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Analyzing the Status of Hazardous Waste in Fars Province of Iran

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Abstract: Hazardous wastes are applied to the wastes that due to having features such as toxicity, corrosivity, ignitability, reactivity or other similar characteristics jeopardize man's health and environment or somehow bring about this possibility. Hazardous wastes are produced from several industrial and commercial sources, agricultural or even domestic activities. The risks of this kind of materials are very different according to the type of hazardous wastes and environmental conditions. Different effects including acute, chronic, short-term and long-term are to be expected. Economic and health consideration initiated a study aiming to identify hazardous wastes in Fars province that has an important role in the developing industry of Iran. In this study the necessary data are gathered through questionnaire, interviewing the authorities of the units and referring to the available documents. The information encompasses the type and amount of waste, method of temporary storage, period of waste discharge, method of final disposal and the condition of recovery and reuse of waste. Also for storing and analyzing the data, "waste database" has been made. The results attained from analyzing the information indicate the production of 1049042 tones of industrial wastes, 13701 tones of hospital wastes and 135563 liters agricultural wastes in the current year (2006-2007), the waste production ratio of different industrial groups is obtained as 31% by chemical industries, 16% by oil and coke industries and 53% by other industries. Furthermore, 10915 tones of wastes (in conformance with appendix no 1 of Basel convention) categorized as hazardous wastes. In the context of the mentioned hazardous wastes, y_{11}, y_{35}, y_{34}, y_{12} and y_{13} (Basel codes) has reported as the major part of this categorization. All of aspects of waste management especially hazardous wastes analyzed and their results demonstrated.

Key words: Hazardous Wastes · Basel Convention · Database · Fars Province

INTRODUCTION

The Hazards of hazardous wastes for human and the environment is increasing due to increase of production rate and different types of chemical reactions. The sources of hazardous wastes are different (industrial, household, commercial, hospital and etc) [1]. However the major sources are industrial, agricultural and hospital activities [1]. Fars is one of the provinces with appropriate conditions and status which enables it to handle a lot of industrial and other kinds of activities related to hazardous wastes and are supposed to handle more in the near future. Due to population increase, urban development and industrials development in this province, especially in recent decades, the hazardous wastes become a real challenge for the province authorities. It is most urgent to protect the environment and to avoid the unpleasant happenings (which have already occurred in other countries) by controlling the hazardous wastes. It is worth to mention that at Fars province, there have been some events with regard to the hazardous wastes which mostly have been underestimated because of the conservative policy of the responsible people at the province. As an example in 1978 the hazardous wastes of a canned food factory caused the death of hundreds of thousand of fish and other aquatic animals. As it was mentioned, the management of hazardous wastes even in developed countries such as the U.S, the U.K and Japan doesn't have a long history and its not more than 4 decades old [2]. What other countries can learn from the researches and the experiences of these countries (U.S, the U.K and Japan)

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is that, the control and prevention cost of hazardous wastes is between 10 to 100 times less than the money that must be paid to clean up the environment because of a case of hazardous wastes [3]. So common sense tells us, that the past and present experiences should be used in order to save the environment as well as to develop and expand industrial activities at the same time. By realizing this fact, the first step to make a correct management system in the area of hazardous wastes is to identify and then classify the hazardous wastes [4,5]. In each management system, the statistics and input information play an important role which can be used most in the future planning [6]. So by considering the fact that, there is no proper system in gathering, storing, management and processing the information in this field and the lack of an appropriate action relating to the hazardous wastes in Fars province, the importance of this research is evident more than ever. We hope that, the results of this research would be helpful to the experts and the people with key responsibilities in Fars environment protection agency and other responsible organizations in the field of hazardous wastes.

MATERIALS AND METHODS

During this research from 2850 industrial units in Fars province which are active in 22 industrial groups, 800 industrial units with possible hazardous wastes residue have been selected as samples for future evaluation and research. To select and screen these samples many factors were considered. In fact those units were selected that had productivity or mining nature and repeatedly in articles, reference books and international and accredited organizations such as U.S environmental protection agency (EPA) and RCRA (Resource Conservation and Recovery Act) and Basel convention have been emphasized [7-9]. After selecting the samples by using proper questionnaire, educational meetings and interview with critics and top managers at the industrial units (licensed by the department of environmental protection agency of Fars province) the necessary information was collected. After that, in order to save and process the information, software called Microsoft ACCESS XP was used and industrial wastes database was formed. To monitor the hospitals and clinical centers, with help of the department of hygiene of Shiraz Medical Science University, the departments of social security and other centers appropriate questionnaires were sent to all clinical centers. Right after collecting the information, to save and better process of information, hospital wastes database was formed. For agricultural specific wastes, all the necessary information from organizations and departments such as the department of plants protection and storage management of Fars, Fars supportive services company and the agriculture department of Fars were gathered and processed [7].

RESULTS

The results of analyzing this information including the uncontrolled industrial sewage indicate that 1049042 tons of wastes are produced each year. About 10915 tons of coded wastes (expressed in enclose 1 Basel convention) under the title of hazardous wastes is classified, the production of this amount of wastes comes from 17 industrial groups among 22 industrial groups in Fars province. From these 17 industrial groups, oil and coke industries (4694 tons in each year), new metal productions (3115 tons in a year), chemical industries (790 tons in a year), radio, TV and mass media communications (824 tons in a year) and textile (612 tons in each year) have got the most share in producing hazardous wastes in Fars province each year respectively and the industrial groups of office machines and accounting (0.1 tons in a year), clothing, fabric and processing fur coat (0.13 tons in a year) have got the lowest share, respectively (in producing the hazardous wastes) (Table 1).

Also 19 code series from Basel codes have been registered in these wastes. Codes y_{11} (4621 tons a year), y_{35} (2069 tons a year), y_{34} (1283 tons a year), y_{12} (864 tons a year), y_{13} (653 tons a year) have got the highest share respectively and codes y_{17} (0.1 tons a year), y_{33} (2 tons a year) have got the lowest share (Table 2).

Table 1: Producing of Hazardous Wastes in Each Industrial Groups (Fars Province, 2007)

Industrial Group	ISIC code	Hazardous waste (ton/year)	Percent
Food and drinks products	15	97.27	1
Textile	17	611.31	6
Clothes and process of fur	18	0.13	0
Tannery, leather, bag, shoes and suitcase	19	299.32	3
Paper and paper products	21	18.85	0
Publication, print, copy	22	21.33	0
Products of oil	23	4693.75	43
Material and chemical products	24	789.50	7
Plastic and rubber products	25	24.00	0
Mineral none metal products	26	27.78	0
Basic metal production	27	248.54	2
New metal products	28	3115.16	29
Machinery and equipment	29	83.67	1
Office machines and accounting	30	0.08	0
Electric machines and appliances	31	59.64	1
Radio, TV and mass communication	32	824.13	8
Other means of transportation	35	0.36	0
Total		10915.00	100

Table 2: Classification of hazardous wastes based on Basel classification (Fars Province, 2007)

Basel code	Code definition	Hazardous wastes (ton/year)	percentage
Y_{11}	Waste tar coming from refining, filtration and distillation	4621.25	42%
Y_{12}	Wastes related to production of formulation, application of ink, colors, pigments alcoholic, lacquer, coloring materials, waxes, oil	863.99	8%
Y_{13}	Wastes related to production of formulation, application of resins, sedate, latex, glues and softness	653.29	6%
Y_{17}	Wastes coming from the metal and plastic covering	0.10	0%
Y_{19}	Metal carbons (reaction of metals with co)	21.16	0%
Y_{21}	Chrome relations (6 capacity)	65.73	1%
Y_{21},Y_{22}, Y_{23},Y_{31}	Chrome reactions, copper reactions, zinc reactions, lead and its reactions	10.00	0%
Y_{22}	copper reactions	34.64	0%
Y_{22},Y_{23}	copper reactions and zinc reactions	20.01	0%
Y_{23}	zinc reactions	390.50	4%
Y_{29}	Mercury and its reactions	152.26	1%
Y_{33}	Minerals cyanides	1.80	0%
Y_{34}	Acid liquids or solid acids	1282.68	12%
Y_{34},Y_{21}	Acid liquids or solid acids, chrome reactions (6 capacity)	1.29	0%
Y_{34},Y_{35}	Acid liquids or solid acids and alkaline liquids or alkalis in the state of solid	50.00	0%
Y_{35}	alkaline liquids or alkalis in the state of solid	2069.16	19%
Y_{36}	Powder or fiber of asbestos	5.00	0%
Y_{7}	Waste materials coming from refining and plating of metals (including cyanides)	200.75	2%
Y_{8}	Wastes from mineral oils which aren't suitable for usual usage	471.24	4%
Total		10915.00	100%

Table 3: Other methods of disposal for hazardous wastes (Fars Province, 2007)

other methods of disposal	(ton/year)	percent
Probably will be thrown away	741.96	10%
Is sold	761.70	10%
Discharging in the well	88.96	1%
Discharging in the city sewage system	1.91	0%
Discharging in the canals around the factory	2380.52	33%
Filtering in the factory	50.96	1%
Discharging in the factory sewage system network	1554.76	21%
It being reused in the some unit	51.82	1%
To be buried in abandoned mines	734.19	10%
Un known	951.20	13%
Total	7318.03	100%

From all physical conditions observed among wastes in Fars province, physical conditions of liquids (5593 tons per year) and semi-solid (564 tons per year) have got the highest share between hazardous wastes respectively in Fars province. The physical condition of sludge (137 tons per year) has got the lowest share (Fig. 1).

Among the characteristics in Fars province hazardous wastes, the characteristics of inflammability and toxicity together with Basel characteristic code (H3 and H12) at a rate of 54% and characteristic of corrosivity with Basel characteristic code (H8) at a rate of 31% have got the highest share (Fig. 2).

How to discharge hazardous wastes, it has to be said that about 2773 tons (25%) of these wastes are discharged in the nature with no control at all. 7% is buried and only 1% is burned. 7381 tons (67%) are classified under other methods that 33% of this is discharged in sewage system network, 21% is filtered or refined in factories. 10% is buried in abandoned mines, 10% is sold and 1% is reused in the respected unit (Fig. 3 and Table 3).

About the responsibility of discharging the wastes, nearly 7897 tons (73%) is discharged by the respected unit and 2974 tons (27%) is discharged by the private sector. With regard to recycle and salvage of these wastes, we must mention only 813.5 tons (7%) is recycled and reused and for the remaining 10101 tons (93%) no recycling or salvaging is done. According to the recent assessment with regard to hazardous wastes, total weight of hospital wastes is nearly 13701 tons a year which 6728 tons a year (49%) of this figure belongs to ordinary wastes (semi-household) and 6973 tons a year (51%) belongs to infectious wastes. (It has been noted that the infectious wastes has received the code y_1 and characteristic code H6.2 in Basel classification. Clinical centers and semi-hospital sections produce almost 93 tons of constant and advent materials in Fars province yearly. The physical state of this material is liquid with corrosive characteristic which has received Basel especial code H_8 and Basel cod Y_1. Based on the list of expired poisons in Fars province obtained from the department of agriculture of Fars, the entire expired poisons at this province is equal to 22405 liters, Neiriz town has got the most (2618 liters) and pasargad town has got the least (50 liters) of the above amount. Also according to the list of expired poisons at the storage of protection management of plants in Fars, the total weight of expired poisons has been announced as 16657 liters. Tetradifon poison has got the most of it (5000 liter) and fitrotion poison has got the minimum (4500 liters). The list of expired agricultural poisons at Fars province supportive

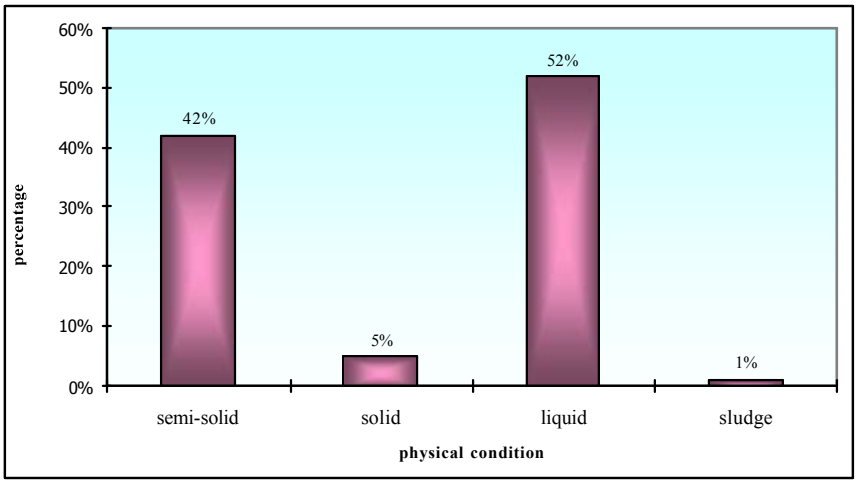

Fig. 1: The Share of Physical conditions for hazardous wastes [10]

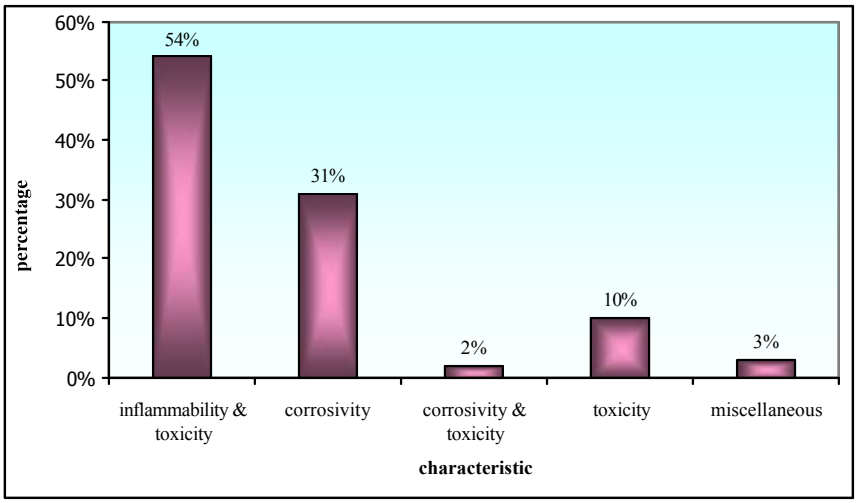

Fig. 2: The share of different characteristics of hazardous wastes [10]

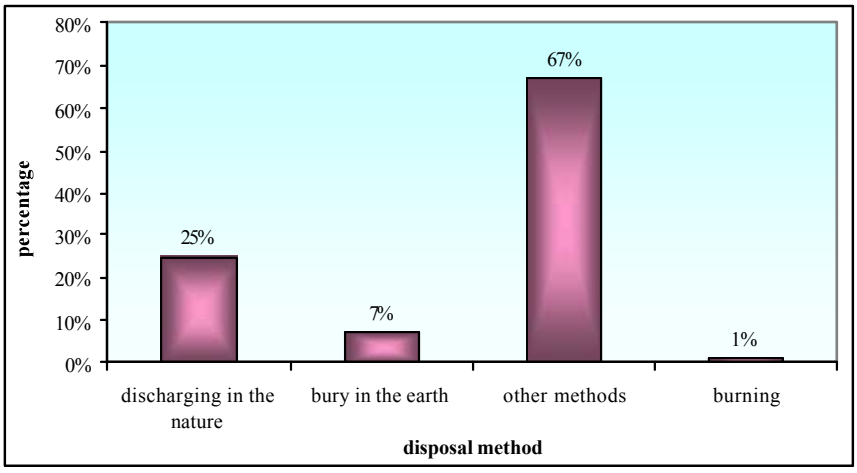

Fig. 3: The share of final disposal methods for hazardous wastes [10]

service company indicates 965000.4 liters. The most belonged to micronized sulphur (20168) liters and Asian sulphur (2000 liters). Overall the total amount of expired agricultural poisons in Fars province is equal to about 135563 liters. According to the department of protection of plants in Fars, in this province nothing is done to deal with expired poisons, they just keep them in the storage and eventually are sent to the ghazvin plant (Shimi Keshavarz) and be destroyed by this company.

DISCUSSION AND CONCLUSIONS

During this research around 10915 tones of encoded wastes (registered in enclose no 1 Basel convention) produced by sampled units were checked. These hazardous wastes belong to 17 industrial groups out of 22 industrial groups in Fars province. Among the 17 industrial groups in the province, industrial groups of coal and oil industries (43%), new metal products (29%) have the highest share in production of hazardous wastes. So these industries are more important than other industries in the field of hazardous wastes, the mentioned industries should be considered as the first priorities. The wastes coming from these industries and factories include all kinds of acids, used soda, ooze and sludge containing heavy metals, oily wastes, acid tars, cyanide and other hazardous and poisonous wastes. These wastes must be discharged under a proper management and minimizing the risk of this danger for human and the environment. Also 19 code series among Basel codes have been registered for these wastes. Codes y_{11} (42%), y_{35} (19%) and y_{34} (12%) have got the highest shares. Therefore for choosing a certain management method, these wastes must be realized as the first priorities. From all physical conditions among the wastes in Fars province, liquid physical condition (52%) and semi-solid (42%) have the first and second rank. So any decisions with regard to selecting the methods, collecting technologies, transportation, filtration, refining, final discharging, recycling and salvaging must be considered and matched with regard to these physical conditions. Among the present characteristics in hazardous wastes in the province, inflammability and toxicity with characteristic Basel cod (H3- H12) together at a rate of 54% and the characteristic of corrosivity with characteristic Basel code (H_8) at a rate of 31% have got the highest shares. Paying attention to the fact that the above characteristics are much more important than the others, at the stage of managing the hazardous wastes and final disposal a great care must be taken to neutralize the methods of inflammability, toxicity and corrosivity. With regard to the method or style of discharging the hazardous wastes we have to confess that not only there is no certain or particular organization that would handle the responsibility, but also, no scientific or logical methods is used by the units which are the major producers of these dangerous wastes. Therefore it is essential that some managing actions be done very soon. Only 7% of these wastes are recycled and reused but for the remaining 93% the story is different and unfortunately nothing is done about it. In general it is for sure that, the share of recycling and salvage with regard to the hazardous wastes is very little or basically nothing. How ever, it's obvious that recycling and salvage is one of the key and main solutions against the problem of hazardous wastes. It's worthy and deserving to accelerate and encourage all types of investigation, inquiry and research to decrease and deduct and reduce danger of hazardous wastes in the environment. All in all it is necessary to adopt methods, collecting technology, transportation, distillation, final disposal, recycling and infectious wastes, constant and advent materials at clinical units and expired agricultural poisons in the province, appropriately and properly. Generally speaking the way that is dealt with hazardous wastes and their final discharge is not satisfactory at all. These wastes based on the presented list by the Basel convention are with no doubt dangerous and require special and fast attention.

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