* solely by wiping and does not require water.

xii. Boiling

The Hanafi *madhhab* state that if *najāsah* oil or meat is boiled on fire, they become *ṭahīr*.

4.2.8 Water Treatment and Purification in *Fiqh*

According to Islamic *Fiqh*, the water purification method is debated in *Fiqh turath* books by previous and today *fuqahā'* (scholars). This method is also based on *ijtihād* and *fatwa* of *fuqahā'* because there is no specific and detail *nas* (script) about it either from al-Quran or al-Sunnah. This part will discuss the water purification method from the views of several *fuqahā'*.

a) Hanafi *Madhhab*

Imam Hanafi argues that impure water becomes clean by letting it flows in a stream. If there is unclean water in a vessel or container, water is poured on it until it flows out of its sides and becomes pure. Similarly, if there is any impure water in a pool or hole, dig another hole even though it is close and drain the impure water into the channel between the two holes. So that all the water accumulates in one hole, the water becomes pure. If the water comes back into impure water for a thing, then the same way can be done to purify it by digging another hole and running it until it accumulates in one hole. Therefore, water

that should not be used for ablution (*wuḍū'*) when it is in a stagnant condition is permissible when the stagnant water is running in any way. If there is even a carcass in it or urine beneath it, there is no sign that the water is flowing and it is known that the water is not in contact with the spring, then, if it is flowing, the water becomes pure (Al-Shadiq, 2015).

b) Maliki *Madhhab*

Al-Malikiyyah said that purifying the impure or *mutanajjis* water can be done by pouring *muṭlaq* water on it until the impurities disappear (Muhammad Jawad, 2000). Removing impurities from water is done if the impure water changes one of the properties of the pure water, whether it smells, tastes or colours, then it is elevated when it is added (poured) water from something else to it or is lifted by itself in addition to something added to the water. Then, all that water would become pure with the erosion of the water being changed by adding water, lifting it, and returning it as it was (Al-Shadiq, 2015).

c) Shafie *Madhhab*

When there is a small amount of water that becomes impure by contact with *najāsah* but does not occur any change in its nature, Shafie said that if the water is collected two *qullah*, it is still considered pure and purifies the impurities. If one has two or more containers and each one contains impure water, then the impure water is collected in one place up to two *qullah*, and then the water is pure and purified (Muhammad Jawad, 2000). In addition, Al-Shiraziyy (2001) explained in the book of *al-Muhadhdhab* said:

"If you want to purify the impure water, then it must be observed (if the water is defiled by reason of taghayyur (change in colour, smell or taste) while it is more than two qullah, then it is purified by the loss of the purifier by itself or (missing taghayyur) by adding to it another water, or (missing taghayyur) by throwing away some of it because the impurities were caused by taghayyur (change of colour, smell or taste) and it was disappeared".

Next, it is also mentioned by Al-Nawawiyy (2009) that if the water had lost its *taghayyur* by taking some of it, the remaining water must have enough two *qullah*. If the water is less than two *qullah* then it is impure.

d) Hanbali *Madhhab*

According to Hanbali, the water will not be pure with enough up even it is in large quantity like to two *qullah* either or by using the impure water or pure water because collecting impure waters does not make the water pure. Likewise, a little pure water is impure with a touch of impure water. Therefore, if it is to be purified, it may be enough water up to two *qullah.* If water is in large quantity changed due to contact with *najāsah,* then it can be purified by simply eliminating the change (Muhammad Jawad, 2000).

So, it can be seen that the study of the status of water discussed in the *turath* book is significant because purifying with pure water is a must before the performance of worship such as pray, *tawaf,* reciting the Quran and so on. In addition, Islam recommends that every Muslim keep their purity free from any *najāsah* that can lead to various diseases.

4.2.9 Theories and *Hukm* on Water Purification

Based on the *fuqaha* views before, the method of treatment and purification of water in Islam can be simplified as follows according to *ijtihād fuqahā'* (Al-Shiraziyy, 1996):

First Theory: The water conditions change on their own naturally (changing of time, sun and wind or weathered)

Second Theory: The condition of water when added pure water to clean up and the *najāsah* disappears from the water

Third Theory: The condition where the dirty water is washed by soil

These theories are based on observation of *fuqahā'* to the people around them and according to the situation of that time. According to Shafie *madhhab*, the water quantity for two *qullah* is equivalent to 270L of water. If the *mustaʿmal* water is collected and more than two *qullah*, the water turns into *muṭlaq* water.

