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Hazardous Waste Management in India

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ABSTRACT

Hazardous waste can be define as any waste, which by reason of any of its physical, chemical, reactive, toxic, flammable, explosive or corrosive characteristics causes danger or is likely to cause danger to health or environment, whether alone or when in contact with other wastes or substances. In India, there are 36,165 nos. of hazardous waste generating industries, generating 6.2 million tonnes of hazardous wastes every year. The most economical method for treatment of industrial effluent is neutralization with lime or some other cheap alkaline agent. The sludge generated by neutralization method is being disposed to fill the low-lying, which is not acceptable. However, it may contaminate the ground water due to leaching of heavy metals. The safest method to dispose the hazardous method is solidification and stabilization of hazardous waste.

Keywords: Conventional Treatment, Hazardous Waste, Solidification/Stabilization

I.INTRODUCTION

Hazardous waste can be defined as waste with inherent characteristics, such as ignitability, corrosivity, toxicity, or reactivity [1]. Hazardous waste management is a new concept for most of the Asian countries including India. The lack of technical and financial resources and the regulatory control for the management of hazardous wastes in the past had led to the unscientific disposal of hazardous wastes in India, which posed serious risks to human, animal and plant life [2]. Sources of hazardous waste include those from industrial processes, mining extraction; tailings from pesticide based agricultural practices, etc. The list of processes generating hazardous wastes by different industries is presented in Table 1. The quantity of hazardous waste generated in India is specified in Table 2. In India, there are 36,165 nos. of hazardous waste generating industries, generating 6.2 million tonnes of hazardous wastes every year.

Table 1: The list of processes generating hazardous wastes [3]

S.No.	Processes	Hazardous Waste*
(1)	(2)	(3)
1.	Petrochemical processes and pyrolytic operations	1.1 Furnace or reactor residue and debris 1.2 Tarry residues and still bottoms from distillation 1.3 Oily sludge emulsion

		1.4 Organic residues
		1.5 Residues from alkali wash of fuels

(1)	(2)	(3)
		1.6 Spent catalyst and molecular sieves
		1.7 Oil from wastewater treatment
2.	Crude oil and natural gas production	2.1 Drill cuttings excluding those from water based mud
		2.2 Sludge containing oil
		2.3 Drilling mud containing oil
3.	Cleaning, emptying and maintenance of petroleum oil storage tanks including ships	3.1 cargo residue, washing water and sludge containing oil
		3.2 cargo residue and sludge containing chemicals
		3.3 Sludge and filters contaminated with oil
		3.4 Ballast water containing oil from ships
4.	Petroleum refining or re-processing of used oil or recycling of waste oil	4.1 Oil sludge or emulsion
		4.2 Spent catalyst
		4.3 Slop oil
		4.4 Organic residue from processes
		4.5 Spent clay containing oil
5.	Industrial operations using mineral or synthetic oil as lubricant in hydraulic systems or other applications	5.1 Used or spent oil
		5.2 Wastes or residues containing oil
		5.3 Waste cutting oils

6.	Secondary production and / or industrial use of zinc	6.1 Sludge and filter press cake arising out of production of Zinc Sulphate and other Zinc Compounds. 6.2 Zinc fines or dust or ash or skimmings in dispersible form 6.3 Other residues from processing of zinc ash or skimmings 6.4 Flue gas dust and other particulates
7.	Primary production of zinc or lead or copper and other non-ferrous metals except aluminium	7.1 Flue gas dust from roasting 7.2 Process residues 7.3 Arsenic-bearing sludge 7.4 Non-ferrous metal bearing sludge and residue. 7.5 Sludge from scrubbers
8.	Secondary production of copper	8.1 Spent electrolytic solutions 8.2 Sludge and filter cakes 8.3 Flue gas dust and other particulates
9.	Secondary production of lead	9.1 Lead bearing residues 9.2 Lead ash or particulate from flue gas 9.3 Acid from used batteries
10.	Production and/or industrial use of cadmium and arsenic and their compounds	10.1 Residues containing cadmium and arsenic
11.	Production of Primary and	11.1 Sludges from off-gas treatment

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secondary aluminum	11.2 Cathode residues including pot lining wastes 11.3 Tar containing wastes 11.4 Flue gas dust and other particulates 11.5 Drosses and waste from treatment of salt sludge

Table 2: Status of hazardous waste generation in India [4]

State	Quantity of Hazardous waste generation (MTA)			
	Recyclable	Incinerable	Land fillable	Total
Andhra Pradesh	313217	31660	211442	556319
Assam	7480	-	3252	10732
Bihar	73	9	3357	3439
Chandigarh	723	-	232	955
Delhi	203	1740	3338	59423
Goa	7614	8271	10763	26648
Gujarat	577037	108622	1107128	1792787
Haryana	4919	1429	30452	36800
Himachal Pradesh	4380	2248	35519	42147
Karnataka	54490	3713	18366	76569
Kerala	23085	5069	690014	780015
Maharashtra	847442	152791	568135	1568368
Madhya Pradesh	127909	5036	34945	167890
Orissa	18427	4052	74351	96830

