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Penambahan Electroplating Sludge dan Alkali Aktivator NaOH-Na2CO3 terhadap Karakteristik Material Geopolimer Abu Terbang pada Pembuatan Blok Beton = The Addition of Electroplating Sludge and Alkali Activator NaOH-Na2CO3 on the Characteristics of Geopolymer Fly Ash Material in the Production of Paving Concrete Block

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Abstrak

Penelitian ini bertujuan untuk mengevaluasi pengaruh penambahan electroplating sludge serta penggunaan kombinasi alkali aktivator NaOH – Na2CO3 terhadap sifat mekanis blok beton produk geopolimer. Studi ini didasarkan pada kebutuhan untuk meningkatkan kinerja beton geopolimer dengan mengintegrasikan limbah industri, yaitu electroplating sludge. Variabel yang diuji meliputi kombinasi alkali aktivator NaOH dan Na2CO3, serta variasi konsentrasi electroplating sludge yang dicampurkan dengan fly ash dari 5% hingga 20%. Rasio alkali aktivator terhadap fly ash dipertahankan pada 0,3, dan rasio Na2CO3 terhadap NaOH diatur pada 1:1. Dalam eksperimen ini, sebanyak 11 sampel blok geopolimer dibuat dan diuji. Dua sampel dengan kuat tekan terbaik adalah sampel C3 dengan kuat tekan 15,82 MPa dan sampel C4 dengan 16,15 MPa. Absorpsi air juga diamati, dengan sampel C3 sebesar 9,764% dan sampel C4 sebesar 1,406%. Hasil kuat tekan pada kode sampel C4 dipengaruhi oleh keberadaan unsur Si (19,757%), Al (8,557%), dan Ca (21,190%) yang tinggi, dengan kristalinitas kuarsa yang dominan sebesar 45%. Uji FTIR menunjukkan pembentukan jaringan geopolimer pada bilangan gelombang 987,22 cm-1 yang meningkatkan kuat tekan produk geopolimer. Selain itu, produk geopolimer yang dihasilkan memenuhi spesifikasi Standar Nasional Indonesia (SNI) 03-0961-1996, yakni minimal 8,5 MPa.

.....This research aims to evaluate the impact of adding electroplating sludge and the use of a NaOH – Na2CO3 alkali activator combination on the mechanical properties of geopolymer concrete blocks. The study is driven by the need to enhance the performance of geopolymer concrete by integrating industrial waste, specifically electroplating sludge. The variables tested include combinations of NaOH and Na2CO3 alkali activators and varying concentrations of electroplating sludge mixed with fly ash, ranging from 5% to 20%. The ratio of alkali activator to fly ash was maintained at 0.3, and the Na2CO3 to NaOH ratio was set at 1:1. In this experiment, a total of 11 geopolymer block samples were prepared and tested. The two samples with the highest compressive strength were sample C3 with a compressive strength of 15.82 MPa and sample C4 with 16.15 MPa. Water absorption was also observed, with sample C3 at 9.764% and sample C4 at 1.406%. The compressive strength results for sample C4 were influenced by the high presence of Si (19.757%), Al (8.557%), and Ca (21.190%), with dominant quartz crystallinity at 45%. FTIR analysis indicated the formation of a geopolymer network at a wavenumber of 987.22 cm-1, which contributed to the increased compressive strength of the geopolymer product. Additionally, the produced geopolymer met the specifications of the Indonesian National Standard (SNI) 03-0961-1996, which requires a minimum of 8.5 MPa.