According to Wijayant and Kaukab (2019), the methods to cleanse impure water or *mutaghayyir*, which has one of its characteristics changed of taste, colour, or smell is by applying these three methods as follows (Majelis Ulama Indonesia, 2010):

i. *Tarīqah Al-Nazh* by draining the impure water and leaving clean water without any change by closing the fountain (water source), disposing of the things causing the water impure and then eliminating the taste, colour and smell causing the changes of water. The water is at least two *qullah* in quantities.

ii. *Ṭarīqah Al-Mukatharah* by adding *muṭlaq* water into the impure water to eliminate all the *najāsah* and everything that makes the water change.

iii. *Ṭarīqah al-Taghyīr* changes the impure water with different traits so that the characteristics of the water return to their original state or are named *istiḥālah.*

The treatment method can be simplifies as follows:

Table 4.7: Discussion on Treatment Method of Water

Madhhab	**Treatment Method**	**Quantity of 2 *qullah* of water**
Hanafi	Addition of *muṭlaq* water (*ṭarīqah al-mukatharah*) • Removal of *najāsah* and discharge of water (*ṭarīqah al-nazh*)	Not required
Maliki	Addition of *muṭlaq* water (*ṭarīqah al-mukatharah*) • Removal of *najāsah* and discharge of water (*ṭarīqah al-nazh*) • Addition of substances that can remove *najāsah*	Not required
Shafie	• Addition of *muṭlaq* or *mutanajjis* water (*ṭarīqah al-mukatharah*) • Removal of *najāsah* and discharge of water (*ṭarīqah al-nazh*) • Natural change (*taghyīr*)	required
Hanbali	• Addition of *muṭlaq* or *mutanajjis* water (*ṭarīqah al-mukatharah*) • Removal of *najāsah* and discharge of water (*ṭarīqah al-nazh*) • Natural change (*taghyīr*)	required

Source: Mohd Mahyeddin et al (2021)

All the theories and *hukm* applied nowadays, especially from the fatwa by related agencies, do not differ from the views that have been discussed and shared by the ancient *fuqahā'* by practising the views that suitable with the situation and issues that happened nowadays.

Thus, the differences in views and opinions among the *fuqahā'* in *madhhabs* do not mean there are disagreement with one another. Still, instead, they complement each other to achieve a comprehensive view of an issue. For example, there are different views on

water classification, *najāsah* classification and the methods of water purification, but each classification is closer to the other or subdivision for the main category. The differences give the *ummah* choice to practice the closer and more suitable way depending on the individual situation with a certain condition.

4.3 Water Treatment and Purification from Science Perspective

Water treatment and purification from science view also have been discussed for general information related to the classification and types of water and water treatment technology used from the past until today.

4.3.1 Classification and Types of Water

There are three types of water as below (Abdullah et al., 2016):

i. Clear Water

The source of water from the faucet or tap

ii. Gray Water

The source of water is from baths, bathroom sinks and washing machines.

iii. Black Water

The source of water is toilets, dishwashers and kitchen drain.

Wash water or greywater is the wastewater of households such as bathtubs, washing machine, dishwasher, shower and sink. It does not include water from the toilet. The water from the toilet belongs to black water. Wash water is different from black water as the washing water can be reused for other activities without having to undergo the treatment process. In contrast, black water should be treated first in the sewage treatment plant before

being reusable. Washing water is still considered safer and does not threaten public health than black water as it contains fewer pathogens.

