

Industrial waste generation and characterization in Iran: a circular economy approach

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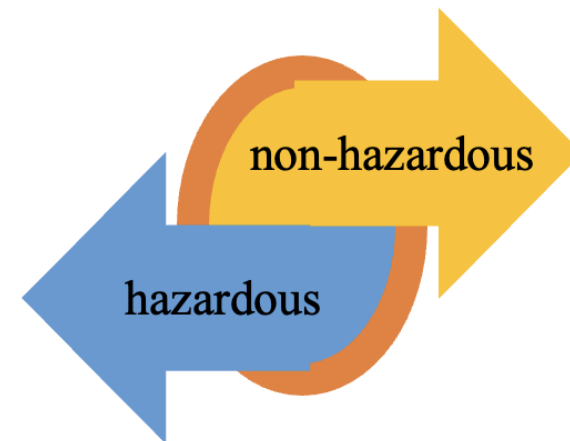
Introduction

The industrial waste can cause environmental pollution. Various forms of industrial waste contain highly toxic organic and inorganic pollutants.

Consequently, such hazardous wastes need to be appropriately managed to protect the environment and public health.

The global industrial waste generation in 2011 was approximately 9.2 billion tons, and the global industrial waste generation per capita is about 1.74 tons.

The United Nations has declared that one indicator of sustainable development is the requirement to substantially reduce waste generation by 2030 as a result of prevention, reduction, recycling, and reuse



Introduction

Iran's economy transformed from agricultural to industrial due to industry development and rapid economic growth.

Iran faces numerous environmental issues due to its expanding urban population, and industrial solid waste management is one of the most pressing ones.

It is estimated that the growth rate of production of this industrial waste is 6.8% per year (Reported by the Department of environmental of Iran, 2020).

To manage industrial waste effectively, it is essential to understand the characteristics, composition, and types of industrial waste (food, chemical industry, etc.).

there has been no comprehensive study of the amount and characteristics of industrial waste, nor its potential for reuse.

This study investigated the generation, characteristics, and reuse potential of industrial waste generated in Iran. This research was conducted in the major international and Iranian national databases, including Science Direct, Scopus, PubMed, Google Scholar, SID, Civilica, and Magiran, using appropriate keywords in order to identify the articles that have been published on the topic at hand.

Methodology

Iranian industries have experienced rapid growth, resulting in an increase in the production of industrial waste, yet no basic steps have been taken to classify or identify the compounds. There is no clear structure or process for describing the current state of affairs in the studies completed today, and case studies and the data they contain are fragmented.

The current situation in Iran:

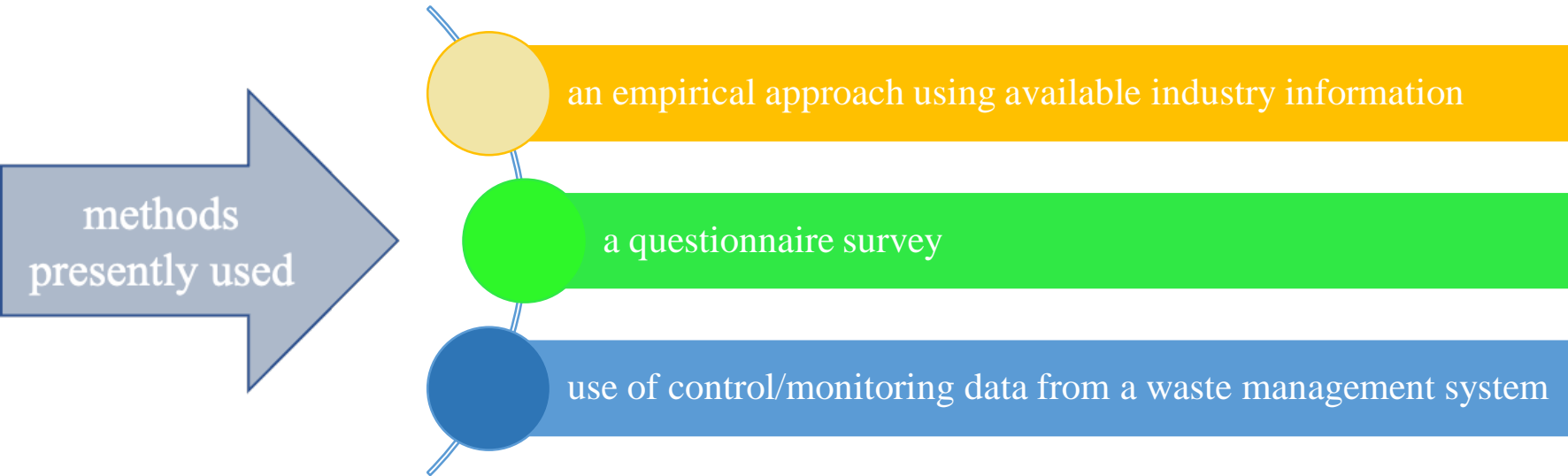
Due to improper transportation and industrial waste disposal, Iran has witnessed one of the most devastating consequences of industrial development over the last few decades.

There are currently no comprehensive waste management systems for the industries in Iran. According to studies, a small percentage of industrial waste produced in Iran is recycled or reused.

Under the waste management law, companies and industries are responsible for managing production waste, so there are no strict rules and regulations in this area.



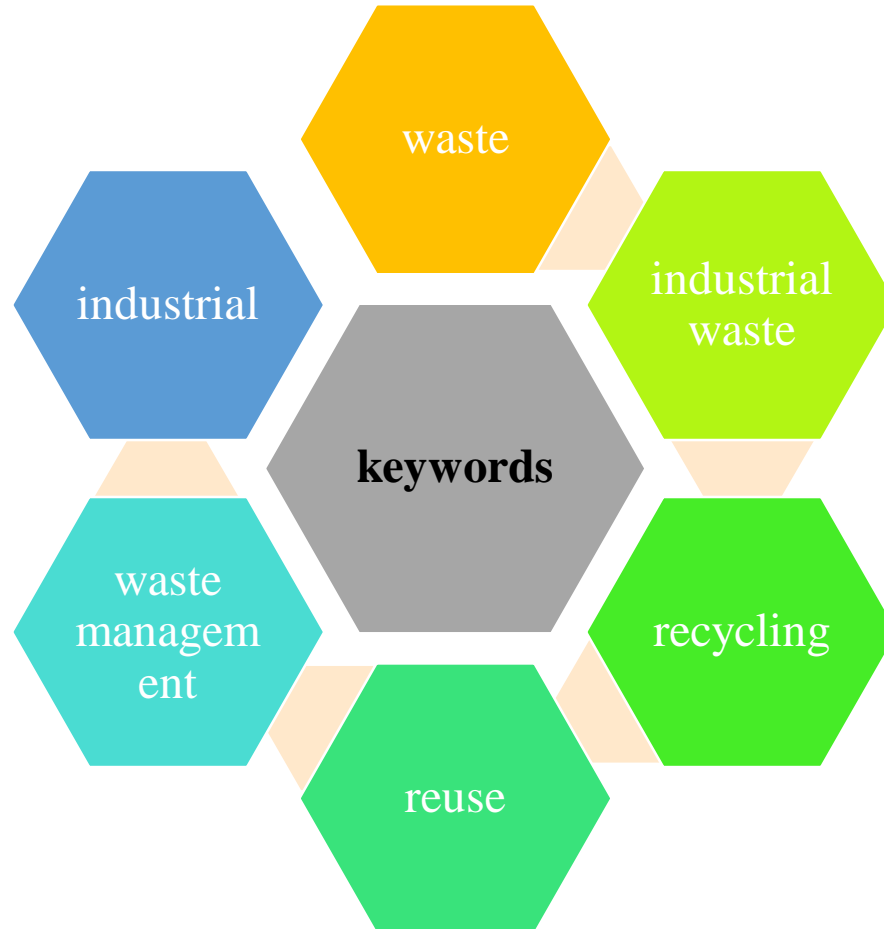
Data collection



The studies used for this research have used two methods of observation and questionnaires. Survey questionnaires were prepared according to Iran's Department of Environmental Protection standards. These questionnaires collect data on waste generation, composition, industry type, waste management methods, and recycling and reusing. Surveys are given to companies and industries, which they fill out, and then the data is extracted.

Search strategy

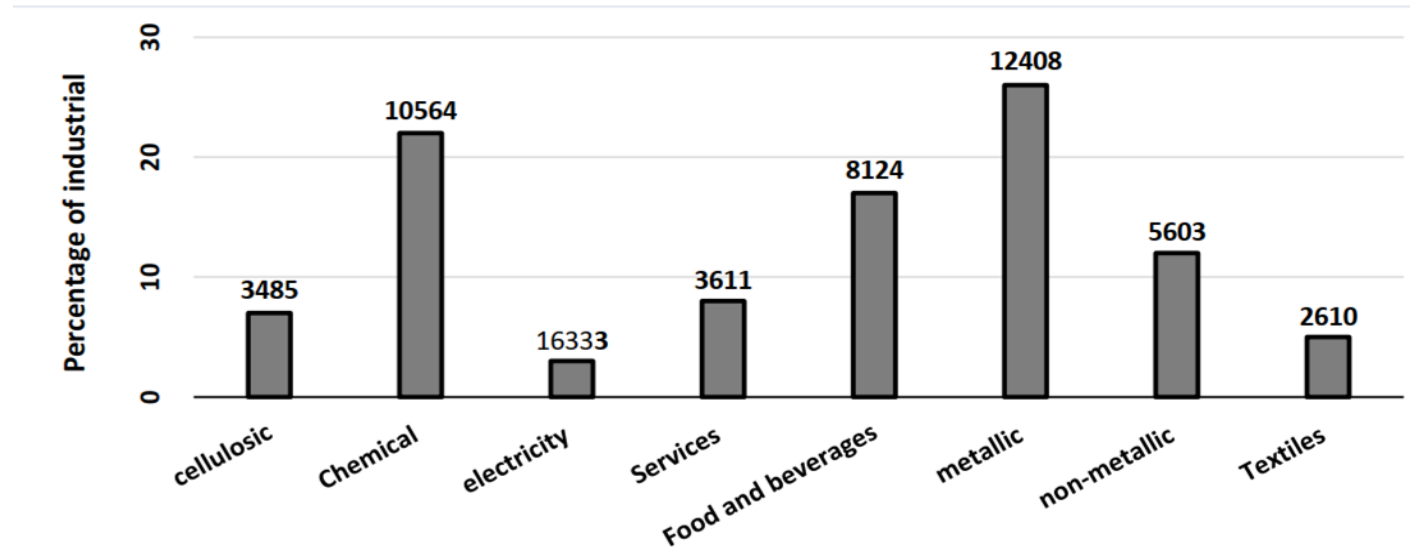
We then checked the abstracts and keywords of each article for relevance to our study, and after filtering and excluding irrelevant papers, we extracted useful and applicant data.



Result and discussion

Classification of industrial activities

In Iran, there are 2400 companies with more than 100 employees and 48038 small industrial units in more than 832 industrial parks.



Classification of active companies in industrial parks in Iran

Articles that have been examined during this study have been classified according to the standard of the Environmental Protection Organization of Iran. The following industries are included in this classification: 1) food and beverages industry, 2) non-metallic mineral industry, 3) cellulosic(wood, paper), 4) metal industry, 5) Textile industry, 6) chemical industry, 7) electronic industry, and 8) machinery and equipment industry.

Result and discussion

Table 1 The generation rate and classification of industrial waste

reference	Study location	Industry activity								Total
		Chemical	Food And Beverages	Metallic	Non-Metalic	Cellucis	electricity	Machinery	Textile	
[31]	Nasir Abad I.P	395	520	170	-	170	420	-	-	1405
[30]	Ore and Shoja abad I.P	-	-	-	-	-	-	-	-	228350
[29]	Bo Ali I.P	1342	665	106	1303	138	33	-	37	3625
[28]	Isfahan I.P	467	984	21464	160	-	-	-	410	23485
[27]	Neyshabur I.P	-	-	-	-	-	-	-	-	15121
[26]	Razi(Isfahan) I.P	1456	16	8846	84	400	-	-	13	10815
[25]	Qazvin I.P	172560	12552	53820	15466	738	-	-	516	255652
[24]	Rasht (food industry waste)	-	91	-	-	-	-	-	-	91
[23]	Rasht I.P	216	204	264	228	96	108	84	144	1344
[22]	Rafsanjan I.P	-	-	-	-	-	-	-	-	2139
[21]	Tehran municipality's 9th zone	-	-	-	-	-	-	-	-	4851
[20]	industries Located between Tehran and Karaj Zone	-	-	-	-	-	-	-	-	45060
[19]	Gilan Province (plastic industries)	-	-	-	-	-	-	-	-	207
[18]	Ghadir iron & steel company	-	-	-	-	-	-	-	-	39307
[17]	Caspian I.P	147	350	413	-	49	103	86	121	1269

Result and discussion

Table 1. continued

reference	Study location	Industry activity								Total
		Chemical	Food And Beverages	Metal	Non-Metalic	Cellucis	Electronic	Machinery	Textile	
[40]	a petrochemical company in west	-	-	-	-	-	-	-	-	353
[39]	Kavir Steel Complex	-	-	99	-	-	-	-	-	99
[13]	Shiraz Oil Refinery Company	348	-	-	-	-	-	-	-	348
[38]	Nazar Abad I.P	-	-	-	-	-	-	-	-	806
[15]	Kavian Petrochemical Company	265	-	-	-	-	-	-	-	265
[37]	Semnan I.P	-	-	-	-	-	-	-	-	5440
[36]	Abas Abad I.P	5281	5817	47232	70	231	-	-	-	59441
[35]	Shams Abad I.P	-	-	7212	426048	-	-	-	-	433260
[34]	Shokohie I.P	911	-	666	640	31	20	2	220	2490
[33]	Birjand I.P	-	-	-	-	-	-	-	-	126
[32]	Yazd I.P	5524	3487	2147	2523	1543	-	5211	1432	21867
[16]	Savojbolagh I.P	4472	5396	5493	1393	1418	1389	3346	477	23384
[10]	Arasanj I.P	36	157	90	14	4	18	6	5	330
	Total	188766	28840	142026	446522	5495	1358	6132	6927	1,180,930

*I.P: Industrial Park

Result and discussion

the total amount of industrial waste produced is 1,180,930 tons per year.

the highest amount of waste produced is from Shams Abad industrial park, and the lowest amount is from Birjand industrial park.

the largest amount of waste is generated by the Non-Metallic industries.

Many large factories and industries, such as chemical and metal industries in Iran, operate outside industrial parks where the amount and classification of their waste have not been carefully studied.

Waste production and classification studies have typically focused on determining the best ways to manage waste. Even though about 50% of industrial waste is recyclable and reusable, these studies show that only a small percentage is recycled.

conclusion

The purpose of this article is to investigate the classification and generation of industrial waste in Iran using a circular economy approach. As a developing country, Iran produces more industrial waste than other countries based on the data and results obtained. There are significant amounts of these wastes that can be recycled or reused; however, due to an inadequate waste management system, only a small percentage of them are. To improve the existing conditions for the reuse and recycling of industrial waste, the following solutions are recommended:

- Scientific training for industries or consulting with experts in this field.
- Implementing an integrated waste management system.
- Establishing a database that includes information about industrial waste generation, classification, and composition.
- Sorting hazardous and nonhazardous wastes at the source.
- Optimizing equipment and production processes.
- Supporting and creating various incentives for waste management in industries.



**THANKS FOR
ATTENDING**