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MANAGEMENT OF COLLECTION, TREATMENT AND DISPOSAL OF HOSPITAL WASTEWATER - CASE STUDY: HAMADAN AND KERMANSHAH PROVINCE` HOSPITALS (2014)

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Abstract

According to environmental standards, treatment and disposal of hospital wastewater consider as a necessary action, so this study aim to survey collection, treatment and disposal of Hamadan and Kermanshah Province` Hospitals in 2014. This is a cross-sectional research which it`s population include 19 public and private hospitals in Kermanshah and 16 public hospitals in Hamadan. Tools and methods for data collection was set through the checklist which includes 18 items, the first 7 items are about general properties of hospital and rest of the items are about hospital`s treatment and it`s wastewater disposal condition. The checklist was fallen out in-person. Finally, the data showed through tables and description diagrams. Results demonstrate that among total 19 hospitals in Kermanshah state, seven hospitals (36.84%) have active wastewater treatment plant, five of them (26.1%) have inactive ones and the other seven hospitals (37.5%) do not have wastewater treatment system. About 16 hospitals of Hamadan, six of them (37.5%) have wastewater treatment and the other ten hospitals (62.5%) do not have wastewater treatment system, and the raw wastewater in these hospitals enters to absorbing well, septic tank or urban wastewater collection systems. Consider to environmental and health problems of discharging hospital wastewater without proper treatment, lack of active wastewater treatment plant in 12 hospitals (63.15%) in Kermanshah state and 10 hospitals (62.5%) in Hamadan state is a serious concern. So in order to

implement the necessary standards in a hospital and establishment of an environmental management system (ISO 14000) for setting a management processes to improve the quality of hospital wastewater disposal, some actions such as obtaining policy for construction of wastewater treatment in every single hospital and operate it by organization and wastewater experts, raw and treated wastewater chlorination to reduce entry pollution into collection systems and wastewater treatment plants, adequate supervision by health authorities, water and wastewater organizations and other related organs could be really effective.

Keywords: management, collection, treatment, disposal, hospital wastewater, Hamadan state, Kermanshah state.

Introduction

Along developing of cities, decreasing their population and expanding of industries, environmental pollution control is getting more and more important every day. Wastewater is one of the environmental pollutants which it needs sanitary collection and treatment and returning into the water cycle in nature if it possible (1-3).For some reasons hospital wastewater compares to urban wastewater is more special (4, 5). Hospitals consume a significant volume of water in any community, according to water consumption per capita, which approximately is 100-200 Liter per day for a person; generally, it is reported 350-1400 Liter per day for a bed in hospitals though (6,7). It has to mention that hospital wastewater generation is various in different communities. Wastewater generation capita in American hospitals is estimated 1000 Liter per day for a bed (8). Moreover, it is 745 Liter per day for a bed on average in Iran, as in Tehran hospitals for small hospitals (up to 400 beds) is 1300 Liter and for large hospitals (up to 1000 beds) is 750 Liter and it is 362 Liter on average in Hormozgan state`s hospitals for each bed (9,10). Hospital`s effluent may include various pathogenic microorganisms, drugs, dangerous toxic materials, solid wastes, radioactive material and radioactive isotopes. Discharging and entering these materials into human`s environment, specially surface and underground water, make great problems and hazards for human. Therefore, it is necessary to have accurate information and do necessary measures to prevent entering hospital wastewater without treatment into environment, surface and underground water, which cause pollution that lead to spread diseases among healthy people of community. Virology researches about water which polluted by wastewater, prove the presence of Enteroviruses and other kind of viruses like Adenovirus in hospital wastewater. In addition, some surveys prove the presence of chlorine and heavy metals such as mercury and silver (11,12). In another research determinate chlorinated organic compounds` concentration up to 10 mg/l (6). Other studies

emphasize the presence of chlorinated organic compounds and drugs (without any removal or treatment by conventional wastewater treatment systems in hospitals) in surface and underground receiving water (12,13). In order to provide more water from underground resources for drinking water in recent years, enter hospital wastewater into surface and underground water and not control pollution lead to spread of diseases and impose high costs for community and related organs (14-17). Therefore, using a systematic method for collection and treatment this kind of wastewater is necessary. Moreover, if hospital wastewater is entered to wastewater collection system and then into wastewater treatment plant it will causes problems like disturbing biological system balance in wastewater treatment plant (15,18). According to above mentioned hospital wastewater treatment and disposal based on environmental standards is a necessary action. Therefore, this study aim to survey of collection and treatment wastewater generated by Kermanshah and Hamadan states` hospitals and if there is a problem, corrective actions and interventions will propose.