However, leftover from washing water is not suitable to be drinking water supply and cleaning personal hygiene as it still contains bacteria that can cause congenital disease water. Leftover from washing water contains impurities, food, oil, hair loss and home cleaning products specific and may seem dirty, but it is a safe source for irrigation purposes on the site home. The most effective and safe step to control the washing water is draining directly into the soil layer at the top, where bacteria in the soil can decompose. Then it becomes a source of nutrients for plants. Water discharged continuously to the river, or the sea can cause pollution, but if used for tree planting, it becomes a valuable fertilizer source (Abdullah et al., 2016). These three types of water have the potential to be reused by specific treatments. Next, Angelakis et al. (2018) also suggested some types of water sources that also have the potential for reclamation and reuse as follows:

Table 4.8: Types of Water Sources Potential for Reclamation and Reuse

Water Source	Description
Blackwater	Wastewater originating from toilets and kitchen sources (i.e., kitchen sinks and dishwashers).
Greywater	Wastewater is collected from non-blackwater sources such as leftover water from bathroom sinks, showers, bathtubs, and laundry.
Wastewater (local)	Water from combined greywater and blackwater sources is not discharged to a collection system (e.g., wastewater from a residence served with a septic tank or seepage pit).
Roof runoff	Precipitation from rain or snowmelt events is collected directly on a roof surface that is not subject to frequent public access.
Stormwater	Precipitation runoff from rain or snowmelt events that flows over land and impervious surfaces (e.g., streets, parking lots, and rooftops). Runoff from roofs with frequent public access is defined herein as stormwater.
Condensate	The water vapour that is converted to a liquid and collected, the most common source in buildings being air conditioning, refrigeration, and steam heating.

Shallow groundwater	Groundwater is located near the ground surface in an unconfined aquifer and, therefore, is subject to contamination from infiltration of surface sources.
Foundation water	Shallow groundwater is collected from drainage around building foundations or sumps.
Blended water	Various water combinations are derived from blackwater, greywater, wastewater, roof runoff, stormwater, condensate, or foundation water. In many areas, ordinances do not allow the combination of roof runoff and stormwater with wastewater as part of the wastewater collection system due to documented concerns associated with sanitary sewer overflows and treatment and hydraulic capacity at publicly owned treatment works. Blended water is the purposeful aggregation of water for use as a non-potable water supply.

Source: Angelakis et al. (2018)

While in the context of portable or drinking water can be divided into two types: pure water and safe water. Pure water is free from extraneous substances, whether harmless or not, and it is hard to produce even with current technological equipment. Safe water may contain some contaminants but will not cause any risks or health effects on humans and is in an acceptable range (Siong et al., 2013).

4.3.2 Water Treatment Technology

Water is essential for humans, especially pure water; however, it is rare to encounter a source of water that requires no treatment before being used, especially for potable water supply (Binnie et al., 2002). It has different purity over the surface of the earth. Hence, water treatment is an initiative to produce pure and clean water to be consumed and used by humans. Water and wastewater treatment processes are chosen based on the initial quality of water and parameters established by regulations and the proposed use (Bernardes et al., 2014).

Water treatment consists of the combination of processes to achieve the desired water quality objectives involving the process of separation, removal and disposal of

pollutants present in water. All these processes are accomplished by four basic methods, which are physical, mechanical, biological and chemical. The details of water treatment methods as explained as follows (Gangaraju et al., 2021):

i. Physical Treatment Method: This method includes using tanks and other structures designed to contain and control the flow of water to remove the contaminants.
ii. Mechanical Treatment Method: This method involves using both simple and complex design and operation machines.
iii. Biological Treatment Method: This method involves the action of bacteria and microorganisms to play a vital role in removing certain pollutants.
iv. Chemical Treatment Method: This method enhances the efficiency of other process operations and for specialized treatments at various treatment stages for addition.

