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Effect of wastewater as sustainable concrete material on concrete performance: A critical review

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ABSTRACT

A massive amount of water has been consumed to produce concrete. The lack of sufficient water for drinking and other essential processes reduces the quantity of water that should be delivered to the people because of the high water consumption by concrete production. All the waste from commercial buildings, households, institutions, and hospitals are known as wastewater. Generally, the water demand is anticipated to increase considerably in the near future. Energy and industry production are expected to witness essential rises in water demand. The enormous quantities of water and generating large quantities of various wastewater from different treatment processes led to exploring different ideas to overcome these issues. One of these ideas is the utilization of wastewater in the construction industry, particularly in concrete mixtures and curing. In the literature, a lack of sufficient studies is obtainable for concrete production from wastewater. This study reviews the chemical composition and physical properties of wastewater and the durability properties of concrete. The treated wastewater from sewage treatment plants (STP) is utilized acceptably for particular utilization. Using treated effluent (TE) in concrete improves cement paste's setting time and compressive strength more than drinking water. The concrete samples containing wastewater recorded 7%–27% lower porosity than control concrete because of the hydration process of cement with time, in addition to the pozzolan reactions. In terms of rapid chloride penetration examination, the authors detected that the samples containing wastewater recorded higher Coulomb charges than that of the control concrete sample without wastewater at 28 curing days because of the high chloride ions in wastewater than that of tap water. The chloride ion penetration increased due to an increase in the domestic wastewater content. Consequently, there is a critical need to improve various processes to adopt and use wastewater in concrete mixtures. This study recommends using a high volume of wastewater to get sustainable concrete with high performance.

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1. Introduction

Concrete was extensively used as a construction material worldwide [1]. The rapid development and increasing population have resulted in increased concrete utilization in huge quantities

[2]. The most disadvantages of concrete production are water and air pollution [3]. The lack of drinking water sources is considered one of the world's greatest difficulties [4]. However, it's expected to increase the water requirement for industrial purposes from 800 billion m³ in 2009 to 1500 billion m³ by 2030 [5]. It's anticipated that water scarcity will happen by 2025, and about 1800 million persons worldwide will suffer [6]. In the construction industry alone, water is also essential, about one trillion cubic

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