Industrial Wastes Risk Ranking with TOPSIS, Multi Criteria Decision Making Method

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Abstract

Today, various types of industrial waste are produced in different industries to meet human demands. Growth in quantity as well as complication in quality of these wastes are followed by the advance of technology. Management of such wastes need a proper identification and comprehensive understanding of the risk, emerging after the harmful characteristics of the wastes and negatively affect the human and environment health. Wastes risk ranking systems, in this regard, links between the industrial wastes indices and mathematical method/algorithm, being able at estimation of the risk level as well as comparison between the wastes of an industrial unit based on the risk level. Complexity of the method, high computational costs and lack of proper description of waste using selected indices in former studies has led to the proposal of an applicable and flexible method. In this study, the "TOPSIS Multi-Criteria Decision-Making (MCDM) method" was developed in order for ranking the risk of various industrial wastes. Totally, a number of 9 subsidiary indices on the human health and 11 subsidiary indices on the environment health was identified and employed. Finally, the proposed waste risk ranking system was used for ranking 9 types of identified industrial waste in three industrial section. Results show that the "TOPSIS MCDM", due to the lack of complexities in method and limited computational costs, is an efficient and appropriate method for ranking industrial wastes.

Keywords: Industrial Waste; Waste Risk Ranking System (WRRS); TOPSIS Multi-Criteria Decision (MCDM) Method; Descriptive Indices of Waste.

1. Introduction

Cities of the Asia and Pacific region have accommodated 2.1 billion people, more than half of the world's urban population, while this portion will continue to grow with the growth of regional urbanization within the current century [1]. Until 2050, nearly 65% of the regional population will be urbanized, starting from 47.4% in 2014. Most of this progress will occur in cities containing below 500,000 residents (i.e. secondary cities and towns) in middle- and low-income countries. Unfortunately, these cities are conventionally provided with the least facilities to face the difficulties cussed by instant urbanization. Urbanization would leave significant tracks on all aspects of life, such as the environmental and human health. Today, human and environmental health issues caused by various types of industrial wastes are resulting from large scale production of wastes, being vast in variety and composition, as well as unfamiliarity with the waste types and complications of waste management [2]. Proper identification of waste directly affects the estimation of their risk, and preparation in order to encounter and prevent the harmful tracks of industrial waste [3, 4]. Physical, chemical, and toxicological properties as well as production volume and use patterns are demanded to identify hazards and estimate the risks resulted from industrial and other groups of wastes [5].