

SUSTAINABLE WASTE MANAGEMENT VIA INCINERATION SYSTEM: AN ISLAMIC OUTLOOK FOR CONSERVATION OF THE ENVIRONMENT

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ABSTRACT

This paper would firstly examine solid waste management currently experienced in Malaysia with special concentration given to waste incineration. Its function and benefits entailed from this system shall then be identified. This paper attempts to emphasize this notion within the Islamic perspective, stressing on the needs to conserve the environment. This study adopts a qualitative approach where the conceptual authoritative literature in the related field is utilized based on content analysis. The related principles of Islamic jurisprudence carefully examined along with the Quranic verses depicting on this issue. This study further submits that incinerating waste could mitigate environmental impact that might otherwise arise from waste. Finally, it further concludes that Islam provides a concrete model of environmental ethics which is based on divine revelation that needs to be observed.

Keywords: sustainable waste management; incineration system; environment conservation; Islamic jurisprudence principles.

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1. INTRODUCTION

The religion of Islam provides very efficient ethical principles and guidelines in dealing with the environmental or ecological crisis which are mostly rooted in moral deprivation. Natural resources should be benefitted by considering the adverse environmental impacts. The idea of benefit maximization from natural resources without giving due consideration to the adverse environment impacts of such action should be rejected as the practice is generated from greed, extravagance and ignorance. It is our duty to conserve the environment and its natural resources for the benefit of all especially the future generation. In Islam for example, the existence of human being is always interrelated to other environmental entities. In its manifestation, Islam divides human interaction into three categories, interaction with God, interaction with human beings and interaction with the environment. Human interaction with environment is mentioned numerous times in the holy Quran, hadith (prophet sayings) and further explained by scholars (Surah Taha: 55, Surah al-Qasas: 77). This interaction is not merely an ethics or alternative duty but an obligation for every Muslim as the prophet said in one hadith,

“The world is beautiful and green and Allah has made you His representatives on it and He sees (all things).”

In relation to this, having effective and efficient municipal waste management is significant not only for the protection of environment but also the health of population. Rubbish and waste for example can cause air and water pollution which can bring health problems in people. To address this problem, modern waste management methods i.e. incineration is created to facilitate its rapid decomposition. In Malaysia, incineration is the second mostly used method to manage waste. It is one of the most effective means of dealing with various types of waste [1]. However, being an attractive technological option for waste management, this type of combustion-based process for municipal solid waste treatment is a subject of intense debate around the world for its assumed negative impacts on human health and natural environment [2-3].

This study is carried out to examine the municipal waste management (MWM) in Malaysia with special reference to waste incineration. In discussing the topic, the process of waste incineration is highlighted with the attention given to Malaysian experiences in handling

waste incineration. To understand from an Islamic viewpoint, the Islamic perspective of environment conservation is thoroughly discussed with special reference to waste incineration. For this, the related principles of Islamic jurisprudence such as *qawaid fiqhiyyah*, *maslahah* and *siyasah syariyyah* are carefully examined. This research employs qualitative method. Library research is used to obtain the data in which a number of references are derived from contemporary researches, related Quranic verses, Prophet's traditions and details opinions of contemporary scholars are referred. This research draws insights from the Malaysian experiences in conducting solid waste management particularly waste incineration. For the finding, this study proposes that any measures to preserve and conserve the environment by whatever means particularly waste incineration is supported by Islam as long as it fulfils the religious requirements.

2. LITERATURE REVIEW

2.1. Incineration: A Closer Look into Its Function and Operation

In response to the worsening garbage problem, enormous academic literatures discussing on the incineration and its functions, elaborating on its effective function and evaluating on its robust advantages and disadvantages in place. In [4] for example highlights that incineration is the second common Municipal Solid Waste (MSW) disposal tools globally acceptable after landfill. Incineration is the best-known method for thermal waste treatment technology that uses combustion to break down organic materials and/or substances. Chambers are flames inside the incinerator at usually around 2400 degrees Fahrenheit that burn the waste in either one stage or in multiple stages. Another work by [5] postulates that incineration is a waste treatment technology that involves the combustion of organic materials and/or substances. The key release for the incineration process consists of generating emissions, liquid discharges and residues of various types which are released to the environment or deposited within a landfill in a controlled manner. The incinerator is built with strong, well-insulated material and well-contained despite of extreme heat [6]. As the waste is burned, incineration of waste materials converts the waste into ash, flue gas and heat. The ash is mostly formed by inorganic constituents of the waste and may take the form of solid lumps or particulars carried by the flue gas. The waste material is then converted into incinerator bottom ash, flue gases,

particulates and heat which can in turn be used to generate electric power. Before they are dispersed in the atmosphere the flue gases should be cleaned of gaseous and particular pollutants while the bottom ash can either be used in cement mix or disposed in landfills [7, 4]. Similarly, as in [6], incineration means the act of burning something which in this case to burn used trash and other multiple kinds of waste until only ashes are left. The heat is left inside the furnace so that all the waste inside the incinerator plant could be burned very quickly and efficiently. He further stresses that the waste will be incompletely burnt as expected if the heat is not well-contained.

On a different note, incineration has been categorized by [8] into 5 categories namely combustion, pyrolysis, gasification, plasma decomposition and detonation. Notably, it is worthy to note that prior to 1970, incineration was associated with the scene of black smoke and the release of odorous gases. Despite this setback, many perceive that some loopholes hindered this technology. In response to this, technology and science advancements have made several endeavors to enhance its role and functions as well as mitigate the emission pollution [9]. As a result, he further adds that the current incinerator is well-equipped with effective combustion and proper pollution control mechanism with the primary goal to alleviate the level of emission pollution. Good planning, technical oversight and sustained supportive supervision of incinerator systems are therefore vital to ensuring safe incineration. Principally, the incinerator has the capability to reduce the weight of the original waste with an average 80-85% and the volume of trash after being compressed is approximately around 95-96% [9-10]. In addition, it can also save the ever-scarce landfill space [9]. This percentage however will depend upon composition and the degree of material recovery from ash for recycling process. This signifies that though incineration may not completely replace landfills, it may significantly decrease the necessary volume for waste disposal [4, 7], especially in small density where the availability of landfill plots is very limited. Amongst its respective function includes incineration as one of the effective tools in pollution prevention after recycling and resource reduction, since it permanently eliminates toxic organics or organics which may cause environmental pollution. Its relative function commonly utilized is burning waste to boil water. The hot flue gases generated could run steam generators. The energy extracted in the boiler is used for producing heat that leads to the contribution of energy,

processed steam or power, thereby contributing to the reduction of fossil fuel consumption and the emission of CO₂[8-10]. Consequently, to maximize production, efforts have been made by the operators to stabilize their energy production and operate the turbine in the most efficient and effective way. This has resulted in combustion stabilization, leading to emissions control via systematic and effective flue gas cleaning. The basic operation of typical waste incinerator process is further illustrated in Fig. 1.