Jammu and Kashmir	6867	141	9946	16954
Pondicherry	36235	25	132	36392
Punjab	89481	14831	13601	117913
Rajasthan	84739	23025	165107	272871
Tamil Nadu	89593	4699	196002	401073
Uttar Pradesh	117227	15697	36370	140146
West Bengal	126596	12583	120598	259777
Chhattisgarh	283213	6897	5277	295387
Jharkhand	204236	9813	23135	237184
Manipur	137	115	-	252
Meghalaya	6443	697	19	7159
Mizoram	12	Nil	90	102
Nagaland	11	Nil	61	72
Tripura	237	30	0	267
Uttarakhand	11	580	17991	18582
Daman, Diu, Dadra & NH	56350	421	17219	73990
Total	3088387 (43.7%)	415794 (6.67%)	2728326 (49.55%)	6232507 (100%)

It is obvious that the recyclable portion of hazardous waste is in the range of 49.55 % and is more than other two categories. The land disposable portion and incinerable portion are in the tune of 43.78 % and 6.67 % respectively. In this paper, we have studied about the safe land disposal method of hazardous waste.

II.CONVENTIONAL METHOD

The most economical method for treatment of hazardous effluent is neutralization with lime or some other cheap alkaline agent. Choice of an agent should be based on [5]

(a) cost per ton of available basicity
(b) space available
(c) Reaction time
(d) Effluent volume
(e) availability of agent and
(f) character of sludge produced.

However, the drawbacks of conventional treatment method are:

(a) Excessive sludge production

(b)Slow metal precipitation kinetics,

(c)Inefficient metal removal due to poor settling and aggregation of metal precipitation,

(d)Landfill disposal problem, and

(e)Contaminate ground water due to leaching properties of heavy metals.

III.SOLIDIFICATION/ STABILIZATION (S/S)

S/S is accepted as a well-established disposal technique for hazardous waste. As a result many different types of hazardous wastes are treated with different binders. The S/S products have different property from waste and binders individually. The effectiveness of S/S process is studied by physical, chemical and microstructural methods. The treatment of aqueous wastes requires be solidifying and also stabilizing. But even solid materials may require to be stabilized prior to disposal in landfill.

Objective of S/S process: - a) chemically react with the free water in the waste to form a dry solid, and b) make the contaminants as immobile as possible. The combined process of solidification/stabilization mixes wastes, soils, and sludge with treatment agents to immobilize, both physically and chemically, the hazardous constituents in those substances. Different types of binding reagents like Portland cement, cement kiln dust (CKD), lime, lime kiln dust (LKD), limestone, fly ash, slag, gypsum etc. have been studied by various researchers [6].

The following are the salient features of S/S method [7]:

(a) Stabilisation and solidification aim to immobilise the toxic constituents of hazardous wastes to prevent them leaching from the wastes once disposed.

(b) Immobilisation is accomplished by reducing the solubility of the waste components, and by physically isolating the waste and decreasing its surface area. S/S therefore involves both physical and chemical processes.

(c) Different terms – such as immobilisation, fixation, solidification and stabilisation - are used to describe the various techniques whereby certain hazardous wastes are converted into a suitable form for long-term disposal.

(d) The technologies are most suitable for treating inorganic wastes. Organic constituents in the waste may make the application of S/S techniques unsafe and inappropriate.

(e) Various binding reagents like Portland cement, cement kiln dust (CKD), calcium oxide, lime kiln dust (LKD), limestone, fly ash, slag, gypsum, etc have been used for treating inorganic waste.

(f) Organic binding reagents are rarely practiced in commercial scale due to their high price compared to inorganic binders .

(g) The chemistry of S/S wastes treatment is complex. Selection of a suitable solidification binder depends on correctly predicting complex interactions between waste components and binders to ensure acceptable and reliable results.

(h) S/S treat ability and final performance of treated waste studies can be placed into two groups: physical and chemical tests. Physical test is unconfined compressive strength test and chemical test or leachability test is called Toxicity Characteristic Leaching Procedure (TCLP).

(i) S/S treated wastes should be disposed in a secure landfill site. They should not be co-disposed with other wastes such as MSW as the acid leachate produced by these may cause severe degradation of S/S wastes.

IV. CONCLUSIONS

Solidification and stabilization sludge can be safely disposed the hazardous waste. But this method is limited by the growing need for landfills to store hazardous waste. The problem can be solved by minimize the generation of hazardous waste and utilize the S/S waste instead of disposing into landfill sites.

REFERENCES

[1]Babu, B.V. and V.Ramakrishna. (2000), Mathematical modeling of Site sensitivity indices in the site selection criteria for hazardous waste treatment, storage and disposal facility", Journal of the Institution of Public Health Engineers India, 2000 (1): 54-70.

[2]http://neerienvis.nic.in/pdf/status_reports_data/Status%20Report%20on%20Management%20of%20Hazardous%20Waste%20inIndia.pdf.

[3]http://envfor.nic.in/soer/2001/ind_waste.pdf

[4]National Inventory of Hazardous Wastes Generating Industries & Hazardous Waste Management in India 2009.

[5]Hoak, D. R., Lewis C. J., 1947. Lime treatment of waste pickling liquor, Industrial and Engineering Chemistry, 39: 131-135.

[6]Devi Anuradha,Singhal Anupam , Gupta Rajiv , Panzade Prasad (2014), A Study on treatment methods of spent pickling liquor generated by pickling process of mild steel, published online in Clean Technologies and Environmental Policy, 16:1515–1527.

[7]Rachana Malviya, Rubina Chaudhary (2006), Factors affecting hazardous waste solidification/stabilization: A review, Journal of Hazardous Materials, B137: 267–276.