Substitusi Parsial Expanded Polystyrene dan Metode Hidrasi Agregat Pasir Terhadap Karakteristik Material Geopolimer Fly Ash pada Pembuatan Bata Ringan = Partial Substitution of Expanded Polystyrene and Sand Aggregate Hydration Method on the Characteristics of Fly Ash Geopolymer Material in Lightweight Concrete Block Production

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Abstrak

Pada penelitian ini, pembuatan bata ringan geopolimer divariasikan rasio substitusi parsial expanded polystyrene (EPS) terhadap agregat pasir sebesar 20%, 30%, dan 40% dari volume bata ringan. Agregat pasir yang digunakan juga divariasikan menurut metode hidrasinya yaitu agregat pasir dengan proses hidrasi dan tanpa proses hidrasi. Karakterisasi yang diujikan berupa analisis kuat tekan, absorpsi air, analisis gugus fungsi FTIR, analisis komposisi XRF, dan analisis kristalinitas XRD. Kuat tekan terbaik yang dihasilkan bernilai 20,14 MPa dengan rasio bahan baku penggunaan substitusi parsial EPS 20 vol% terhadap agregat pasir yang menggunakan metode hidrasi. Nilai tersebut lebih tinggi dibandingkan dengan sampel dengan persentase substitusi parsial EPS yang sama tanpa melalui proses hidrasi pada agregat pasir yang bernilai 19,10 MPa. Dalam variasi rasio substitusi parsial EPS, nilai kuat tekan pada tiap persentase sampel berkurang senilai 1,2% untuk sampel dengan substitusi EPS 20% ke 30% dan 10,04% untuk sampel dengan substitusi EPS 30% ke 40%. Hasil analisis FTIR menunjukkan adanya Si-O-T (T = Si atau Al) pada 953,36 cmâ»¹ dan 869,91 cmâ»¹ yang merupakan karakteristik utama dari struktur geopolimer dan indikasi pembentukan rangkaian geopolimer. Hasil analisis XRF menunjukkan bahwa material geopolimer dengan menggunakan metode hidrasi pada agregat memiliki struktur yang lebih kuat karena adanya kalsium oksida (CaO) dan silikon dioksida (SiO2) yang tinggi sebesar 32,18% dan 45,78% yang berpengaruh terhadap peningkatan kinerja mekanis material geopolimer pada metode hidrasi agregat. Sementara hasil analisis XRD menunjukkan adanya mineral Quartz, Okenite, dan Faujasite-Na pada bata ringan geopolimer.
.....In this study, the production of geopolymer lightweight bricks was varied by partial substitution ratios of expanded polystyrene (EPS) to sand aggregate at 20%, 30%, and 40% of the lightweight brick volume. The sand aggregate used was also varied according to its hydration method, specifically sand aggregate with and without the hydration process. The characterizations tested included compressive strength analysis, water absorption, FTIR functional group analysis, XRF composition analysis, and XRD crystallinity analysis. The best compressive strength achieved was 20,14 MPa with a raw material ratio of 20 vol% partial EPS substitution to sand aggregate using the hydration method. This value was higher compared to the sample with the same EPS partial substitution percentage without the sand aggregate hydration process, which measured at 19,10 MPa. Within the variation of EPS partial substitution ratios, the compressive strength value of each sample decreased by 1,2% for the sample with 20% EPS substitution to 30% and 10,04% for the sample with 30% EPS substitution to 40%. FTIR analysis results indicated the presence of Si-O-T (T = Si or Al) at 953,36 cmâ»¹ and 869,91 cmâ»¹, which are the main characteristics of geopolymer structures and an indication of geopolymer framework formation. XRF analysis results showed that geopolymer material using the hydration method on the aggregate had a stronger structure due to high calcium oxide (CaO) and silicon dioxide (SiO2) contents of 32,18% and 45,78%, respectively, which contributed to the

improved mechanical performance of geopolymer material in the aggregate hydration method. Meanwhile, XRD analysis results indicated the presence of Quartz, Okenite, and Faujasite-Na minerals in geopolymer lightweight concrete blocks.