All these methods are used in traditional and certain modern water treatment. Thus, there are two phases in introducing water treatment which is traditional and modern (Binnie et al., 2002).

a) Traditional Water Treatment

Conventional or traditional water treatment consists of some or all of the following main processes:

a. Catchment control
b. Raw-water storage
c. Removal of coarse solid by screening
d. Sedimentation
e. Aeration (also common for ground waters high levels of iron)

f. Chemical dosing

g. Coagulation and flocculation

h. Slow sand filtration

i. Rapid gravity filtration

j. Pressure filtration (also common for ground waters)

k. Chlorination (also common for ground waters)

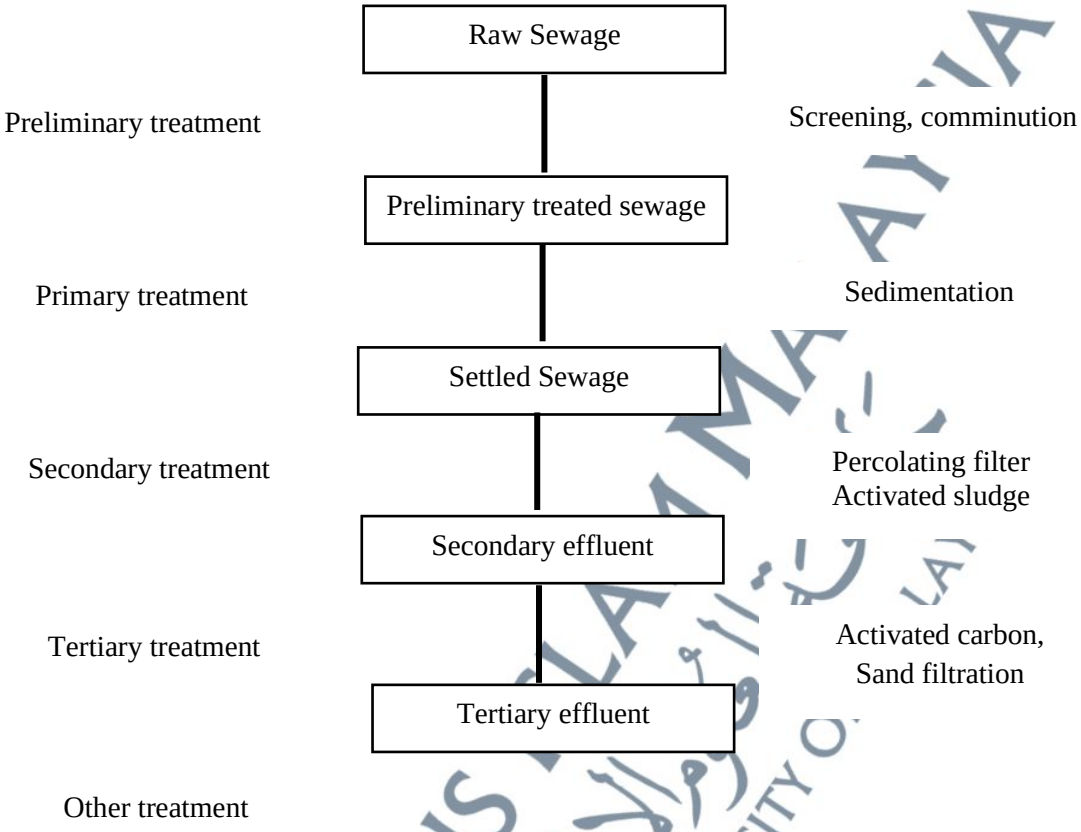
l. Chlorine contact tank (also common for ground waters)

m. Settlement and recycling of filter wash water

n. Disposal of sludge to lagoon

o. Dewatering of sludge

The flow of the processes can be simplifying as follows:



Source: Adapted from Sammon (1973)

Figure 4.1: Steps in Conventional Sewage Water Treatment

Usually, this traditional water treatment process needs to be combined or integrated with other processes to ensure the quality of water produced. But, traditional water treatments are ineffective in removing some contaminants and harmful compounds that can be produced during the disinfection phase, for example, trichloromethane produced from the reaction of chlorine and natural organic matter (D. Zioui et al., 2015). So, scientists and researchers constantly innovate to improve water quality over time.

b) Modern Water Treatment

Due to the development of water quality standards, water treatment processes must also undergo a period of development. The UK and Europe adopted the national laws of the water quality standard in the 1980 EU Drinking Water Directive led to the introduction of new treatment processes and the traditional treatment processes required to meet this standard. Modern water treatment processes include:

a. Improve coagulation control

b. Dissolved Air Flotation (DAF)

c. Advanced clarifiers (lamella separators and advanced 'sludge blanket' system)

d. Ozonation

e. Granular Activated Carbon (GAC) adsorption

f. Membrane-based processes

g. Air stripping of volatile organic chemicals

h. Advance disinfection (ultraviolet, ozonation and chlorine dioxide)