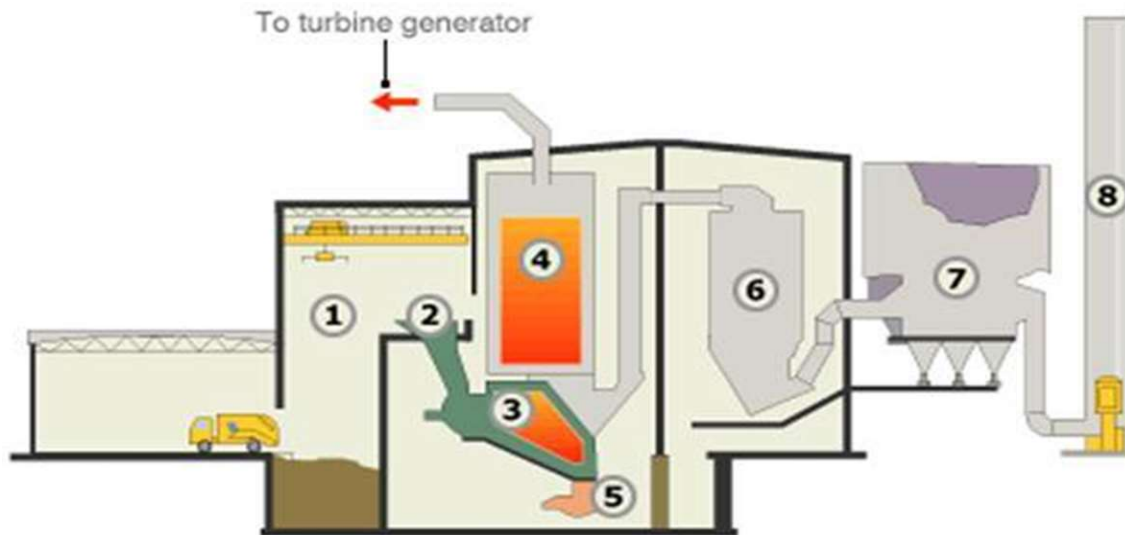


Fig.1. A schematic diagram depicting the common MSW incineration basic process and functions of typical solid waste incinerator [11]

The above diagram depicts the basic process of a typical solid waste incinerator. The process begins with the combustion process: (1) The incoming waste is brought to the waste incineration plant and dumped into the holding area, (2) Waste is then continuously grabbed and dropped into a furnace by an overhead crane. The waste is combusted in the specially designed furnace at high temperatures of $> 850^{\circ}\text{C}$ for more than 2 seconds with sufficient supply of air to ensure complete burning of the waste and to prevent the formation of dioxins and carbon monoxide. Boiler/steam turbine (3) The heat from the combustion is used to generate steam in the boiler. The steam then drives the turbine which is coupled to the electricity generator. From the furnace, the waste is gradually fed into the incinerator. This incinerator runs at a range of temperatures depending on the type of trash being incinerated. The heat from the incineration of the waste is then used to heat up the working fluid (usually water) in the boiler. The steam from this process is then piped to a turbine generator to create

electricity, (4) The flue gases containing fine ash and other toxic vapors then pass through a scrubber reactor. This scrubber treats the flue gasses for acid pollutants such as SO₂ and also dioxins, (5) From the scrubber, the gases can then pass through a fine particulate removal system, which can further reduce the toxicity of the flue gasses in the baghouse, (6) The flue gases are then released through the chimney stack, (7) The leftover burnt waste and heaviest ash fall into a collection area. At this point, an electromagnet can be used to pick up any leftover metals. The ash residues from incineration generally include bottom ash from the furnace and fly ash from the exhaust gas cleaning units. The bottom ash consists of wastewater which can either be reused as construction material or disposed at landfills or recycled. Fly ash is typically stabilized and solidified by reagents (e.g. cement) and disposed at dedicated landfills with continuous environmental monitoring [11-12].

2.2. Incinerating Waste: The Malaysian Experience

In Malaysia, the waste generation rate in big cities such as Kuala Lumpur is continuously rising every year due to the uncontrollable consumption, the increasing population, the attitude towards shopping and the high living standards. Consequently, many cities in Malaysia encounter waste management crisis due to the considerable increase in the volume of waste collection, uncontrolled production and consumption patterns, lack of adequate resources to manage the waste generated. This is followed by various constraints currently existing in Malaysia such as limited landfill sites, immature recycling and biological treatment infrastructures. In view of this scenario, it has prompted the call to find practical solutions and consider reducing a bulk of waste. The proponents of incinerator persistently claim that incineration technology would be one of the most viable, practical methods in treating municipal solid wastes in Malaysia [4]. Similarly, despite the issue being associated with landfilling, in [8] further claimed that the Malaysian government has formed a special committee from the cabinet instructing them to suggest a holistic waste management frame for the country particularly for populated areas. This dedicated committee has proposed and emphasized on the development of incineration facilities in tackling and overcoming this problem.

Currently in Malaysia, the average per capita generation of municipal waste is about 0.85 kg/person/day. In major cities such as Kuala Lumpur, it is estimated that the generation of

waste is about 1.5/kg/person/day [13]. For waste management currently, incineration or “mass burning” is the second mostly used method in Malaysia [1]. This modern system is the common municipal solid waste disposal method globally after landfills. It is one of the most expensive waste treatment facilities especially when equipped with energy recovery and advanced emission control technology. Originally, waste incineration was introduced for volume reduction and hygienic reason [14].

