

## The Effect of Partially Replacing Cement with Metakaolin on the Properties of Concrete

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**Abstract :** