Editorial

iMedPub Journals
www.imedpub.com

Environmental and Toxicology Studies Journal
ISSN Environ Toxicol Stud J

2020
Vol.4 No.2:1

DOI:10.36648/2472-0151.6.1.100047

Plastic Incorporation in Composites Aiming Circular Economy and Energy Efficiency of Buildings

Flores-Colen I*

Civil Engineering Research and Innovation for Sustainability, Instituto Superior Técnico, Universidade de Lisboa, Av. Rovisco Pais, 1049-001, Lisbon, Portugal

Corresponding author: Ines Flores-Colen, Civil Engineering Research and Innovation for Sustainability, Instituto Superior Técnico, Universidade de Lisboa, Av. Rovisco Pais, 1049-001, Lisbon, Portugal, E-mail: ines.flores.colen@tecnico.ulisboa.pt

Received date: July 06, 2020; **Accepted date:** July 20, 2020; **Published date:** July 27, 2020

Citation: Flores-Colen I (2020) Plastic Incorporation in Composites Aiming Circular Economy and Energy Efficiency of Buildings. Environ Toxicol Stud J. Vol.6 No.1. DOI: 10.36648/2472-0151.6.1.100047.

Editorial

Environmental pollution derived from plastics is one of the major challenge of the XXI century. Common plastics are non-biodegradable (e.g. PET, PE, PS) and may take hundreds of years to degrade. Global production of plastics reached 322 Mton in 2015 (25.8 Mton/in Europe) and is expected to double over the following 20 years. Its massive use has not been balanced by recycling and recovering processes (<30%) [1]. In Europe (2018), other end-use destinations are incineration (where potentially reusable materials are burnt and contaminants released) (43%) and landfill (25%) [2].

Plastic waste that ends up in the oceans (1.5-4% of global plastics production) is among the most visible signs of environmental pollution, triggering a growing public concern [1]. Animals can be entangled in plastic or poisoned by microplastics [3], causing numerous deaths and affecting the whole food chain. Furthermore, plastic waste on land is estimated to be 4-23 times higher than waste released into the oceans, affecting terrestrial ecosystems and water resources [4]. Recent insight driven-actions have been made on the hazards of ocean plastic pollution.

The new EU Circular Economy Action [5] points out the plastic and construction sectors as those with higher resources use and with higher potential for circularity. Plastic reuse/recycling were identified as a strategy to boost European competitiveness and innovation, control climate change and accomplish the UN 2030 Sustainable Development Goals. Plastic waste can be thus transformed into a new resource, reducing the dependency on fossil fuels [2]. Chemical recycling can produce useful feedstock for the industry and products for other applications [6] including construction.

There is also a growing concern for buildings' sustainability. Energy-saving and environmental-wise European directives promote building energy efficiency, and buildings NZEB [7] which allow the reduction of CO_2 emissions and guarantee adequate levels of thermal comfort. These legal impositions promoted the use of thermal insulation solutions. Thus, it is necessary to develop cost-effective mortars, with a positive balance between thermal conductivity/mechanical strength, and a sustainable and long life cycle, to be applied on thermal retrofitting and new buildings.