Given the above, a number of incinerators have been operating throughout Peninsular Malaysia. For example, the incinerator in Pulau Pangkor which had begun operation on 19th March 2002. The capacity of the incinerator is for 20-ton waste generation. However, the island generates only 6-7 tons per day. Another incinerator built by Kuantan Municipal Council for research and development (R& D) in the year 2004 had consumed about 120 liters (L) of diesel to incinerate only 1 ton of MSW. Malaysia has another five small scale incinerators built in five tourism spots, with the capacity of less than 100 tons each in Pulau Langkawi (100 ton/day), Pulau Tioman (10 ton/day), Pulau Pangkor (20 ton/day), Cameron Highlands (40 ton/day), Labuan (60 tons/day) and one mass scale incinerator facility with the capacity of 800-1000 tons of MSW per day in Kuala Lumpur [4]. This endeavor was successfully developed by the National Solid Waste Management Department. All these incinerators have no energy recovery except in Pulau Langkawi, capable of generating 1 MW of electricity [4-6, 8]. Conversely, the most comprehensive incineration plant in Malaysia belongs to Core Competencies Sdn Bhd (CCSB), a company established in 2008 located in Semenyih, Selangor and operates based on refuse-derived fuel (RDF) technology. This technology requires more pre-processing steps prior to the actual incineration and involves four major processing steps, namely, physical separation of incombustible materials, reducing moisture, decreasing size and palletizing (to ensure size homogeneity). The power plant is comprised of a single 8.9 MW extraction condensing turbine generator and a 55-ton steam generator. Its boiler operates at a load of 46- ton/hour and delivers 38 tons of steam to the turbine. Another 8 tons is delivered to the processing plant at 338 lb/in² absolute pressure through a pressure-reducing valve to generate hot air for the waste drying step by the secondary heat exchanger. Its actual capacity is 1000 tons of MSW/day and 8.9 MW of electricity generation and is currently operating at 70% of its actual capacity and exports

approximately 5 MW electricity to the grid [8]. The primary purpose of building all these incinerators is to reduce waste going to landfills which has always been the traditional disposing method. All these small incinerators had failed due to faulty design, improper operation, poor maintenance and high diesel usage as well as waste characteristics due to high moisture content of 60% to 70%. They were all designed for western characteristics of waste which is quite different from the Malaysia environment.

Another controversial incinerator project is in Broga, Hulu Langat, Selangor, Malaysia but has received objections and protests from concerned citizens. Due to the high public complains and the large investment needed (USD400 million), this project was thus terminated [15, 5]. The proposed Broga incinerator was a thermal treatment plant for solid waste management. It was designed to treat 1,500 tonnes of municipal solid wastes per day. MSW incinerators are normally fed a mixed waste stream and the combustion of such waste leads to hazardous substances originally present within the waste being mobilized into releases from the incineration plant. In fact, it is a widely acknowledged fact that all types of incineration result in releases of toxic substances in ashes and in the form of gases/particulate matter to the air. These substances include heavy metals, numerous organic compounds such as dioxins, furans and gases such as nitrogen oxides, sulphur oxides, hydrogen chloride, hydrogen fluoride together with carbon dioxide which can cause pollution [5]. Despite of this, in [5] further claimed that considering its merit and advantages as good solid waste management, it is important for Malaysia to also use incinerators for solid waste management in the future. The scholars further outlined the advantages of using this method. Amongst others include incinerators could solve the land deficiency problem to build landfills. Especially for densely populated areas, it is difficult to find space for additional landfills; incinerators could convert waste to energy: incineration plants generate electricity and heat that can substitute power plants powered by other fuels at the regional electric grid and steam supply for industrial customers; It could also avoid the release of carbon dioxide and methane: every ton of municipal solid waste incinerated would possibly prevent about one ton of carbon dioxide from being released to the atmosphere. On top of that, it could produce good by-products: incineration of medical waste and sewage sludge produces an end product ash that is sterile and non-hazardous while the bottom ash residue after combustion has been

shown to be a non-hazardous solid waste that can be safely landfilled or possibly reused. However, for the opponents, this modern technological option for waste management is still being debated especially on its negative impacts [2].

