

Identification and classification of Industrial Hazardous Wastes - A case study of Iran

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Abstract: Hazardous wastes are special kind of wastes which has distinctive characteristics such as toxicity, corrosively, ignitability and reactivity that jeopardize health of human beings and environment in which they live. Hazardous wastes are produced from several industrial and commercial sources, agricultural or even domestic activities, but the most important sources are industrials. 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 industrial 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 hazardous wastes, method of temporary storage, period of hazardous wastes discharge, method of final disposal and the condition of recovery and reuse of hazardous wastes. Also for storing and analyzing the data, "industrial hazardous wastes database" has been made. The results attained from analyzing the information indicate the production of 1049042 tones of industrial wastes in the 2011s, the wastes 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, Y₁₁, Y₃₅, Y₃₄, Y₁₂ and Y₁₃ (Basel codes) has reported as the major part of this categorization.

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1. 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 [1]. The sources of hazardous wastes are different (industrial, household, commercial, hospital, and etc) [2, 7]. However the major sources are industrials [9, 12 & 4]. 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 the 1978s 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 5 decades old [4].

What other countries can learn from the researches and the experiences of these countries (U.S, the U.K and Japan) 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 [8]. 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 [5, 10].

In each management system, the statistics and input information play an important role which can be used most in the future planning [1, 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.

2. Research Method

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 & Recovery Act) and Basel convention have been emphasized [10, 1& 11].

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 hazardous wastes database was formed.

3. 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(824 tons in a year), radio, TV and mass media communications (790 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)

Table 1: Producing of Hazardous Wastes in Each Industrial Groups (Fars Province, 2011)

Industrial Group	ISIC code	Hazardous waste (ton/year)	percent
Food & drinks products	15	97.27	1%
Textile	17	611.31	6%
Clothes & process of fur	18	0.13	0%
Tannery, leather, bag, shoes & suitcase	19	299.32	3%
Paper & paper products	21	18.85	0%
Publication, print, copy	22	21.33	0%
Products of oil	23	4693.75	43%
Material & chemical products	24	824.13	8%
Plastic & 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 & equipment	29	83.67	1%
Office machines & accounting	30	0.08	0%
Electric machines & appliances	31	59.64	1%
Radio, TV & mass communication	32	789.50	7%
Other means of transportation	35	0.36	0%
)total(10915.00	100%

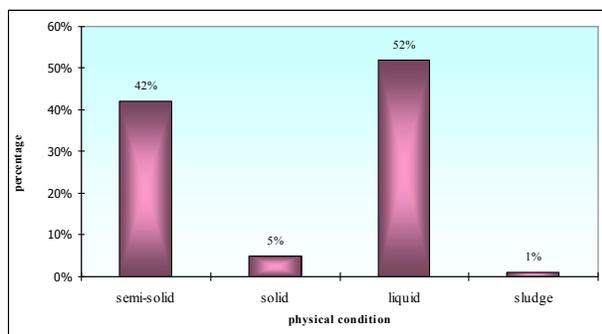
Also 19 code series from Basel codes have been registered in these wastes. Codes y_{11} (4621 tons a year), y_{35} (2069 tons a year), y_{34} (1283 tons a year), y_{12} (864 tons a year), y_{13} (653 tons a year) have got

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 2: Classification of hazardous wastes based on Basel classification (Fars Province, 2011)

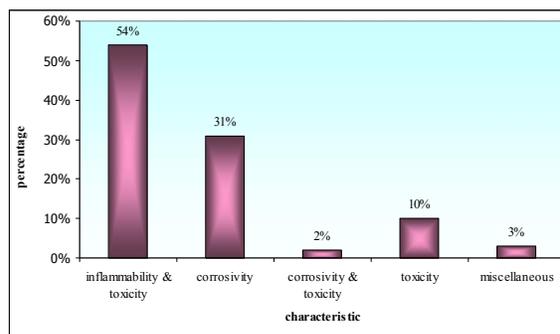
Basel code	Code definition	Hazardous wastes (ton/year)	percentage
Y ₁₁	Waste tar coming from refining, filtration & distillation	4621.25	42%
Y ₁₂	Wastes related to production of formulation, application of ink, colors, pigments alcoholic, lacquer, coloring materials, waxes, oil	863.99	8%
Y ₁₃	Wastes related to production of formulation, application of resins, sedate, latex, glues & softness	653.29	6%
Y ₁₇	Wastes coming from the metal & 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 & its reactions	10.00	0%
Y ₂₂	Copper reactions	34.64	0%
Y ₂₂ , Y ₂₃	copper reactions & zinc reactions	20.01	0%
Y ₂₃	zinc reactions	390.50	4%
Y ₂₉	Mercury & 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 & 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 & 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%

From all physical conditions observed among hazardous 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. (Figure. 1)

**Figure. 1:** The Share of Physical conditions for hazardous wastes (Fars Province, 2011)

Among the characteristics in Fars province hazardous wastes, the characteristics of inflammability

and toxicity together with Basel characteristic code (H3 & 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. (Figure. 2)

**Figure. 2:** The share of different characteristics of hazardous wastes (Fars Province, 2011)

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 the canals around the factory, 21% is Discharged in the factory sewage system network. (Figure. 3) and (Table 3)

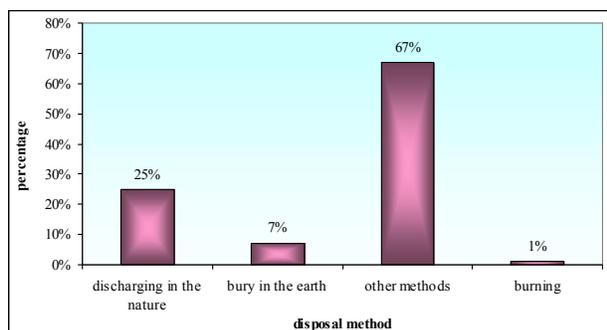


Figure. 3: The share of final disposal methods for hazardous wastes (Fars Province, 2011)

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%

Table 3: Other methods of disposal for hazardous wastes (Fars Province, 2011)

About the responsibility of discharging the hazardous 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

4. Discussion and Conclusion

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 corrosively 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 corrosively.

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.

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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