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Assessment of Incineration Plants and Autoclave by Rapid Impact Assessment Matrix Method

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Using method to disinfect hospital waste in Gillan province because of population density and high groundwater levels as well as touristic area, the pollutions and controlling them need special management and planning. This research is cross sectional in terms of studied time and it is applied in terms of purpose. The studied population is governmental hospitals of Gilan province. The effects were studied by identifying health and environmental, biology and ecology, social and economic standards, use of incinerator and annihilator under the various scenarios and by using survey of related professionals and experts and then by using quickly assess matrix method. Results related to the chemical physical environment showed that the annihilator system with 12 negative scores has more negative effects compared with 4 negative scores of incinerator .But an incinerator is more important due to huge negative impacts on the air quality. Biological and ecological consequences showed annihilator system has more chance with 3 negative scores compared with 20 negative scores of incinerator. Diagram related to socio-cultural components showed that annihilator with 73 positive scores has better place compared with 37 positive scores of incinerator. Annihilator system is more acceptable economically from the point of view of experts, although it has 34 negative scores but economically it is more affordable compared with 47 negative scores of incinerator.

Key words: Incinerator system, Annihilator system, Hospital wastes, Environmental pollution.

Today different environmental crises such as the destruction of the ozone layer, global warming, destruction of plant and animal,destruction of habitats of creatures and pollution of natural resources such as water, soil and air due to the arrival of various contaminants have been wider that jeopardize human and other creatures' life seriously. To achieve sustainable development the earth should be taken care of more than before and meanwhile protecting the environment, natural resources should be used rationally and sensibly.

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One of problems that have been created due to urban and industrial development is producing waste in different shapes that unfortunately bad management in many developing countries has created serious problems for human and other creatures through incorrect disposal of wastes. Because of this, choosing applicable and comprehensive methods in the field of collecting, controlling, treatment and disposal of solid, semi-solid and liquid waste seem necessary. The subject of waste disposal and especially dangerous ones in big cities is very complicated and expensive. According to the reports which have been proposed in earth conference, world population is estimated to be reached to 8.5 billion in 2025 and total waste generated by human will reach to 5 times more than 1992. Therefore the subject of managing

solid waste is discussed that is choosing techniques, technologies and management programs for achieving solid waste management goals in which the goal is protecting environment and controlling the pollutions derived from these materials.

Despite the reality that healthcare centers wastes includes only 1% of whole wastes, because of their dangerous nature that consists of pathogenic microorganisms are more important than other wastes and can cause the pollution of environment and health disasters in case the lack of correct planning. Therefore, how to control and disinfecting, collection and transportation and disposal should be highly noticed and using methods that are more acceptable in terms of health and environment, these wastes should be managed.

Nowadays different methods have been proposed for solving hospitals waste disposal problem that each one has special process as well as special operational problems. General principles and fundamental techniques of these methods include: autoclave, radiation, ultraviolet (UV), microwave, chemical disinfection, incinerationand, sanitary burial. Choosing system depends on achievable goals. The main and initial aim is disposing large volume of waste and beside that if there were other interests, that method would be more noticed.

In managing urban waste, incineration is one of waste disposal methods and incinerators are systems that are used in order to this. The heat generated in these utilities for generating steam and following that district heating or power and energy generation, can be recycled. One of the most striking features of incineration process is that it is designed for working in high temperatures as result there will be the capability of reaching wastes to less than 5% of initial value (more than 95% of conversion). Although incinerators' technology has been developed in two recent decades but the subject of air pollution has been still remained as a main problem in constructing and using that.

Acceptable attention was not performed in the field of solid wastes management before the adoption of the law of waste in 2004 in our country, and traditional and wrong methods were used for the collection and disposal of solid wastes in most cities, but important steps have been taken in this way in recent years with legal requirements and provide governmental facilities.

Health care centers have been established many scattered and provide varied healthcare services that cover a small hospital to a large hospital in Gilan province with an area of 14044 square kilometer. For the same ratio, quantity and quality of produced wastes is also very different at these centers.

One of the biggest problems in management of hospital wastes in Iran and in Gilan province is incorporation of special wastes with other safe wastes inside the hospital center and this matter makes very costly the safe-making process of these wastes.