2.3. An Islamic Perspective on Conservation of the Environment

The functions and benefits of generating waste to energy coupled with the Malaysian experience in utilizing incinerator as waste management method has been examined. Following this, the discussion shall further extend on how does Islam believes consistently on promoting to conserve the environment. Literatures stressing on the needs to protect and preserve the environment, specifically under Islamic tenets are enormous. Similarly, Islam has also widely emphasized numerous academic literatures on the environmental ethics. This includes its principles and ethics required in dealing with the environment and the impact upon the failure to preserve them. According to [16], the ecological crisis faced currently warrants for the urgent solution of the environmental ethics. Considering that environmental ethics are essentially closely related with the intrinsic value and beliefs, religions have been getting more recognized to define proper environmental ethics. As a result, all the environmental crisis is due to the failure on the part of the human to comprehend himself and realizing that he is the vicegerent and trustee of the All-Merciful and Bountiful. Also, it is further believed that the separation between the worldly matters and religion may be the core aspect which in turn lead to the environmental crisis [17]. Conversely, worldly living and religion are inseparable as religion is the best element to mould ones' attitude and behavior towards nature, other human beings and all creatures for example animals and plants.

This signifies that Islam is a perfect religion, truth and gives guidance to all mankind. As a perfect religion, its teaching incorporates the relationship between human and God, between human and other humans and human with the environment. These three holistic relationships have always been comprehensively emphasized in primary sources and given due regard in Islam in order to maintain and preserve sustainable development. Reviewing the affirmative evidences also reaffirm that the original concept of sustainable development with special dimension on the environment which includes environmental discourse, healthy environment and ecological balance have already been highlighted in the Islamic teachings. An insight study of this concept in the Qur'an and *Sunnah* also depicts numerous definitive divine

injunctions (*nusus*) that nuance on conservation of the environment and the role of mankind in maintaining it. The concept of vicegerency (*Khalifah*) plays the main function upon the creation of a human. As a vicegerent, humans bear responsibility to manage, administer and protect the earth to the fullest endeavor. Human and nature have the right to a healthy environment and sustainable development. Thus, the principles of moral basis and ethics to deal with the environment have already been provided under the auspices of Islamic teaching. An overview of the basic concepts of environmental ethics and approaches, certain Islamic principles and perspectives on environmental ethics in the lights of Quranic verses and Hadith are significantly pertinent to further be examined. In [17] argues that the concept of debtor and creditor exists between God and servant. While God is the real owner, the creditor who encompasses everything, and to Him, human owes its existence. Everything in the universe is created by God and has been specifically declared in the Quranic verse:

“There is no God but He, the Creator of all things”

(Surah Al-An’am, 6:102)

“And whatever in the heavens and whatever is in the earth is Allah’s and Allah encompasses all things”

(Surah al-Maidah, 4:126)

The same view has been shared by [18], the *Qur’an* uses an environmental theme in exhorting humankind to be moderate. It has been stated from the imperatives laid down in Qur’an:

“It is He who produces gardens, both cultivated and wild, and palm trees and crops of diverse kinds and olives and pomegranates both similar and dissimilar. Eat of their fruits when they bear fruit and pay their dues on the day of their harvest, and do not be profligate. He does not love the profligate.”

(Surah al- An’âm, 6:141).

In addition, the Qur’an refers to the creation or the natural world as signs (*Ayat*) or also known as a symbol or proof of Allah’s divinity. The Qur’an is proof of Allah and so likewise is His creations. Human is then responsible for taking care, preserving and maintaining the nature and all its segments associated with it, according to God’s command [16-17]. This denotes that comprehensive environmental ethical approach between human-nature interaction has already been established. Similarly, many verses from the Quran repeatedly

urge for respecting and reflecting on Allah's glory in His creation and this is evident from various Quranic verses in place. For example:

“The seven heavens and the earth and all beings therein, declares His Glory: There is not a thing but celebrates His praise.”

(Surah al-Ahzab, 33:72)

Following this, the underpinnings of Islamic principles concerning nature and the environment are very closely related to the understanding of humanity. Thus, the established concept of environmental ethics incorporates; The *Principles of Unity (Tawheed)*, *Principles of Trusteeship (khilafah)* and *Principles of Responsibility*. This tawhidic concept exemplifies the oneness and unity of Allah as this affirms the interconnectedness of the natural order and the recognition that there is one, absolute transcendent Creator of the universe [18-19]. To confirm this, the Qur'an elucidates:

“To him belongs whatever is in the heavens and the earth, all obey His will and it is He who originates creation.”

