

# ELABORATION OF A DATABASE OF THE INDUSTRIAL SOLID WASTES IN MOROCCO

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## ABSTRACT

A database structure was concretised. It includes the solid waste structure and industrial activities. The solid waste structure includes 6 solid waste categories and 38 subcategories. For that of industries activities generating, it includes 8 industry types, 29 categories and 107 industry subcategories. In order to fill the database concretised of information and data on the amounts, type and composition of industrial solid wastes a study of characterisation was carried out on 21 industrial companies in the areas of Casablanca, Fès and Mohammedia in Morocco. In our study, questionnaires were used to collect data in the areas of study.

**Keywords:** *Solid Waste -Industries-Database-Morocco*

## 1. INTRODUCTION

In Morocco there are no statistics on wastes which would allow an analysis of amount and types of wastes. The studies realised focus on technical questions dealing with wastes disposal taking into account only a reduced number of sectors from only few areas in Morocco

Considering the industrial pollution in morocco, the principal sources are: food industries, mining, paper pulp factories etc. These industries produce various industrial wastes by products types of which the data on the quantities are scattered. This situation results from the fact that industries have traditionally managed their waste products by discharging them into the environment without pre-treatment (Zamorano, 2005). This practice results in an increase of pollution and produces a negative environmental impact.

To face this situation we have to take into account clean technologies (Maes, 1986). In the case of surface treatments, these clean technologies are reached by various conditions: rationalization of consumption, substitution of the polluting baths by non-polluting baths and introduction of certain technologies (Khyati and Messafi, 2004).

Many researches (Zamorano, 2005, Balakrishnan, 2007) give examples of the use of questionnaires with a view to study the quantity and type of industrial wastes generated. In his research Zamorano (2005) gives other international examples researches using of questionnaire in particular El-Fadel et al (2001), Abduli (1996), Asadi et al. (1996).

In morocco one can quote here a estimation study of the Commercial Department of the Ministry for Trade and Industry (M.T.I, 1994) and the study concerning the guidlines of waste management of the Ministry of the Environment (M.E, 2000).



The objective of this study is to develop a database of industrial solid wastes for the acquisition of information and data on the amount and types of solid wastes in Morocco, for their recovery or their treatment. For the collection of our data, a questionnaire was used. The questionnaire focused on industrial sectors such as Surface treatment, manufacturing industry of metallic packing, pneumatic manufacturing industry and plastic packing manufacturing industries

Maes, M., 1986. Industrial wastes, mode of employ Edited by Lavoisier. Paris, France. pp. 1-539.

Ministry of the Trade and Industry, 1994. Situation of industrial waste, Rabat, Morocco. pp. 1-37.

Secretariat of State in Charge of the Environment, 2000. Design for the care of industrial and hospital waste to the areas of Morocco ,Rabat, Morocco. pp. 10-14.

## 2. MATERIAL AND METHODS

### 2.1. Data collection

There are three general methods presently used to analyse the generation, type and composition of industrial waste (Zamorano, 2005):

- an empirical approach using available industry information,
- a questionnaire survey,
- a control/monitoring data from a waste management system.

On the basis of the studies carried out in other countries, our research laboratory, together with the companies, prepared a questionnaire

Taking into account a certain reticence on the part of the entities surveyed to provide information (e.g., financial data as well as any information that might lead to economic Sanctions) as well as our research needs, a final version (which was accepted) of the questionnaire was proposed. This final version included information on the following items:

- Identification of the company
- Products of the company
- Input

- Processes used
- Solid wastes
- Level of appearance
- Nature of waste treatment if any
- Method of waste disposal

The questionnaire was given to the 21 companies located in the areas of Casablanca, Mohammedia and Fès in Morocco. Sample that was adequate for the purposes of our research. All employers answered the questionnaire.

### 2. 2 . Industrial Solid waste Database

A previously reported data for some Agricultural and food industries, paper industry, Textile industry, Chemical industries and various industries is found in Boeglin (1999). It was used for the elaboration of our database. structure

In the interface of the database developed in this work, we have two modules: Industries Generating and Solid Wastes. Each module contains several categories, where each category contains several subcategories. Each subcategory is represented by more database tables. Each database tables consist of fields under which the data collected are stored. Microsoft Access was employed to develop the Solid industrial wastes database.

### 2. 3. Waste characterisation.

There are many classification methods of wastes, Elshorbagy and Alkamali (2005.). Some of these classification methods are: source of wastes (industrial, domestic, institutional, medical, etc.), chemical and physical properties (inert, flammable, organic, etc.), environment risk hazardous impact, quantity and frequency of generated waste (minute, frequent, interim, patches, etc.) and applied management method (recycle, reuse, disposal, etc.)

In this work, the wastes generated were classified according to their composition Zamorano (2005).

- Plastic, including packing wastes (packing materials containing hazardous products are included in the hazardous waste group)
- Metals (e.g., Iron, aluminium, bronze, lead, copper, steel and brass) from packing
- Textiles



- Rubber
- Hazardous wastes, including car oil, and varnish

Boeglin, J.C., 1999. Industrial pollution of water. Characterisation, Classification, Measure. Technique of the engineer, G 1210,1-12

### 3. RESULTS AND DISCUSSION

#### 3.1. Constitution of the database

The tables of the database are constituted as follow:

Wastes	Input
Reference	Reference
Name	Name
Tonnage	Tonnage
Code	Categories
Companies	Categories
Companies	

Apparition level	Nature of waste Treatment if any
Reference	Reference
Apparition nature	Nature of waste
Generating operation	Valorization processes
Categories	By
Companies	Categories
	Companies

Waste disposal	Generating industries
Reference	Reference
Name of method	Companies
By	Contact
Nature of waste	Fonction
Categories	Address
Companies	City
	Postal code
	Telephone
	Fax
	Codes

Products
Reference
Name
Type
Production capacity
Categories
Companies

The distribution of 21 companies in morocco is as follow:

Casablanca: 18 Companies

Fes : 1 Company

Mohammedia: 2 Companies

The total number of database tables used is 880.

#### 3. 2. Database structure of solid waste

The database structure includes solid waste and waste generating industries:

The diagram of figure 1 shows the structure of solid wastes database. The solid waste structure includes seven categories: Sludge of finish work of materials (metals, glass, etc.), Solid mineral wastes of mechanical and thermal treatments, Banal waste, Solid mineral wastes of chemical treatments, Materials and soiled material, Waste of cooking, fusion and incineration, and Rejects of use, losses. Each waste category includes subcategories. Each category of wastes gives access to all the data and related information. For instance case of Rubber figure 2.

#### 3. 3. Database structure of generating industries

The diagram of figure 3 shows the structure of the generating activity database. The generating activity structure includes eight generating activities: energy, Textile and Leather, Wood and Furnishings, Various industries, Metallurgy- Mechanical and Electric construction, Para chemistry, Agriculture-Agricultural industry, Chemical industry, Paper, Paperboard, Printing works, nonmetal ores, Building materials-Ceramics- Glass. Each generating activity category includes subcategories. Each subcategory of generating activity gives access to all the data and related information. For instance case of machining figure 4.

#### 3. 4. Analysis of the Database structure

To connect the solid wastes of figure 1 to the industries data of figure 3, in the same way as (Maes, 1986) we proceed as follows.: Sludge of finished work and the work of the materials (metals, glass, etc.) are annexed to the work of metals (rolling, wiredrawing, drawing, milling, etc.), manufacture of packing, melting industries, greazing (Gisard,1986) and oil and grease



industries from animal or vegetable. Solid mineral waste of mechanical and thermal treatments are annexed to the mechanical industries, metallurgy, iron and steel industry, surface treatment and to the manufacture of products based on asbestoses. Solid mineral wastes of chemical treatments include the chemical industries, iron and steel industry and mechanical industries. Waste of materials and materials soiled are annexed to the various industries, users of materials and materials soiled. The rejects of use and losses are annexed to the mechanical industries, electric, electronic, various industries, powders manufacture industries and explosives. Simple Waste is connected to the processing industries of rubber and plastics, building materials industries, ceramics and glass, papers and paperboards industries, wood and furnishing industries, textiles and clothing industries, industries of building sites, construction and earthwork.

### 3. 5. Application examples: request

Table 1 show the results of Pneumatic industry in the zone of Casablanca. These results are obtained from figure 2 on the Rubber level. The solid waste generated by this activity is grouped in table 1. Tonnages of solid waste vary from 0,720 to 1,080 ton per annum; with a total quantity of 3 tons. Solid waste of this activity are treated by the company itself, or incinerated by a third, or put in discharge.

Table 2 represents the solid waste quantities on the level of a manufacturing industry of metallic containers characterised by name, tonnage, code and category. These results are obtained from figure 2 when Rubber is substituted by Metals. Tonnages of the solid wastes caused by this company are 20 tons per annum and 3000 tons per annum. They gather: Tinplate and Aluminium. This waste is sold at foundries or steel-works (aluminium or iron fiber).

Table 3 represents the solid waste quantities on the level of two manufacturing industries of plastic packing in the zone of Casablanca. This type of industry counts among its solid waste plastic bags. These bags can be recycled onto dustbin bags, or put in storage by the company itself until later use. The results of Table 3 are obtained when Rubber is substituted by Plastic materials Figure 2.

Maes, M., 1986. Industrial wastes, mode of employ Edited by Lavoisier. Paris, France. pp. 1-539.

Grisard, N.D., 1986. Industrial and urban solid waste, treatment, destruction and valorization. Technical and documentation. Lavoisier; edition CEDEDOC. Paris. pp. 1-84.

## 4. CONCLUSION

The annual production of solid wastes on a industrial scale is significant. These solid wastes present a large quantity of reusable elements and can thus replace sources of raw material of natural origin used in industries. The samples analyzed in the present study are devoid of dangerous industrial solid wastes. The dangerous industrial wastes including several types such as Organic waste (hydrocarbons, tar, solvents, sludge of painting, etc). Mineral solid waste (sands of foundries, sludge of metal hydroxides, cyanided salts of hardening, fly-ashes of treatments of smoke, etc). This amount, even though will be small compared to the total generated industrial wastes, needs special and careful precautions for handling and disposal.

Valorisation of industrial wastes via the development of a database can contribute to reduce the cost in supply of raw materials for industries and, at the same time, to decrease the pollution of the environment.

As part of the collection of solid wastes, we tried to obtain information on the types and amounts of wastes of certain sub sectors particularly important, such as surface treatment, manufacturing industry of metal packaging, tire manufacturing industry and plastic packaging manufacturing industries. We therefore obtained relevant information on the major types of wastes which permitted us to acquire a good estimate of the quantity. However the information obtained was not complete and only concerned a few sub-sectors. Accordingly, the data available can not allow us to determine the amounts of solid wastes by the method of collection by questionnaire. In order to obtain reliable data for developing a database, we will have to resort to other method using available industry information



## REFERENCES

- [1]. Abduli, M.A., 1996. Industrial waste management in Tehran. *Environment International* 22,,335–341
- [2]. Alkamali, A., Elshorbagy, W., 2005. Solid waste generation from oil and gas industries in United Arab Emirates. *Journal of Hazardous Materials* B120, 89–99
- [3]. Asadi, M., Razy, D.F., Vojdony, M.,1996. Identification of industrial wastes in Tehran and methods for their disposal. *Waste Management and Research* 14, 211–217.
- [4]. Balakrishnan, M, Tewari, P.K., Batra, V.S., 2007. Efficient water use in industries: Cases from the Indian agro-based pulp and paper mills. *Journal of Environmental Management*,1-9.
- [5]. El-Fadel, M., Zeinati, M., El-Jisr, K., Jamali, D., 2001. Industrial waste management in developing countries; the case of Lebanon. *Journal of Environmental Management* 61, 281–300.
- [6]. Khyati, A., Messafi, A., 2004. Treatment of liquid rejections emanating from industries of surface treatments and their re-use in the chains of circuits according to the principle “rejection zero”. *Desalination* 167, 87-99.
- [7]. Zamorano, M., Ramos, A., Matara,A., Ulierte, N., Casares, M.L.,2005. Solid industrial wastes and their management in Asegra (Granada, Spain). *Waste Management*, 25, 1075–1082.

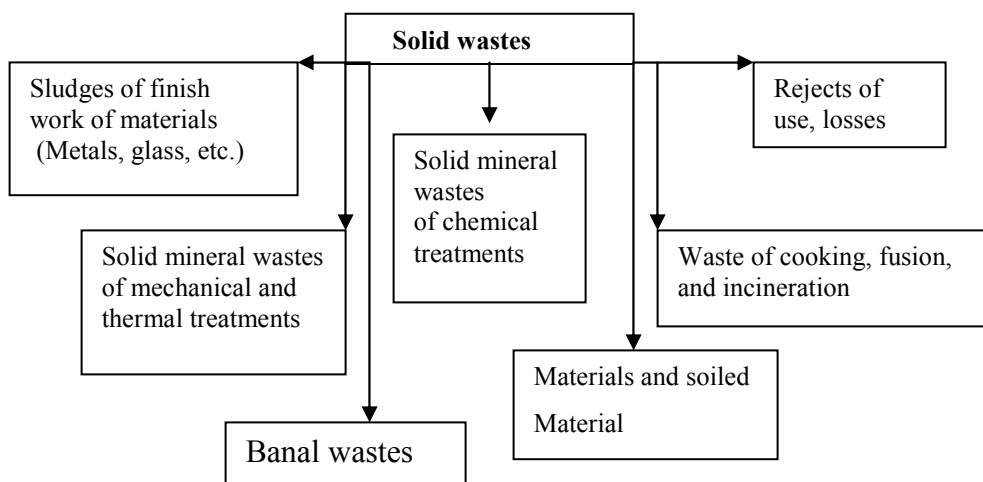


Figure 1: Diagram of the database structure of solid wastes

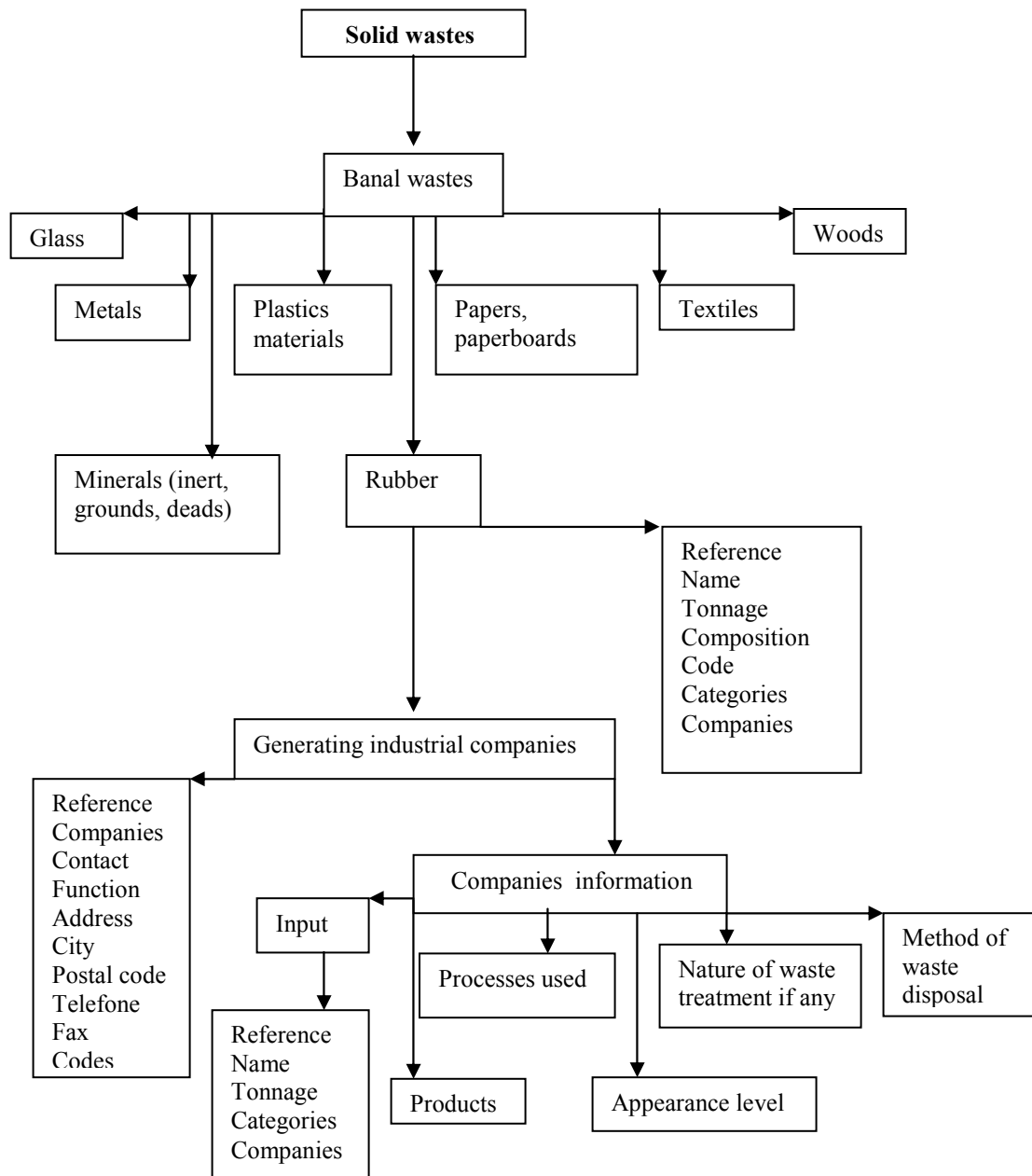


Figure 2: Diagram of the database structure of banal wastes

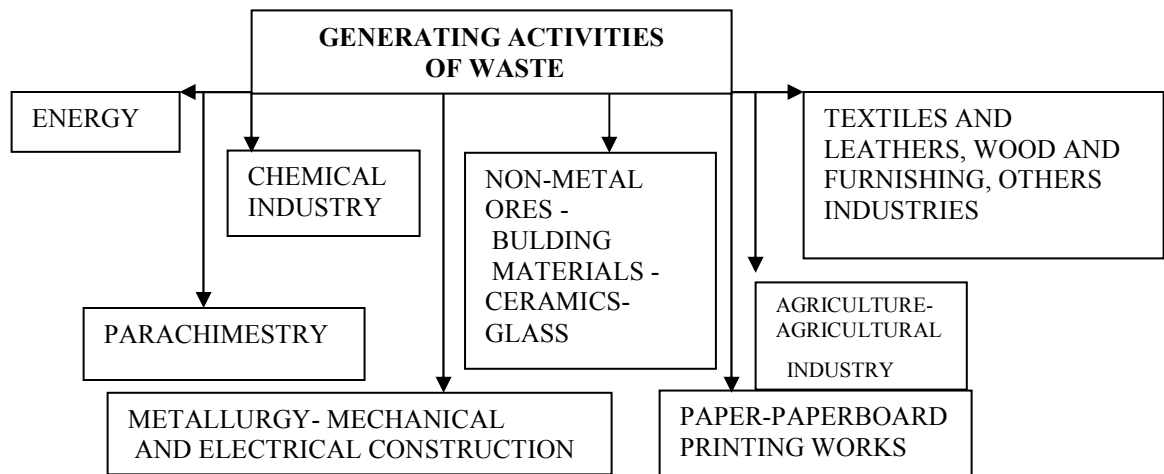


Figure 3: Diagram of the database structure of industries



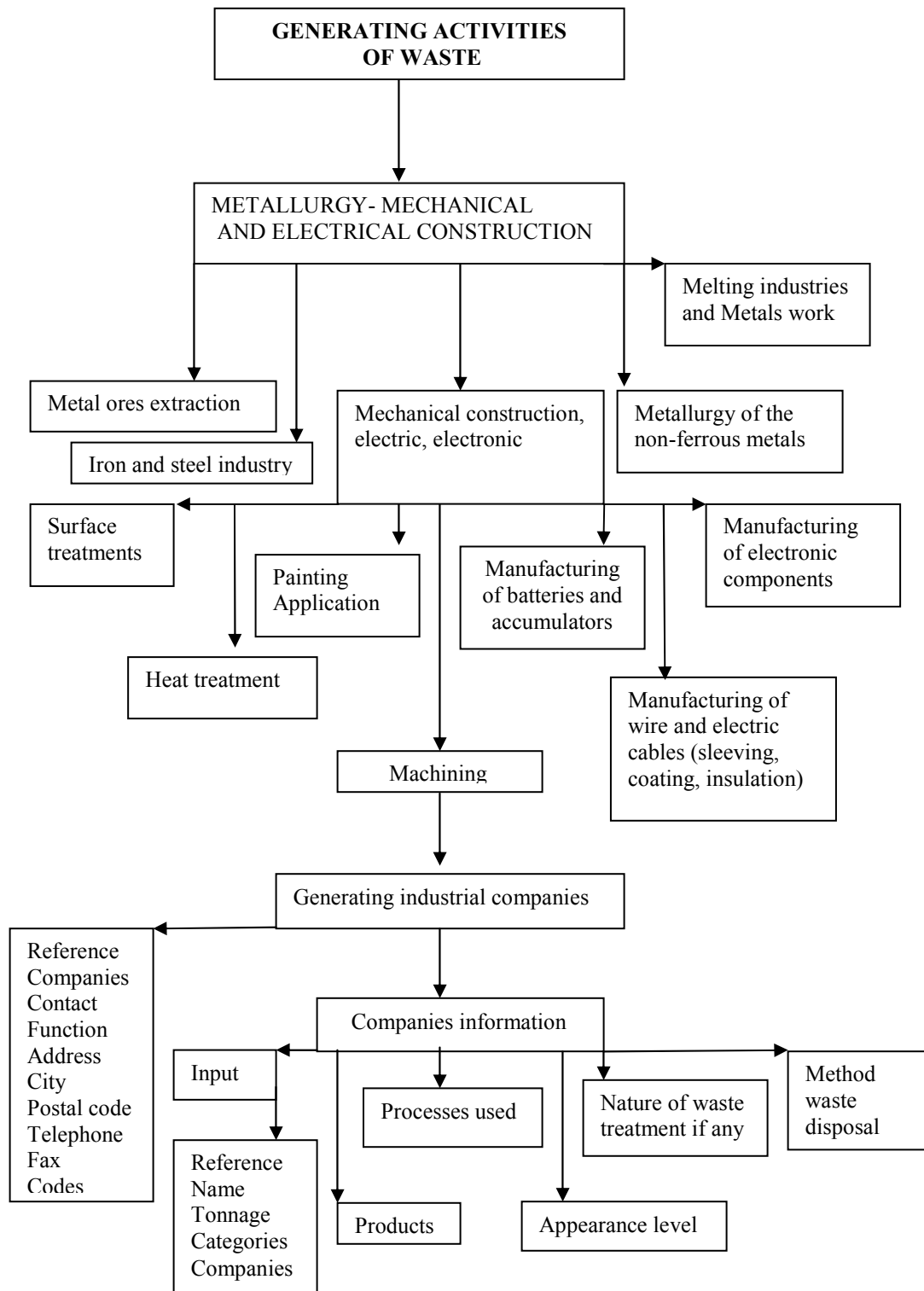


Figure 4: Diagram of the database structure of the Mechanical construction, electric and electronic

*Table 1: Solid waste quantities on the level of a pneumatic industry in the zone of Casablanca*

Réf	Name	Tonnage	Code	Category
1	Natural rubber	1080 Kg/annum	C840	Pneumatic manufacturing
2	Synthetic rubber	720 Kg/annum	C840	Pneumatic manufacturing
3	Gum-Nilon fiber	1200 Kg/annum	C840	Pneumatic manufacturing

*Table 2: Solid waste quantities on the level of a manufacturing industry of metallic containers in the zone of Casablanca*

Réf	Name	Tonnage	Code	Category
1	Tinplate	3000 tons / annum	C810	Manufacturing of metallic containers
2	Aluminium	20 tons / annum	C810	Manufacturing of metallic containers

*Table 3: Solid waste quantities on the level of two industries of plastic packing in the zone of Casablanca*

Réf	Name	Tonnage	Code	Category
1	plastic bags	180 tons/annum	C830	Manufacturing of plastic packings
2	plastic bags	36 tons/annum	C830	Manufacturing of plastic packings