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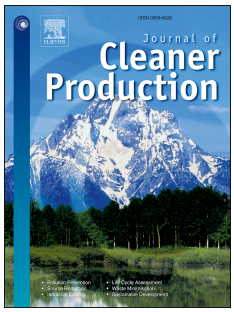

Study on Utilization of Red Brick Waste Powder in the Production of Cement-based Red Decorative Plaster for Walls

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Study on Utilization of Red Brick Waste Powder in the Production of Cement-based Red Decorative Plaster for Walls

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Abstract: Current management for red brick waste is insufficient, and a new method is needed. We sought to develop a new approach for effective management. Red cement-based decorative plasters were prepared with red brick waste powder (RBWP), white Portland cement, quartz sand, redispersible emulsion powder, hydroxypropyl-methyl cellulose ethers and silicone hydrophobic agent. The colors, water absorptions and strengths of different plasters were investigated, and the mechanisms responsible for their performance variations were explored by high-resolution transmission electron microscopy, X-ray powder diffractometry and scanning electron microscopy. The relative economic and environmental benefits were also analyzed. The feasibility of recycling RBWP in the production of cement-based red decorative plaster for walls was evaluated. The resulting plaster provided appropriate color adjustment, and the water resistance of the plaster was not greatly affected. The compressive and flexural strengths of plaster were improved. However, the improvement decreased as the sand replacement ratio increased. The tensile bond strength of the plaster is related to the RBWP content. More RBWP negatively affects the tensile bond strength of the plaster. Calcium hydroxide in the hardened paste varies with RBWP content. This variation correlates with the appearance and level of pozzolanic reaction in the plaster with RBWP. Plaster with RBWP has a denser microstructure than the control. In addition to the pozzolanic reaction, this denser microstructure also contributes to performance improvements such as compressive and flexural strengths. To improve the economic and environmental efficiencies, it is also feasible to recycle RBWP in the production of cement-based red decorative plaster for walls. These results demonstrate the effective use of red brick waste. They also provide a reference strategy for the management of red brick waste in other developing countries that are carrying out or will carry out urbanization activities.

Key words: **Red Cement-based Decorative Plaster; Waste Red Brick; Strength; Water Absorption; Microstructure**

1 Introduction

In the past three decades, unprecedented urbanization has occurred in developing countries. The intense urbanization of recent decades has generated huge volumes of construction and demolition waste and has led to the excessive consumption of natural resources (Song et al., 2014). Demolition waste is responsible for approximately 30-40% of the total waste generated in the municipality (Villoria Saez et al., 2015; Ravindra et al., 2015). It has become a major environmental issue and has created pressure for authorities to manage waste in a more sustainable manner (Song et al., 2014; Coelho and de Brito, 2013; Coelho and de Brito, 2013a). In 2014, Chinese construction and demolition waste reached several billion tons. Chinese brick-making has a 2000-year history, and an incalculable number of red and gray bricks have been used in rural construction and building since 1900 (Wu et al., 2011). In recent years, rural reconstruction has accelerated, and many old brick-concrete houses were purposefully demolished in China. A great deal of brick waste has been generated, and approximately 0.4 billion tons of this waste is produced every year. In other developing countries such as India, Russia, and Brazil, great quantities of brick waste are also produced due to recent urbanization (Villoria Saez et al., 2015). The waste