(Surah al-Rum, 30:25)

Within the Islamic worldview, the Principles of Trusteeship (Khilafah) denote that Allah has passed the whole of creation to humans by virtue of the trust placed on them. Deriving its term from the root of Khalafa which means 'followed' or 'succeeded'. Allah further says:

“It is He Who appointed you Khalifs on this earth”

(Surah al-An'am, 6:167)

On the other hand, the principle of responsibility denotes the context of *Khalifah* which is closely connected with trust (amanah) that has been vested to humans. Thus, as Khalifahs, humans must fulfill the trust placed on him and act accordingly to Allah's will and injunctions, avoid injustice against Allah's earth and His creations. The Quran further speaks:

“For He it is Who has made you Khalifa on earth, and has raised some of you by degrees above others, so that He might try you by means of what he has bestowed on you. And thereupon We made you their Khalifa on earth, so that We might behold how you act”

(Surah al-An'am, 6:165)

In addition, it summarizes the roles that human should have with nature, i.e. as nature's manager and user. In one hadith, Abdullah ibn Umar reported that Rasulullah SAW uttered:

“Every one of you is a shepherd and is responsible for his flock. The leader of people is a guardian and is responsible for his subjects. A man is the guardian of his family and he is responsible for them. A woman is the guardian of her husband’s home and his children and she is responsible for them. The servant of a man is a guardian of the property of his master and he is responsible for it. No doubt, every one of you is a shepherd and is responsible for his flock”

(Sahih al-Bukhari 6719, Sahih Muslim 1829)

Given to the above, it is submitted that the three central concepts of Islam i.e. concepts of *tawhid*, concept of *Khilafah* (man’s vicegerency) and *amanah* (trusteeship) are the pillars of the environmental ethics of Islam. Hence, for supporting a holistic approach in order to conserve the environment, all these elements are an integrated body. A combination of the concepts including *tawhid* (oneness of Allah), *khilafah* (vicegerency) and *amanah* (trust) in the sustainable management of natural resources in the environment, while developing the society that supports the Islamic perspective of conservation of environment [20]. The encompassment of all creations by Allah SWT revealed that all things have originated from one source. Within this comprehensive framework, the spirit of human nature is thus existing and we are obliged to prevent the natural environment from degradation. Furthermore, certain general principles in the Qur’an have generally outlined that our planetary system, the earth and its ecosystems work and circulate within their own limits and tolerances. Likewise, within the above framework, it denotes that Islamic teaching has also set a limit and boundaries of human behavior to avoid excessive demand and utilization of natural resources [18]. Similar view has also been pointed out by [21] where he diligently promotes the concept of development and environment are interdependent. Despite the requirement for development, the element of environment sustainability should be adopted as a guiding principle, while the impact of such development on the environment must be given due consideration. It is therefore necessary to examine each of these aspects of the environment and development in Islam.

On the other hand, in [17] further added that conservationism and preservations are associated with resources. In conservationism, various elements of the environment need to be protected only when they have economic value, whereas in preservationist it rejects strict economic

valuation of nature by upholding the natural preservation to ensure the diversity of species and maintaining beautiful natural resources. Under the principles of land ethics, there is a need to act upon conscience between people, encouraging respect for his fellow members and respect for the community. Also, it enlarges the boundaries of the community to include soil, water, plants, animals and collectively, the land as biological mechanism. Therefore, there is a need to preserve the integrity, stability and beauty of this biotic community without infringement. To achieve this, some crucial factors in environmental conservation need to be observed and conceived. These include rejecting any irresponsible domination over the earth. Although human beings have superiority over other living organisms, but this should be accompanied by following God's command and acting with good behavior towards other creations. Allah SWT has precisely mentioned in one verse:

“Behold, thy Lord said to the angels: “I will create a vicegerent on earth”. They said: “Wilt thou place therein one who will make mischief therein and shed blood?- whilst we do celebrate Thy praises and glorify Thy holy name)?”. He said: “I know what ye know not.”

