Waste

1- Sustainable Practice in Pavement Engineering through Value-Added Collective Recycling of Waste Plastic and Waste Tyre Rubber

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Abstract:
Waste plastics, such as waste polyethylene terephthalate (PET) beverage bottles and waste rubber tyres are major municipal solid wastes, which may lead to various environmental problems if they are not appropriately recycled. In this study, the feasibility of collectively recycling the two types of waste into performance-increasing modifiers for asphalt pavements was analyzed. This study aimed to investigate the recycling mechanisms of waste PET-derived additives under the treatment of two amines, triethylenetetramine (TETA) and ethanolamine (EA), and characterize the performances of these additives in modifying rubberized bitumen, a bitumen modified by waste tyre rubber. To this end, infrared spectroscopy and thermal analyses were carried out on the two PET-derived additives (PET-TETA and PETEA).
In addition, infrared spectroscopy, viscosity, dynamic shear rheology, and multiple stress creep recovery tests were performed on the rubberized bitumen samples modified by the two PET-derived additives. We concluded that waste PET can be chemically upcycled into functional additives, which can increase the overall performance of the rubberized bitumen. The recycling method developed in this study not only helps alleviate the landfilling problems of both waste PET plastic and scrap tyres, but also turns these wastes into value-added new materials for building durable pavements. (C) 2021 THE AUTHORS. Published by Elsevier LTD on behalf of Chinese Academy of Engineering and Higher Education Press Limited Company.

2- Beyond Mechanical Recycling: Giving New Life to Plastic Waste

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Abstract:
Increasing the stream of recycled plastic necessitates an approach beyond the traditional recycling via melting and re-extrusion. Various chemical recycling processes have great potential to enhance recycling rates. In this Review, a summary of the various chemical recycling routes and assessment via life-cycle analysis is complemented by an extensive list of processes developed by companies active in chemical recycling. We show that each of the currently available processes is applicable for specific plastic waste streams. Thus, only a combination of different technologies can address the plastic waste problem. Research should focus on more realistic, more contaminated and mixed waste streams, while collection and sorting infrastructure will need to be improved, that is, by stricter regulation. This Review aims to inspire both science and innovation for the production of higher value and quality products from plastic recycling suitable for reuse or valorization to create the necessary economic and environmental push for a circular economy.

3- Mechanical, chemical and hydrothermal activation for waste glass reinforced cement

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Abstract:
Land disposal of waste glass results in hazardous environmental contamination. Such waste material should be reclaimed because it is inert and consequently nondegradable. The main component of glass is silica showing pozzolanic properties in cementitious matrices. Thus, the use of waste glass as a supplementary cementitious material in concrete is a sustainable solution to the land disposal of such waste materials. However, concrete incorporating waste glass suffers from deleterious expansion arising from alkali-silica reaction (ASR). This paper shows the effects of different activation approaches, including mechanical, chemical, hydrothermal, and combined activation, used to mitigate ASR. To this aim, activated waste glass powder (WGP) was produced using the aforementioned approaches and used in concrete as sand replacement at percentages of 0%, 10%, 20%, and 30%. The water to cement ratio remained unchanged for all mixes. Results showed that the combined activation was the optimal approach to increase mechanical property. The hydrothermal activation effectively reduced the detrimental ASR expansion, while the chemical treatment induced excessive expansion even for mixtures

with a low WGP content of 10%. Also, microstructural analyses showed erosion on the surface of WGP activated by chemical and combined activation methods. Besides, few CH crystals were observed on 75 mu m WGP mortar samples, illustrating the excellent pozzolanic activity on finer WGP.

4- Predicted growth in plastic waste exceeds efforts to mitigate plastic pollution

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Abstract:
Plastic pollution is a planetary threat, affecting nearly every marine and freshwater ecosystem globally. In response, multilevel mitigation strategies are being adopted but with a lack of quantitative assessment of how such strategies reduce plastic emissions. We assessed the impact of three broad management strategies, plastic waste reduction, waste management, and environmental recovery, at different levels of effort to estimate plastic emissions to 2030 for 173 countries. We estimate that 19 to 23 million metric tons, or 11%, of plastic waste generated globally in 2016 entered aquatic ecosystems. Considering the ambitious commitments currently set by governments, annual emissions may reach up to 53 million metric tons per year by 2030. To reduce emissions to a level well below this prediction, extraordinary efforts to transform the global plastics economy are needed.

5- COVID pollution: impact of COVID-19 pandemic on global plastic waste footprint

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Abstract:
Plastic products have played significant roles in protecting people during the COVID-19 pandemic. The widespread use of personal protective gear created a massive disruption in the supply chain and waste disposal system. Millions of discarded single-use plastics (masks, gloves, aprons, and bottles of sanitizers) have been added to the terrestrial environment and could cause a surge in plastics washing up the ocean coastlines and littering the seabed. This paper attempts to assess the environmental footprints of the global plastic wastes generated during COVID-19 and analyze the potential impacts associated with plastic pollution. The amount of plastic wastes generated worldwide since the outbreak is estimated at 1.6 million tonnes/day. We estimate that approximately 3.4 billion single-use facemasks/face shields are discarded daily as a result of COVID-19 pandemic, globally. Our comprehensive data analysis does indicate that COVID-19 will reverse the momentum of years-long global battle to reduce plastic waste pollution. As governments are looking to turbo-charge the economy by supporting businesses weather the pandemic, there is an opportunity to rebuild new industries that can innovate new reusable or non-plastic PPEs. The unanticipated occurrence of a pandemic of this scale has resulted in unmanageable levels of biomedical plastic wastes. This expert insight attempts to raise awareness for the adoption of dynamic waste management strategies targeted at reducing environmental contamination by plastics generated during the COVID-19 pandemic.