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ENVIRONMENTAL PERFORMANCE OF A POLYAMIDE-BASED THERMOPLASTIC COMPOUND WITH BROMINATED FLAME RETARDANTS

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Abstract – Thermoplastic compounds are present in various industrial, domestic and consumer applications thanks to their strength, lightness, flexibility, and processing properties. However, thermoplastics are often derived from polymers formed from nonrenewable sources, such as petroleum. In addition, the production processes have a high consumption of energy. For this reason, assessing the environmental impacts caused by the production process is of primary importance. This research evaluates the environmental performance of a polyamide-based thermoplastic compound with brominated flame retardants. The objective is to understand which phase of the production process has the most significant impacts. The assessment of environmental impacts was carried out through the Life Cycle Assessment methodology using *SimaPro v9.5*, *Ecoinvent v3.9* database and *ReCiPe 2016 v1.07* impacts assessment method. The primary data were generated and collected in a factory in northern Italy, and the Functional Unit considered is 1 kg of final product. The results show that the upstream phase accounts for more than 90 % of the environmental profile, especially in human noncarcinogenic toxicity, with more than 56 % of the total impacts and fine particulate matter formation with 18 % shares. At the climate change level, the product delivers a total impact of 6.17 kg CO₂ eq per kg of the final product. This study indicates that most of the impacts are caused by the production of raw materials. For this reason, it is necessary to introduce more sustainable and environmentally friendly raw materials.

Keywords – *Appropriate technology; circular economy; climate change; ecodesign; Life Cycle Assessment; sustainable processes; thermoplastics*

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