(Surah al-Baqarah, 2:30)

Humans have to accept responsibility towards nature and exercise trustworthiness upon the entire universe; conserving and improving the environment is another crucial element because the human being is not merely responsible for conserving God's creations, but also has responsibility for improving the natural environment. Furthermore, it is obligatory for humans to avoid overexploiting natural resources as it can bring destruction and damage to living organisms. Necessary steps to safeguard the environment and combat climate change are essential in delivering sustainable development. To this end, Islam provides general framework for the sustainable utilization of the natural resources, particularly water, trees and animals [21]. Of this, it has been mentioned in the Qur'an:

“When he turns his back, His aim everywhere is to spread mischief through the earth and destroy crops and progeny. But Allah does not love mischief-making.”

(Surah al-Baqarah, 2:205)

Similarly, deleting any inner self causes environmental crisis, which is caused by lustful desire. As a consequence, environmental degradation is the impact resulting from the forgetfulness to Allah SWT. Allah SWT states to the effect that;

“And be not like those who forsake Allah, so He made them forsake their own souls; these it is that are the transgressors”.

(Surah al-Hasyr, 59:19)

Above all, humans must manage these resources in a sustainable manner through the conservation of the environment to ensure it will render benefits for the future generation. Duties conferred on man to ensure a sustainable society based on the special position of *khilafah* endowed with shall be duty bound to follow as we are accountable and answerable for unreasonable and extravagant use of natural resources.

2.4. Incinerating Waste: An Islamic Outlook within Jurisprudential Principles Framework

The main purpose of this study is to examine whether introducing an incinerator for waste management is viable and sustainable option from the Islamic point of view. It is to be noted that globally, millions of tons of municipal solid waste (MSW) are generated every day. Solid waste is more easily recognised which includes all unwanted or unusable items, by-products from end-users, remains as well as household, residential and industrial garbage. Urban waste management is drawing increasing caution, as it can easily be observed that too much garbage is thrown in the streets, causing inconveniences, environmental pollutions and posing a public health risk. The higher the material turnover and the more complex material are produced, the more challenging it is for waste management to protect man, environment and resource conservation.

From the Islamic perspective, a number of jurisprudential principles can be invoked to show the seriousness of Islam in protecting the environment by whatever means which result in benefits for individuals and society. One of the principles that can be referred is the doctrine of *maslahah*. According to [22], *maslahah* consists of considerations which secure a benefit or prevents harm but are in the meantime, harmonious with the objectives (*maqasid*) of the *Shari'ah*. These objectives consist of protecting the five essential values namely religion, life, intellect, lineage and property. Any measure which secures these values falls within the scope of *maslahah*, anything which violates them is *mafsadah* (evil) and preventing the latter is also *maslahah*. Thus, the use of incineration to resolve the waste management problems could be considered as a great *maslahah* as it will avoid problems relating to open dumping waste or

uncontrolled waste management which is detrimental to health and life.

In determining the *maslahah*, the authority is subject to specific guiding principles. The most important is legal maxims, which consist mainly of a statement of principles derived from a detailed reading of the rules of *fiqh* on various themes [23-24]. One of the examples of legal maxims that can be referred is, “harm must be eliminated” (*al darara yuzaalu*) (Ibn Nujaim, 1980). It is a derivative in turn of the renowned *hadith*(*la darara wala dirara*), which means “let there be no infliction of harm or its reciprocation” [25]. The maxim indicates the importance to remove all kinds of harm whether it involves individual, society or the environment.

With regards to the *darar* (harm) of uncontrolled urban waste management, numerous studies have been conducted. An ecology study by [26] for example, reported an excess of cancer deaths in the provinces of Naples and Caserta (196 municipalities). This high level of cancer mortality in the area can be linked to the level of pollution caused by inadequate waste-control methods and illegal dumping. A geographical study pointed out a very high statistically significant increase of mortality for liver cancer in females (SMR = 181.13; lower limit of 95% CI > 100) in a municipality characterized by multiple dumping sites. The study also pointed out a statistically significant increase of mortality for lung cancer, especially for females in two out of three municipalities. Similarly, a study by [27] showed an increase of mortality for larynx cancer in three municipalities characterized by multiple dumping sites. For those living near to landfill, children are at a higher risk than adults for long exposure to hazardous substances produced. Open dumping of municipal solid waste, deteriorating soil quality and decrease in vegetation abundance are grave consequences of it. Scientifically, it has been proved that open waste dumping contributes to soil contamination and effects plant diversity [28]. Thus, according to Islam, all the *darar* (harm) resulted in uncontrolled waste management should be eliminated to preserve the wellbeing of the individual and society.

