Environmental Engineering and Management Journal xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
http://www.eemj.icpm.tuiasi.ro/; http://www.eemj.eu

"Gheorghe Asachi" Technical University of Iasi, Romania

COMPREHENSIVE ENVIRONMENTAL IMPACT COST QUANTIFICATION MODEL OF TEXTILE PRODUCTS

Qianwen Huang[1], Yue Sun[1], Cai Hao[1], Qizheng Li[2], Ying Zhang[1], Xin Li[1], Laili Wang[1,3,4*]

[1]School of Fashion Design & Engineering, Zhejiang Sci-Tech University, Hangzhou, Zhejiang 310018, China
[2]College of Textile Science and Engineering (International Institute of Silk),
Zhejiang Sci-Tech University, Hangzhou, Zhejiang, 310018, China
[3]Research Center of Digital Intelligence Style and Creative Design, Zhejiang Sci-Tech University, Hangzhou 310018, China
[4]Green and low-carbon technology and industrialization of modern logistics,
Zhejiang Engineering Research Center, Hangzhou 310018, China

Abstract

Global warming, air and water pollution, and other ecological challenges significantly hinder sustainable human development. The textile industry, while crucial to national economies, poses considerable environmental risks. Current evaluation tools often fail to normalize various environmental impact indicators, and few studies examine these impacts from an economic perspective. This research quantifies the multidimensional environmental impacts of textile production through a unified comprehensive index, enabling cross-process evaluation. By employing comprehensive environmental impact assessment frameworks, the study assesses the effects of greenhouse gases (GHG), volatile organic compounds (VOCs), and wastewater pollutants on human health and ecosystems. Additionally, it introduces a novel method for quantifying environmental impact costs for textile products, integrating the Environmental Profit and Loss (EP&L) method with the willingness-to-pay (WTP) approach. Example was provided based on viscose fiber production. The result reveals that GHG emissions account for 52.88% of the total environmental impact cost, followed by VOCs at 38.48%, with water eutrophication from wastewater pollutants contributing only 8.64%. This case study confirms the scientific feasibility and applicability of the proposed methods for textile products, facilitating comparability among various textile products and supporting informed decision-making.

Key words: comprehensive environmental impact cost, greenhouse gases, textile products, volatile organic compounds, wastewater pollutants

Received: June, 2024; Revised final: October, 2024; Accepted: November, 2024

* Author to whom all correspondence should be addressed: e-mail: wangll@zstu.edu.cn