It is needed to more investigations in the field of comparison safe-making methods and disposal; summary of conducted researches is as follows: Torabifard (2007) in a research named investigation and comparing environmental and health dangers in incinerators and sanitary burial that its results have been mentioned in national Conference on Waste 2007, states that in a suburb community sample that live around burial and burning location, none of special effects on human health (the factors causing cancer, liver diseases, damaging neural systems, mutational effects on reproduction) can be expected but there certainly are problems because of foul-smelling environment around burial location and lowering the quality of neighborhood air. In a research by Asgharinejad in 2006 named calculating and mathematical simulation of solid waste incinerator, the researchers has investigated thermal value of Tehran urban wastes based on Dolang models and it has been identified that urban wastes are capable of being burned by incinerator without helping fuel.Mardani (2007) in a research stated that the share of incinerator in air pollution is very low rather than other air pollutants. Paraschiv and et al (2015) in a research named "New energy value chain through pyrolysis of hospital plastic waste" states that changing the reactor scale does not result in significant differences in pyrolysis product distribution, neither in gas composition. On the other hand, the aspect and the quality of condensable fraction display a high variability. Also, the energy contained in the final valuable pyrolysis product was compared with the energy

demand during the thermochemical transformation in order to evaluate the energy efficiency of the process. Chen and et al (2012) in a research named "Key Issues Study on the Operation Management of Medical Waste Incineration Disposal Facilities" states that this paper, according to the characteristics of the medical waste incineration technologies and processes and on the basis of

Table 1. Rating Summary of annihilator item assessment matrix

Environmental situation	-E	-D	-C	-B	-A	N	+A	+B	+C	+D	+E
Physical-chemical environment	3	13	6	7	19	10	4	7	8	8	6
Biological - Ecological	-	-	1	3	18	12	3	2	4	6	4
Socio-cultural	-	4	2	6	16	14	12	23	16	32	16
Economic	-	23	7	28	17	7	9	16	10	6	-
Total	3	40	16	44	70	43	28	48	38	52	26

Table 2. Rating Summary of incinerator item assessment matrix

Environmental situation	-E	-D	-C	-B	-A	N	+A	+B	+C	+D	+E
Physical-chemical environment	9	8	7	9	6	17	6	12	11	14	-
Biological - Ecological	1	5	1	6	16	6	4	3	-	2	-
Socio-cultural	3	14	8	5	13	9	21	8	15	28	8
Economic	2	22	12	29	15	4	2	7	14	8	2
Total	15	29	28	49	50	36	33	30	40	52	10

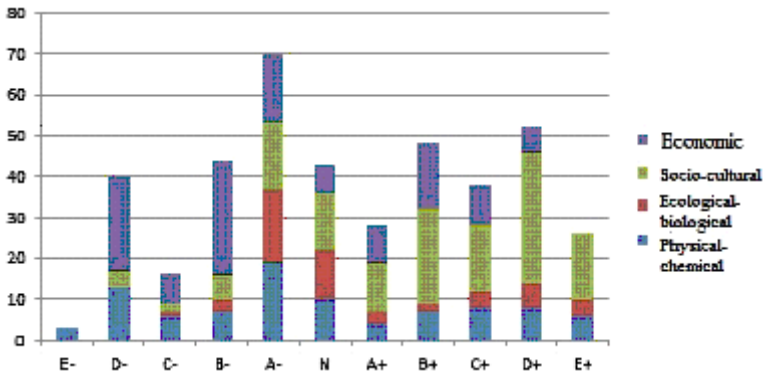

Fig. 1. The summary of annihilator item assessment matrix

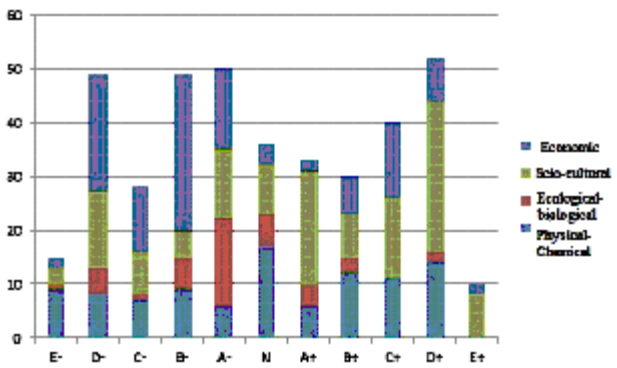

Fig. 2. The summary of incinerator item assessment matrix

systematically analyzing the pollutants generation nodes and release characteristics during the incineration disposal of medical waste, discusses key problems and contents to be highlighted concerning the operation management of medical waste incineration facilities from the perspective of pollution control by combination with our current main problems with regard to this, proposes to improve the capability of operation management of medical waste incineration facilities on the basis of full use of the best available technology and puts forward appropriate countermeasures for the facilities operation around the source classification, process control, performance control, supervision and management and other aspects.

Effective control of generated infectious medical wastes in the form of management and monitoring system based on the international rules and principles is one of the appropriate solutions in the framework of establishing the ideal hygienic conditions in the health and care centers.

Therefore the current research aims to investigate autoclave methods and hospital waste disposal by incinerators (the advantages and disadvantages of each one), compare disinfecting and incinerators methods through rapid influences assessment matrix and propose optimum option for disinfecting and disposing hospital wastes of Gillan and reformation solution in current management situation.

Research hypotheses

- Annihilator is the best option for disposing hospital wastes in Gillan Province.
- Locating studies are necessary for the establishment and construction of central waste incinerators.
- Disinfecting installing is necessary in each hospital.

Methodology

Research method was survey.In terms of study time, this research is sectional and in terms of goal is applied one. study population includes government hospitals in Gillan in 1391. The situation of wastes and hospital wastes' management were first investigated through library and internet studies then different sections of incinerator's equipment such as air pollution controlling units, wastes' thermal value and hospital wastes' combinations and output gases standards were studied. Different options of hospital waste disposal will be investigated and compared. Through identifying environmental-health, biological and ecological, social and economic criteria, the application of incinerator and annihilator under different scenarios will be studied using surveying experts and specialties and then by rapid influences assessment matrix (RIAM). Measurement tool was a researcher made questionnaire. This questionnaire was given to 13 experts in different sections including stakeholders and influential people and their ideas are taken into consideration. These groups include: 1-enforcement and custodian system: Gillan medical university, health experts of governmental hospitals environment; 7 people, 2- monitoring system: environment organization; 3 people, 3-academics: professors and students; 3 people.

Research findings

Considering the diagram above that states the results obtained from environmental evaluation of annihilator system, it can be said that: This system has positive effects in the social and cultural field (green columns). The most negative effects of this method are related to economic field (purple columns).There are few negative effects in ecologic and biologic field (-A). The only big negative effect (-E) is in using annihilator system physically and chemically.

Considering the diagram and table above that states the results obtained from environmental evaluation of incinerator, it can be said that: The most positive effects of incinerator are related to social-cultural fields. The most negative effects of incinerator are in economic field and somehow physical and chemical field. The biggest negative effect is related to physical-chemical effects. The big positive effect of this system is in the social and cultural field.

CONCLUSION

Since the beginning of ninth government, the policy of health ministry has been based on using annihilator systems instead of incinerators in Gillan that have very low technology. Nowadays most of hospitals in Gillan are using or installing disinfectors.

The results obtained from surveys shows the preference of annihilation method rather than incineration. Among selected criteria for assessing

annihilator and incinerator, all criteria except chemical-physical components preferred annihilator.

One of main reasons for low acceptance of incinerators is negative mentality of interviewee experts about gas pollutants and the smoke of incinerators.

The obtained results out of case comparison of environmental items of two annihilator and incinerator systems are as follows: the diagram related to chemical and physical environment shows that annihilator system with 12 negative scores compared to 4 negative score of incinerator has more negative effects but the incinerator is more important because of big negative effects on air pollution. related diagram to biological and ecological consequences shows that annihilator system with 3 negative scores compared to 20 negative scores of incinerator is more accepted. related diagram to social, cultural components shows that the most scores belong to this section. Due to this, annihilator with 73 positive score compared to 37 positive scores of incinerator has better position. Big positive effects of public acceptance in annihilator are significant. in this terms also annihilator system is more accepted according to experts, although it has 34 negative scores, but compared to 47 negative scores of incinerator is economically more affordable.

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