Plastic materials have been also used in insulating materials due to their low cost, density and weight, and good durability. The incorporation of plastic waste and bio plastics are relevant energy savings strategies in new construction products [8]. Municipal solid waste mainly contains six plastics fractions which include: HDPE, LDPE, PP, PS, PVC and PET. All these plastics are generally not biodegradable, deriving from oil, constituting an increasing environmental load [9]. Hence, the use of recycled plastic materials can significantly contribute towards a more sustainable construction. Several studies have incorporated plastic waste in conventional concrete and mortars, to enhance mechanical and durability properties, leading to environmental benefits [10-12]. EPS, LDPE, HDPE, PS, Mix plastic, PVC, PET, EVA, and PUR have also led to increased thermal performance when incorporated as fine or coarse aggregates (25 to 60% by volume). However, the weak plastic aggregate-cement bond, related to the hydrophobic nature of the plastic, provides low mechanical strength. The addition of plastic fibers (of PP), with ratios of incorporation of 0.1% to 1% by volume, can reinforce the composite, reducing water permeability and improving durability. The benefits of each plastic on the composite's properties significantly depend of the recycling and treatment methods (e.g. crushing; grinding; heating; immersion) [13]. Mechanical recycling (with lower environmental impact) generally lead to worse properties when the plastic waste is submitted to a melting treatment [9,14]. Chemical recycling is an interesting option, allowing the treatment of waste containing mixed plastics or even contaminated plastic material for which mechanical recycling is not feasible [9]. Highly porous foamed aggregates (PUR, 10%-50% partial sand replacement) on conventional composites lead to a better hydrothermal performance, improving the moisture transport properties and the durability to sulfate attack [14]. Furthermore, bio plastics produced from renewable sources can replace the previous petro-chemical plastics. There are a few studies on their incorporation, as powder or fibers, to achieve improved thermal performance, e.g. [15].

The development of a global clean energy economy makes energy saving a strategic goal. In other hand, the incorporation of plastic in construction materials boost the potential for circularity. The balance of these issues will allow materials with multi performance, low environmental impacts and reduced costs during the service life.

References

1. European Commission (2018) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A European Strategy for Plastics in a Circular Economy, Brussels.
2. Plastics Europe (2019) The Circular Economy for Plastics. A European Overview, Association of Plastics Manufacturers. Plastics Europe AISBL.
3. Ribeiro F, Garcia AR, Pereira BP, et al. (2017) Microplastics Effects in “Scrobicularia Plana”, Marine Pollution Bulletin 122: 379-391.
4. Horton AA, Walton A, Spurgeon DJ, et al. (2017) Microplastics in freshwater and terrestrial environments: Evaluating the current understanding to identify the knowledge gaps and future research priorities. Science of The Total Environment 586: 127-141.
5. EU Circular Economy Action Plan (2019) A new Circular Economy Action Plan for a Cleaner and More Competitive Europe. European Commission.
6. Santos E, Rijo B, Lemos F, et al. (2019) A catalytic reactive distillation approach to high density polyethylene pyrolysis-Part 1-Light olefin production. Che Eng J 378: 122077.
7. European Union (2018) Directive (EU) 2018/844 of The European Parliament and of the Council of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on the energy efficiency. Brussels, Belgium.
8. Abu-Jdayil B, Mourad A, Hittini W, et al. (2019) Traditional, state-of-the-art and renewable thermal building insulation materials: An Overview. Constr & Buil Mat 214: 709-735.
9. Santos E, Rijo B, Lemos F, et al. (2019) Lemos, M.A.N.D.A. - A catalytic reactive distillation approach to high density polyethylene pyrolysis – Part 1 - Light olefin production. Chem Eng J 378: 122077.
10. Vale M, Mateus MM, Galhano dos Santos R, et al. (2019) Replacement of petroleum-derived diols by sustainable biopolyols in one component polyurethane foams. J Clean prod 212: 1036-1043.
11. Pedreño-Rojas MA, de Brito J, Flores-Colen I, et al. (2020) Influence of gypsum wastes on the workability of plasters: Heating process and microstructural analysis. J Build Eng 29: 101143.
12. Pedreño-Rojas MA, Rodríguez-Liñán C, Flores-Colen I, et al. (2020) Use of Polycarbonate Waste as Aggregate in Recycled Gypsum Plasters. Materials 13: 3042.
13. Gu L, Ozbakkaloglu T (2016) Use of recycled plastics in concrete: A critical review. Waste Management 51: 19-42.
14. Coppola B, Courard L, Michel F, et al. (2018) Hygro-thermal and durability properties of a lightweight moratr made with foamed plastic waste aggregates. Constr & Buil Mat 170: 200-206.
15. Sayadi A, Neitzert TR, Clifton GC, et al. (2018) Ultra-lightweight concrete containing expanded poly-lactic acid as lightweight aggregate. KSCE J Civil Eng 22(10): 4083-4094.