Material and Methods

This is a cross-sectional research, at first to identity wastewater treatment and disposal condition, after coordination with the authorities of the hospital and then visit the hospital, a checklist used for collecting data from 19 (1 public and 18 private hospitals) in Kermanshah and 16 (public hospitals) in Hamadan (2014). The checklist includes 18 items that the first 7 items are about general properties such as hospital location, hospital type, establishment year, ownership, etc. Next 11 items are about hospital`s wastewater treatment and disposal condition (include raw wastewater`s receiving source, existence or absence of wastewater treatment plant, type of wastewater treatment system, the causes of defective in wastewater treatment system, etc.). The validity of the checklist checked out according to considered objects and components. Also, specialty in questions and match the checklist question with objects of research was perused by professors in department of environmental health engineering and their corrective comments about the structure of checklist`s questions was applied. Then results presented in descriptive tables with Excel software.

Results

Tables number 1 and 2 show general properties of public and private hospitals in Kermanshah and Hamadan, respectively. Table number 3 presents the operation condition of wastewater treatment in Kermanshah and Hamadan states` hospitals. According to results demonstrated that the main reasons of inactivity in disable refineries are defective in facilities, structural defects and absence of expert operator.

Table-1: General properties of public and private hospitals in Kermanshah (2014).

Hospital code	City location	Type of hospital	Established year	Hospital ownership	Total number of beds	Number of active beds	Green spaces` irrigation source	Raw wastewater receiving source
A	Ghasreshirin	General and professio	1997	public	96	30	Other resources	Enter to wastewater collection system directly
B	Javanrood	General	2000	Public	78	78	Private well	Contains Proprietary treatment system
C	Paveh	General	2005	Public	70	52	Water distribution	Enter to wastewater collection system
D	Harsin	General	2004	Public	80	36	Private well	Absorbing well
E	West eslamabad	General	1988	Public	120	120	Private well	Contains Proprietary treatment system
F	Kangavar	General	1967	Public	76	59	Water distribution	Enter to wastewater collection system
G	Sahne	General	1948	Public	45	25	Private well	Enter to wastewater collection system
H	Sarpolzahab	General	2008	Public	96	46	Private well	Septic tank
I	Kermanshah	Professio nal	2006	Public	515	700	Private well	Contains Proprietary treatment system
J	Kermanshah	General	1979	Public	130	110	Water distribution	Enter to wastewater collection system
K	Kermanshah	professio nal	1999	Private	215	215	Water distribution	Contains Proprietary treatment system
L	Kermanshah	Professio nal	1979	Public	220	162	Private well	Enter to wastewater collection system
M	Kermanshah	professio nal	1999	Public	154	154	Private well	Enter to wastewater collection system
N	Kermanshah	Professio nal	1969	Public	80	80	Water distribution	Enter to watercourse in back of the
O	West gilan	General	2006	Public	60	29	Private well	Contains Proprietary treatment system
P	Kermanshah	Specialist	2011	Public	107	84	Water distribution	Contains Proprietary treatment system
Q	Kermanshah	Professio nal	2005	Public	220	220	Water distribution	Enter to wastewater collection system

R	Kermanshah	Professio nal	1981	Public	250	250	Water distribution	Contains Proprietary treatment system
S	Songhor	General	2011	Public	96	96	Private well	Contains Proprietary treatment system

Table-2: Show general properties of public and private hospitals in Hamadan.

Hospital code	City location	Type of hospital	Established year	Hospital ownership	Total number of beds	Number of active beds	Green spaces` irrigation source	Raw wastewater receiving source
A	Bahar	General	2005	public	32	21	Private well	Absorbing well
B	Razan	General	1997	public	100	100	Private well	Septic tank
C	Asadabad	General	1984	public	111	47	Private well	Contains Proprietary
D	Hamadan	General	2006	public	1500	`1500	Private well	Contains Proprietary
E	Asadabad	General	2007	public	82	64	Water distribution	Contains Proprietary
F	Malayer	General	2008	public	98	98	Water distribution	Contains Proprietary
G	Nahavand	General	1991	Public	170	128	Private well	Contains Proprietary
H	Kabudar-Ahang	General	1996	Public	78	78	Private well	Enter to wastewater
I	Toserkan	General	1976	Public	150	94	Private well	Enter to wastewater
J	Hamadan	General	1969	Public	220	220	Private well	Enter to wastewater
K	Hamadan	professional	1932	Public	200	120	Private well	Enter to wastewater
L	Hamadan	professional	2007	Public	150	100	Water distribution	Enter to wastewater
M	Hamadan	General	1977	Public	100	60	Private well	Enter to wastewater
N	Hamadan	professional	1974	Public	300	118	Private well	Enter to wastewater
O	Malayer	General	1995	Social security	160	130	Water distribution	Enter to wastewater

P	Malayer	General	1995	Public	164	164	Water distribution	Enter to wastewater

Table-3: The operation condition of wastewater treatment in Kermanshah and Hamadan Province hospitals.

