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Tesis

Evaluation of the Performance of Permeable Concrete Reinforced with Natural Agave and Bamboo Fibers for Urban Flood Mitigation in Huancayo

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Abstract Urban flooding is a growing challenge in cities worldwide, aggravated by climate change, inadequate infrastructure, and rapid urbanization. In Huancayo, Peru, streets such as Jirón Angaraes, Tarapacá, and Bolognesi are prone to recurrent flooding, leading to significant disruptions in daily life and deterioration of rigid pavements. This study aims to develop an innovative, sustainable solution to mitigate urban flooding by creating a permeable concrete mixture infused with natural fibers from agave (A) and bamboo (B). These fibers are incorporated to enhance both the drainage efficiency and the structural integrity of the concrete. The study examines various fiber dosages (0.4%-1.2%) and their effects on the mechanical properties and permeability of the concrete, using cylindrical and beam specimens tested for compressive strength, flexural strength, and permeability at different curing stages (7, 14, and 28 days). The results demonstrated a synergistic effect between bamboo and agave fibres, significantly improving the mechanical strength and permeability of the concrete, making it more efficient for water management. The optimal mix, composed of 0.8% agave fibres and 0.4% bamboo fibres, achieved a compressive strength of 242.06 kg/cm ² and a permeability of 1.167 cm/s, achieving an ideal balance between durability and permeability that offers an innovative solution to address urban flooding. These results highlight that the incorporation of natural fibres in pervious concrete not only provides an environmentally friendly alternative to conventional materials, but also contributes to the development of resilient infrastructure. This scalable and sustainable approach has the potential to be applied in other vulnerable regions globally, establishing itself as a valuable contribution to the field of civil engineering and urban resilience.

Keywords Agave Fiber, Bamboo Fiber, Permeability, Permeable Concrete, Permeable Concrete

1. Introduction

Globally, flooding in urban areas has been an increasing challenge due to the environmental and socioeconomic changes faced by the population. These factors, combined with the inappropriate use of flood-prone areas and the deterioration of storm drainage infrastructure, have exacerbated the vulnerability of cities. In particular, rigid pavements in urban areas channel large volumes of water into sewer systems, leading to collapse