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The Application of CFD for Modelling Flow and Visualization in a Cement Mill and Experimental RTD Validation Using Radiotracer Technology

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Cement manufacturing represents an energy-intensive process due to the large power consumption of mills which are an integral process units of the entire cement manufacturing process. Therefore, performance optimization of cement mills is key in ensuring inefficiencies. Yet, performance optimization of such mills is impossible without adequate technical information about the milling process. Experimental residence time distribution (RTD) techniques are known to provide accurate process information and are useful in the validation of computational fluid dynamic models of the particular process under study. This first part of the study presents key process parameters of a cement mill obtained using the radiotracer residence time distribution (RTD) technique at the Ghana Cement plant located in Tema in the Greater Accra region of Ghana. 40mCi of liquid 198AuCl4 agglomerated with cement powder and water was used as the radiotracer and introduced at the mill inlet. The passage of the radiotracer at the outlet was monitored by an external sodium iodide scintillation detector. Data analysis revealed the presence of dead zones or channeling within the mill as indicated by the disparity in the experimental mean residence time of 33.65 minutes and theoretical mean residence time of 58.15 minutes. In the second part of the study, ANSYS CFD Simulation Software will be used to model the flow in the cement mill for visualization as a complimentary method to the radiotracer RTD technique. ANSYS DesignModeler will be used to create the geometry of the 11.4 m long mill with a diameter of 3.6m and ANSYS meshing used to create the computational mesh. FLUENT, the fluid analysis tool of the ANSYS sotware, will be employed to calculate the fluid flow throughout the geometry using the computational mesh, and CFD-Post for the analysis of the results in the form of velocity profiles. Particle tracking discrete phase model (DPM) will be used for the RTD simulation by tracking virtual particles injected at the inlet of the mill and recording the time required for them to reach the outlet. The results of the CFD simulation will aid the optimization of experimental parameters of the radiotracer RTD technique for cement mill investigations.

Country/Organization invited to participate

Ghana

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