Variable		Kermanshah Province		Hamadan	
		Number	Percent	Number	Percent
Wastewater treatment	Existence	12	63.15	6	37.5
	Absence	7	36.85	10	62.5
	Total	19	100	16	100
Wastewater treatment	Active	7	58.33	5	31.25
	Inactive	5	41.66	11	68.75
	Total	12	100	16	100
Wastewater treatment system`s	Hospital	12	100	4	66.67
	Private sector	0	0	2	33.33
	Water and wastewater	0	0	0	0
	Total	12	100	6	100
Hospital`s wastewater treatment system type	Conventional activated sludge	6	50	5	83.33
	Septic tank	3	25	1	16.67
	Activated sludge with extended	3	25	0	0
	Total	12	100	6	100

Discussion

According to results, among the 16 hospitals in Hamadan and 19 hospitals in Kermanshah, just 6 (37.5% of total) and 7 (36.84% of total) hospitals, respectively, contain active wastewater treatment plant to remove the hospital wastewater pollutants. Rest of the hospitals enter their wastewater into wastewater collection system without removing it`s dangerous pollutants. In order to discharge of hospital wastewater into environment and urban wastewater system that lead to many hazards, so lack of active wastewater treatment plant in 12 hospitals in Kermanshah (63.25%) and 10 hospitals in Hamadan (62.5%) is a serious concern.

Consider to high pollution and existence of multiple compounds such as not metabolized drugs, antibiotics, disinfectants, systolic factors, radioactive materials, contrast supplier, X-Ray and other hazardous and persistent materials need to treatment before discharging, because hospital wastewater contains some material, which cannot be removed even by conventional wastewater treatment plant (19). In the other hand, hospital wastewater contains high risk factors for human

health and environment, for instance high concentration of pathogens, toxins and disinfectants, ionizing isotopes, drugs, contaminated liquids, patient`s blood and etc. So if this wastewater enter to collection system and wastewater treatment plant without any treatment can lead to disturb the wastewater treatment plant`s balance and will make a lot of hazards for personnel and refinery`s operators (8). Studies by Ghanazade et.al and Dehghan Kong Zeiton et.al confirm this subject (19, 20). Studies in Iran by Samaei and Mokhtari in 2008, emphasis on using more advanced methods in wastewater treatment to remove pollutants like detergents from hospital wastewater (21). According to results, even chlorination does not perform in hospital wastewater (in none of hospitals with lack of wastewater treatment system and in some of hospitals include wastewater treatment system) before discharging into receiving source. Therefore, chlorination (as minimal necessary actions to make the disposal wastewater harmless for wastewater collection system) is a necessary action for defective wastewater treatment or for reducing the microbial load (22, 23).

Ghanazade et.al study`s Results demonstrated that among 19 hospitals in Markazy state in 10 hospitals, wastewater enter to absorbing well and in 5 hospitals enter to wastewater collection system without any treatment. Among 4 hospitals which have refinery, wastewater system of 3 hospitals is disable or it have a little efficiency. All of Markazy state`s hospitals do not have wastewater system operator or refinery, generally this study reported that hospital wastewater`s disposal in Markazy state is not desirable (20). According to results, among hospitals which have wastewater treatment plant (12 hospitals) in Kermanshah state, 5 of them are disable, the main reasons of inactivity are defective in facilities, structural defects and lack of expert operator. According to environmental health officials in hospital, financial problems do not effect on disability.

While in other study by Akbarpoor (2007) in Tehran demonstrated that among 144 public and private Tehran`s hospitals, 85 hospitals contain wastewater treatment plant and 39 hospitals lead their wastewater to absorbing well that could pollute underground water because hospital wastewater contain heavy metals. According to results, the main problem of hospitals related to wastewater treatment and disposal management reported lack of economic funding. Results also demonstrate that among 7 hospitals in Kermanshah and 4 hospitals in Hamadan, which have wastewater treatment system, environmental health personnel operate the system. They mainly is not familiar with operation and maintenance of wastewater treatment process, considering to biological process in wastewater treatment (e.g. activated sludge). biological factors as the basic principle in processes, need special condition for operation and maintenance, so it can be said that

operation and maintenance of any part of wastewater treatment system associated with sensitivity and complexity. Therefore, corrective operation in these systems needs expert that unfortunately, this issue neglected in Kermanshah hospitals. Therefore, in order to lack of proper operation, after while wastewater treatment systems will be disable.

Conclusion

According to mentioned results, generally wastewater treatment and disposal management is not desirable in Hamadan and Kermanshah states. Therefore, to implement the necessary standards in a hospital and establishment of an environmental management system (ISO 14000), in setting a management processes to improve the quality of hospital wastewater disposal some actions such as obtaining policy for construction of wastewater treatment in every single hospital and operate it by organizations and wastewater experts, chlorinate raw wastewater (and treated wastewater if it possible) to reduce entry pollution into collection systems and wastewater treatment plants, adequate supervision by health authorities, water and wastewater organizations and other related organs could be really effective. If in addition to meeting the main objects (prevent it`s dangerous for environment and human health) perform adequate and throughout treatment (match with standards) on hospital wastewater the effluent can be used for irrigating hospital`s green spaces that may recover some of the costs.

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