Recycling of Cement Kilns Dust (CKD) to Improve the Mechanical Properties of the Base Course Layer in Highways

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Cement production industry suffers from a huge increase in the Cement Kiln Dust (CKD) as a solid waste; the fine powder separated in the dust collection system when burning the cement clinker at a rate of 40 kg/ton of clinker. The CKD is a mixture of partially burned material and raw materials, clinker dust, ashes of burning fuel that is rich in sulfates and alkali halides with a pH level above 12.5. The significant amount of CKD creates an environmental storing problem. This study aimed to recycle the CKD in highways construction instead of disposal in landfill. The surface layers of asphalt suffer from cracks due to weakness in the base course layer plus the asphalt mixtures and lack of stability of the soil. CKD has been chemically and physically characterized to improve the stability properties of the base course layer. The results revealed that addition of CKD has improved significantly the mechanical properties of the base course layer. The results showed significant increase in California Bearing Ratio(CBR%) 234.5, 334.4, 362.7, and 384.6% by adding 0, 5, 15, and 25% of CKD.The chemical composition of CKD is similar to cement. The Scanning Electron Microscope (SEM) photos showed that the average particle size is about 0.5 microns. The granules are mainly spherical shaped with cubic crystals of sodium and potassium salts. Environmental impact assessment study for the use of CKD in base course layer revealed that the concentrations of heavy metals in CKD are fixed and non-soluble with water. The study showed that there is a high economic feasibility of the use of CKD in improving the mechanical properties of the pavement of highways. Since the cost of the application of CKD is closed to zero. Moreover, it will save at least millions of dollars in a city like Amman.

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