The Effects of Wood Ash on the Properties of Concrete

Van Grouw, Austin (School: Warwick High School)

Sand is being depleted at an alarming rate, and it's estimated that by 2050, about 68% of the world's sand will have been consumed (UNEP, 2022). This is a concerning issue because the concrete industry is the second largest consumer of sand, and reducing the amount of sand needed to make concrete could make a significant difference. This project aimed to test the effectiveness of using wood ash as a substitute for sand in concrete (Yang, et al, 2019). Three different variables were tested, starting with the hardness of the concrete. Concrete blocks were created using 0%, 25%, 50%, 75%, and 100% wood ash. A Shore D Durometer was used to measure the hardness of each block, and the results showed that the 100% wood ash concrete performed 14% better than the sand-based concrete ($p = 1.11E-16$). The second experiment was conducted to test the durability of the materials. For this, a testing device was used to drop a hammer directly onto the surface of the concrete to see how many strikes it could withstand. The final experiment aimed to determine the rate of flow. Interestingly, the concrete with wood ash and the concrete with sand showed no noticeable difference in flow ($p = 0.97$). Overall, this project concluded that wood ash can be a viable substitute for sand in traditional concrete making.

Awards Won: