A review of thermal treatment options for single-use, multilayered and composite waste plastics in Africa

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Abstract

The goal of this paper is to highlight the current level of waste plastics valorization through thermal treatment and its suitability in African countries. The state of the art in energy recovery from plastics waste was investigated, with a focus on the differences for available treatment options like gasification, pyrolysis, incineration or combustion, and catalytic gasification. The investigation was achieved through the review of papers published in scientific journals and conferences, with consideration of technical reports for additional information.

This review paper first highlights the prevalent condition of waste plastics in Africa, with consideration on generation, and disposal or treatment. Furthermore, the values of measured and calculated energy conversion efficiencies are compared for each thermal process.

The investigation revealed that with an average electrification rate of less than 25 %, improved thermal treatment options for the generation of electrical and chemical energy as output products are needed. Also, the method most often used for waste plastics treatment in Africa is combustion. This is due to the low separation efficiency of waste plastics from Municipal Solid Wastes (MSW). Cogeneration involving an incinerating system and a steam conversion system produces the best outcome for electrical energy generation. However, the best energy efficiency relies on the size of the plant, making this method unsustainable on a small scale. Conversely, for chemical energy production, pyrolysis/gasification offers the best energy recovery efficiency with a promising gas output lying between 20 – 80 %, a liquid output of 30 – 70 % and solid output of 10 – 30 %. For electrical energy production, the best conversion efficiency is achieved through gasification combined with a generator. This would guarantee a thermal efficiency of 70 – 80 %. The feasible waste plastics treatment options are presented based on the waste plastics profile in Africa.

Introduction

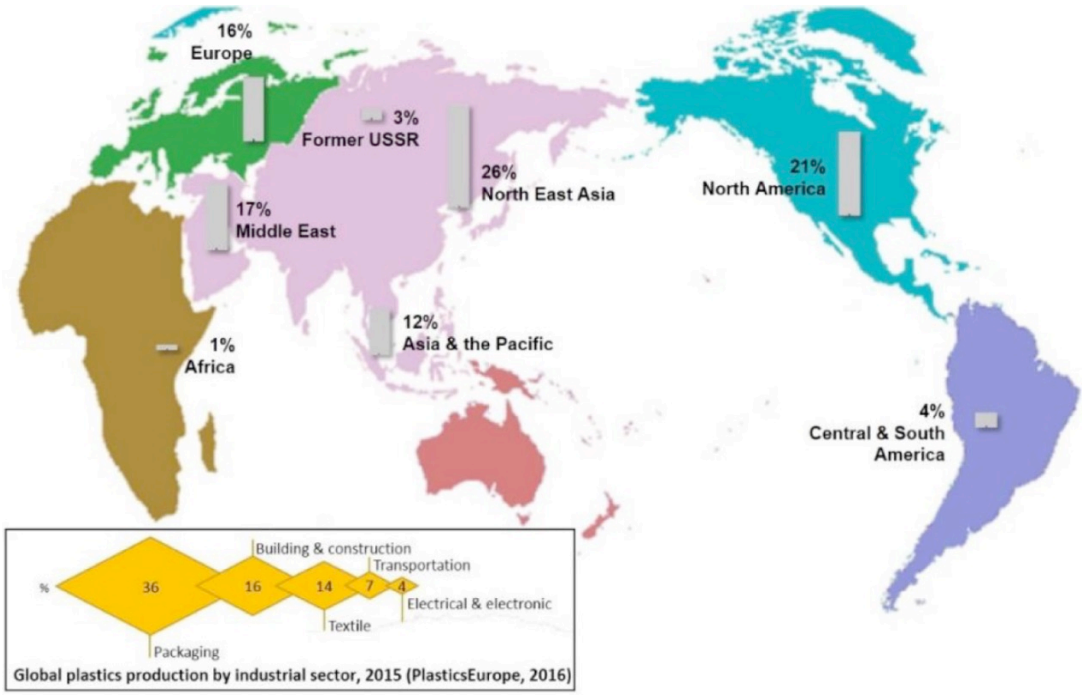

Figure 1: Graph review showing composite waste plastics in the world and in Africa (data limitations) (Geyer *et al.*, (2017))

References

1. (Geyer *et al.*, (2017))