These phases include water treatment for domestic and industrial purposes but for domestic purposes that focus of this research, not all the water treatment phases are used. Focusing on the water filter that the household has used for domestic purposes, various types of water filters are manufactured to treat the water by removing contaminants from the supplied water. Each type of water treatment is designed to treat specific water quality problems; not all filter systems can solve all water quality problems.

The standard water filter that is used for domestic purposes is an activated carbon filter, membrane filter, reverse osmosis filter, distillation filter, and ultraviolet light (UV light) filter) and also a combination of either of all filters. However, the standard filters that the household has used are activated carbon filters and membrane filters. The activated carbon filter is usually made up of wood, coal and coconut shell as the base materials depending on the carbonization process. These materials are heated to a high temperature to produce activated carbon. This filter can be divided into granular and powdered activated carbon (Mohd Mahyeddin, 2016).

Figure 4.2: Granular Activated Carbon

Granular activated carbon is made from coal and is hard and dense to pump.

Figure 4.3: Powdered Activated Carbon

While powdered activated carbon filter is from coal-based product activated at high temperature and then pulverized to powder form. The activated carbon filter uses Van der Waals forces that are highly short-range and sensitive to the distance between the carbon surface and the adsorbate molecule. The attractive forces can be altered by increasing carbon density or reducing the distance between the carbon surface and the adsorbed substance. When attractive forces between the carbon surface and the contaminant are more potent than forces keeping the contaminant dissolved in water, the organic materials will be attached to the carbon surface, therefore, adsorption can take place (Tadda et al., 2018).

Then, the residual disinfectant, such as chlorine, can be removed by activated carbon. Activated carbon acts as a reducing agent to reduce chlorine to a non-oxidative chloride ion. The chemical reaction involves transferring electrons from the carbon surface to chlorine. As carbon surfaces become filled up, removal effectiveness will be reduced. The filter needs to be replaced with a new cartridge. This is how activated carbon operates (Tadda et al., 2018).

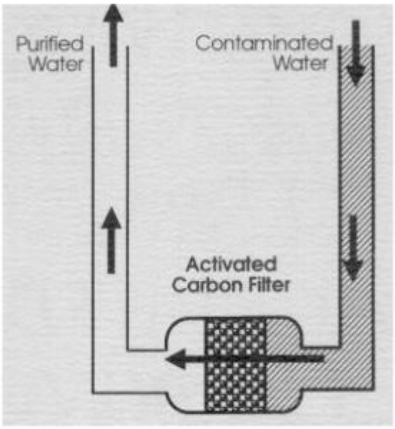


Figure 4.4: The Process of Water Treatment Using Activated Carbon Filter

The other type of filter that is commonly used for domestic purposes is the membrane filter. This filter is made up of polymer or ceramic materials. The other material that can be used is fibre which is usually made of cellulose, rayon, or other thread.

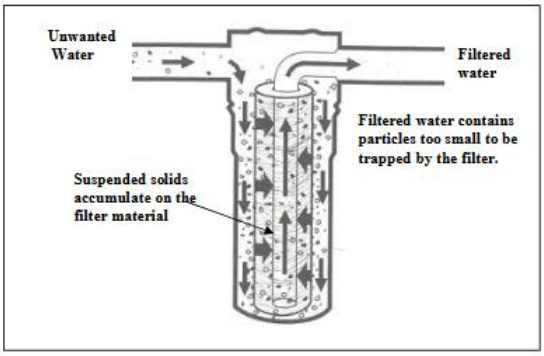


Figure 4.5: Membrane Filter Operation for Water Treatment

The membrane filter process operates by the water flowing into a cartridge at high pressure and making its way into the stem. The tightly wrapped fibres form a cylinder around a tubular opening, and pressure forces water through the wrappings to the inner opening that leads to the faucet or pipe. The fibre will then filter out the larger particles, such as organic matter, sand, mud and silt. After that, the filtrate will pass to the opening that leads to the

faucet. Normally, the flow rate is high with higher pressure as it is on the main pipe (Tadda et al., 2018).