Another relevant maxim is *al darar al asaddu yuzalu bil ahaffu* i.e “a greater *darar* is eliminated by tolerating a lesser one” or “the greater harm is removed by a lesser one” [29]. This maxim provides whenever there is a clash between greater harm and lesser harm, the lesser harm should be tolerated as it has lesser impacts compared to the greater harm. The maxim recommends the authorities to take precautionary measures in introducing any policy

so as to avoid greater effects or long-term effects. With regards to waste incineration, even though a few studies show some disadvantages of using it [30-31], the implications of having uncontrolled waste management is much greater. Thus, it justifies the use of such modern methods.

The other related maxim is *tasarraful imam a la al raiyyati manutun bil maslahah* [29], which means that “the affairs of the imam concerning his people are judged by reference to *maslahah*”. The maxim affirms that in fulfilling the duty, the authority should give the priority to the welfare (*maslahah*) of the people. Relating to the waste incineration, studies proved important significant *maslahah* from its implementation. Study by [14] for example had shown that together with prevention and recycling measures, waste to energy (WTE) facilities contributes significantly to reaching the goals of waste management. Sophisticated air pollution control (APC) devices ensure that emissions are environmentally safe. Incinerators are crucial and unique for the complete destruction of hazardous organic materials, to reduce risks due to pathogenic microorganisms and viruses and for concentrating valuable as well as toxic metals in certain fractions. Bottom ash and APC residues have become new sources of secondary metals, hence incineration has become a materials recycling facility too. WTE plants are supporting decisions about waste and environmental management. They can routinely and cost effectively supply information about chemical waste composition, as well as about the ratio of biogenic to fossil carbon in MSW and off-gas. Thus, since it is scientifically proven that there are many benefits (*maslahah*) from waste incineration compared to other methods such as landfills, the Malaysian authority should choose it as a main method to dispose waste.

The other Islamic jurisprudential principle that can be applied is the concept of *siyasa shar'iyah* (*Shariah-oriented policy*). The using of waste incineration is justified by the doctrine of *siyasa shar'iyah*, which authorises the authority to determine the best method of waste disposal. In this doctrine, the authority may accordingly take discretionary measures, enact rules and initiates policies as they are deemed in the interest of good government, provided that no substantive principles of the *Shariah* is violated [23]. This *siyasa shari'yyah* denotes administration of public affairs with the aims of realizing the interest of the people and preventing them from disruption, which is in harmony with the general

principles of *Shari'yyah* [32]. This maxim is important especially for the authority to implement waste incineration, as it is proven that the technology is necessary for viable and sustainable waste management.

3. CONCLUSION

From the above discussion, this study submits that destruction and degradation of environment crisis due to the growth of industrialization and human activities towards developing countries are inevitable. Even so, there is no technology that is risk-free. However, it could be safely and effectively employed with a minimum risk assessment by handling with proper, effective as well as efficient design and operation. Above all, it can be concluded that the planning of the waste management is an important task which involves not only logistical planning and scientific knowledge but also a religious understanding in order to balance the impact on the environment and the effectiveness of the process. Despite the two-conflicting interest involved, the *Shariah* has prescribed comprehensive guidelines on how to conserve the environment. Furthermore, three established *qawaid fihiyyah* principles underlying specific Islamic legal maxims could be used as a guideline in handling this issue. This include *The interest of the community takes precedence over the interests of the individual. Relieving hardship takes precedence over promoting benefits. A bigger loss cannot be prescribed to alleviate a smaller loss and a bigger benefit takes precedence over a smaller one.* Conversely, a smaller harm can be stipulated to avoid a bigger harm and a smaller benefit can be dispensed within preference to a bigger one. As earlier observed, Islam promotes every measure that brings about benefit to mankind. Thus, it is further suggested that incineration offers a viable choice and amongst the sustainable option for waste management compared to other methods for its valuable benefits and efficiency gained. A centralised system of waste treatment will thus ensure the benefits and public interest (*Maslahah mursalah*) of the society at large are well-preserved.

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