

GEOPOLYMER MORTAR WITH FLASH-CALCINED DREDGED SEDIMENT

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Geopolymer concrete (GPC) is a new alternative building material based on developing concrete without requiring the addition of ordinary portland cement (OPC), thus decreasing CO₂ emissions coming from clinker production. However, GPC requires materials rich in silicon (Si) and Aluminum (Al) that can react with alkaline silicates to yield polymeric Si-O-Al bonds [1][2]. Sediments are considered fine contaminated materials coming from marine activities [3]. Over 56 million m³ are dredged each year in France year [4][5][6][7]. Unfortunately, these materials are classified as waste materials with high moisture content and organic matter [8][9][10][11]. But, thermally treating sediments at high temperatures can eliminate their organic content and allow their usage as supplementary cementitious materials (SCMs) or in GP formulations. This study aims to use flash calcination at 750 °C as a thermal treatment method to remove both organic content plus pollutants, and to activate clay minerals in sediments. This process allows sediments to act in GP mortar formulations as an alumina-silicate source with potassium silicate as the alkaline reagent used to ensure the success of the geo-polymerization reaction. Also, metakaolin (MK) and granulated blast furnace slag (GBFS) are used in these formulations following a proper mixing procedure to ensure hardening and stabilization. Then the GP mortar formulations are molded, sealed, and cured at 20 °C under ambient conditions. After day 7, the GP mortar formulations reach a minimum compressive strength of 35 MPa depending on the proportions of the materials of each mortar and on the potassium silicate to binder ratio. A water boiling test, water curing test, acid attack test, and high-temperature resistant test were used to check the durability of the designed GP mortar.

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