Thus, water filter treatment technologies are seen as the best solution to produce clean and safe water to be used and consumed by humans daily. But, in Malaysia, the polemic regarding utilizing materials of *haram* animals' origins and *najāsah* often raises concerns among Muslims (Mohd Mahyeddin, 2016). There are various issues exposed by Muslims regarding the status of *halal* and *haram* in their daily life consumable and non-consumable products, for instance, a controversy on the use of ceramic products and home appliances such as bone China dish wares that are produced from animal bones of pigs and halal animals but not slaughtered according to Islam (Utusan Malaysia, 2012).

Water filter products also have not escaped from the controversy of using bones of cows and pigs in filtering drinking water and also act as calcium and collagen suppliers in drinking water (Sinar Harian, 2014). According to Mohd Mahyeddin (2016), consumable products like ceramic and water filters are only externally used. Some of the original materials from animal sources have been chemically processed, resulting in new products that are different from their original material, which was *haram*. This changing process is known as *istiḥālah*, which Islamic scholars term. But, there are different fatwas on the ruling of using products based on prohibited animals according to the variety of views and opinions by *fuqahā'* (*Fiqh* scholars).

Water filter systems are used on a large scale for industrial and domestic uses that introduce natural and synthetic materials to use as absorbers of water contamination (Mohd Mahyeddin, 2016). The materials are made up of polymers, clay, industrial waste, biomass or others (Tovar-Gómez, 2013). Usually, animal bone use is widely applied in many water

filter products, outdoor filters or domestic dispensers to produce activated carbon and bio-ceramic (Mohd Mahyeddin, 2016). The explanation of activated carbon and bio ceramic that is widely used in water filter products is detailed below:

i. Activated Carbon

Activated carbon removes colour or impurities from liquids and gases in chemical compound separation and extraction (Collin Dictionary, 2015). The characteristics of activated carbon are black in colour, no smell or taste and available in various forms and sizes, such as granules or pellets and powder (Yahya et al., 2015). Usually, carbon in granule sizes (0.42 – 0.60 mm) is used as the filtering medium because it has a more extensive surface area to absorb more organic materials in water (Nguyen, T. V. et al., 2014). The applicability of carbon is selected due to the ability to filter contamination in water, the level of potential activation and supply stability (Yahya et al., 2015).

Several raw materials and plants can produce this carbon, but its effectiveness is different towards each material (Mohammad Khah & Ansari, 2009). Hence, animal bone by animal bones is often selected for industrial use for its low cost and high efficiency as an absorbent of fluoride and iron ions (Leyva-Ramos et al., 2010; Meddelin-Castillo et al., 2007). Animal bone char is also proven to filter various heavy metals like cadmium, copper, zinc (Mortazavi et al., 2010; Pureysuvan et al., 2004), mercury (Hassan et al., 2008) and cobalt (Pan et al., 2009). This absorbency of fluoride by bone char is very effective due to the existence of calcium in the bones, and this fluoride will attach itself to calcium (Deal, 2012).

ii. Bio-ceramic

According to Mohd Mahyeddin (2016), bone char acts as ceramic in water filters and is usually used in domestic water filter products and supply of calcium and collagen. Bone char functions to absorb dirt and hazardous heavy metals and helps to increase body metabolism naturally. Besides bones, bio-ceramic also can be produced from tilapia scales, bamboo carbon, coconut shell and seashell (Mohd Mahyeddin, 2016). The amount of calcium in each of the sources varied as below:

Table 4.9: The Amount of Calcium for Each Sources

Bio-ceramic Sources	Amount of calcium (%)
Tilapia Scales	5.36
Seashell	0.74
Animal Bones	0.42

Source: Mahyeddin (2016)

Although animal bone is not the best source to supply calcium and collagen in water compared to seashell and tilapia bones, animal bone is a popular choice in the industry due to the lowest price compared to other sources (Mohd Mahyeddin, 2016).