

TYPES, AMOUNTS AND EFFECTS OF INDUSTRIAL SOLID WASTES

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Keywords: Solid waste, hazardous waste, industrial solid waste, waste generation, waste management, environmental protection, waste category, environmental effect, water, air, soil, route, environment pollution

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Summary

The industrial solid wastes have done harm to the environment and human health. The first step towards prevention and control of pollution of industrial solid wastes that the types, is a full understanding of amounts and effects. The intrinsic characteristics of industrial solid wastes include occupying land when stockpiling, dumping, disposing or storing, having large categories and quantity. In this chapter, solid wastes from mining industry, metallurgical industry, power industry, chemical industry, oil chemical industry, and light industry are introduced and the waste generation coefficient in these industries also summarized. The environment effects, including natural environment, atmospheric environment, water environment, and soil environment, of industrial solid wastes are introduced briefly.

1. Introduction

Industrial solid waste refers to solid waste generated in production activities such as industry, traffic, and resource development. They include solid wastes, semi-solid wastes, and liquid and gaseous wastes in vessels that are not permitted to discharge into the environment. Industrial solid wastes are classified into organic wastes and inorganic wastes based on their components; into solid wastes, semi-solid wastes and liquid (gaseous) wastes based on their species; into hazardous wastes and common wastes based on pollution characteristics. Because many industrial solid wastes hold hazardous characteristics, they usually receive special attention.

Industrial solid waste pollution has become an increasingly serious problem in the world. The developing countries have to specially confront it. Every year, large quantities of

industrial solid wastes are generated from the growing industries. However, there are no adequate treatment and disposal facilities and qualified personnel in these developing countries. All these have seriously hindered the development of industries in these countries and done harm to the human being health and the environment.

During 1980s, much attention has been paid to the pollution control of industrial solid wastes. Significant progress has been made in establishing corresponding management and legislation systems, in developing treatment and disposal technologies, and in turning the research results into industrial practice. As a result, the serious situation of hazardous waste pollution has been alleviated in the developed countries although this situation has not completely changed. However, many problems in the management of industrial solid wastes need to be resolved in the developing countries.

2. Types of Industrial Solid Wastes

In general, industrial solid wastes are classified into the following major types:

(1) Solid wastes from the mining industry

This kind of waste includes waste stones generated during mining and tailings. Waste stones mean wall rocks peeled off from major ore during the mining of metal and non-metal mines. Tailings mean the residue slag after distilling refining mines during mill run.

(2) Industrial solid wastes from the metallurgical industry

This kind of waste includes varies of slag from the metallurgical procedure and processing of metals and non-metals. Some industrial solid wastes from the metallurgical industry are listed in Table 1.

Slag	Sources
Blast furnace slag	Generated in blast furnace iron smelting
Steel slag	Generated in steel smelting by level furnace, converter, and electric stove
Non-ferrous metal slag	Generated in smelting processing of the non-ferrous metals, such as copper, nickel, lead, and zinc
Red mud	Generated in abstracting aluminum oxide

Table 1: Industrial solid wastes from metallurgical industry

(3) Solid wastes from the power industry

This kind of waste includes coal fly ash, coal slag, and flue ash from power plants in which coals are used as fuel. It also includes gangue generated from coal excavating and coal-washing.

(4) Solid wastes from the chemical industry

This kind of wastes includes inferior products (semi-finished products), outgrowth, disabled catalysts, waste additives, raw materials that have not reacted, and impurity in raw materials discharged from chemical reaction during production processes, such as chemical combination, decomposition and synthesis. They also include wastes discharged from refining, separating, and washing procedures and from devices. Furthermore, they include the pyritic slag, acidic slag, alkali slag, salt mud, mud from kettle, residues of refining or distillation, pharmaceutical wastes, waste medicines from the producing and processing sectors in the chemical industry, and waste pesticides from medicine and insecticide production. In addition, they include dust from air pollution control facilities, sludge from wastewater treatment facilities, solid wastes from equipment examination and repairing, equipment scraps, vessels, and industrial refuses.

(5) Solid wastes from the oil chemical industry

This kind of wastes includes oil mud, tar shale slag, waste catalysts, and waste organic solvent in oil processing.

(6) Solid wastes from light industry

This kind of wastes includes sludge, animal residues, waste acid, waste alkali, and other wastes from the processing procedure in light industries, such as food industry, paper making and printing industry, spinning and dye-printing industry, and leather industry.

(7) Other industrial solid wastes

These kinds of waste mainly include metal dross from mechanical processing, plating sludge, construction wastes, and slag from processing in other industries.

In the USA, solid wastes means any garbage, refuse, sludge from a wastewater treatment plant, a water supply treatment plant, or an air pollution control facility; and other discarded materials including solid, liquid, semi-solid, or contained gaseous materials arising from industrial, commercial, mining, and agricultural operations, and from community activities; but does not include solid or dissolved materials in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges which are point sources subject to permits under the Federal Water Pollution Control Act, as amended, or source, special nuclear, or by-product materials as defined by the Atomic Energy Act, as amended. Industrial and special wastes are primarily non-hazardous wastes generated by certain industries and households. Industrial solid wastes come from a broad spectrum of USA industries and are neither municipal nor hazardous wastes under federal and most state laws.

Some industrial solid wastes may be listed in the catalog of hazardous wastes or identified as holding hazardous properties based on the hazardous waste identification standards and identification method. In the USA, hazardous waste is defined by RCRA as a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may either cause, or significantly

contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed. This is a definition used widely. UNEP defined, in the working group meeting of the environmental management of hazardous wastes in December of 1985 that hazardous wastes indicate wastes in solid, sludge, liquid and gases in vessels, which held chemical reactivity, toxicity, explosibility, erosion, or other characteristics that can result in adverse effects to the human health and environment. These wastes are legally called hazardous wastes even if they are mixed with other wastes, have been generated, are in disposal, or are in transportation. UNEP lists 45 categories of wastes that should be controlled, and 2 categories that need to pay special consideration in Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their disposal (Table 2). At the same time, a list of hazardous characteristics is shown (Table 3). In China, hazardous wastes are divided into 47 categories according to the National Catalog of Hazardous Wastes. It includes the 45 categories in the Basle Convention, which are named as HW1 to HW45, and two more items, which are named as HW46 for nickel compound wastes and HW 46 for barium compound wastes.

Categories	Waste source and hazardous components
Y1	Clinical wastes from medical care in hospitals, medical centers and clinics
Y2	Wastes from the production and preparation of pharmaceutical products
Y3	Waste pharmaceuticals, drugs and medicines
Y4	Wastes from the production, formulation and use of biocides and phytopharmaceuticals
Y5	Wastes from the manufacture, formulation and use of wood preserving chemicals
Y6	Wastes from the production, formulation and use of organic solvents
Y7	Wastes from heat treatment and tempering operations containing cyanides
Y8	Waste mineral oils unfit for their originally intended use
Y9	Waste oils/water, hydrocarbons/water mixtures, emulsions
Y10	Waste substances and articles containing or contaminated with polychlorinated biphenyls (PCBs) and/or polychlorinated terphenyls (PCTs) and/or polybrominated biphenyls (PBBs)
Y11	Waste tarry residues arising from refining, distillation and any pyrolytic treatment
Y12	Wastes from production, formulation and use of inks, dyes, pigments, paints, lacquers, varnish
Y13	Wastes from production, formulation and use of resins, latex, plasticizers, glues/adhesives
Y14	Waste chemical substances arising from research and development or teaching activities which are not identified and/or are new and whose effects on man and/or the environment are not known
Y15	Wastes of an explosive nature not subject to other legislation
Y16	Wastes from production, formulation and use of photographic

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Biographical Sketch

Jinhui Li is an associate professor of the Department of Environmental Science and Engineering, Tsinghua University, is also the administrative director of the Asia-Pacific Regional Center for Hazardous Waste Management Training & Technology Transfer. Mr. Jinhui Li got his B. S. degree and M. S. degree in the Department of Environmental Sciences, Nankai University and his Ph. D. in the Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences in 1997. His research interests mainly focus on hazardous waste policy and management, recycling and recovery of wastes, soil pollution remediation, environmental risk assessment, aquatic chemistry of acid rain. The main projects under his management or involvement include: (UNIDO) Cleaner Production and Solid Waste Management; Feasibility Research of the Project on the Treatment and Disposal of Hazardous Wastes in Suzhou; Technological Policies on the Prevention and Control of Hazardous Wastes of China; Guideline of Assessment Technique for the Operation Capacity of Hazardous Wastes of China; SVE Technique for Volatile Organic Matter; Minimization of Solid Wastes; National Action Plan and Regional Decision-making Support System of Hazardous Waste Management of China; (Germany, GTZ) China Zhejiang Project on Hazardous Waste Management; (World Bank) China Shandong Environmental Project, Hazardous Waste Management-Implementation Support. He has published more than 50 papers on above subjects, and is one of the authors for five books.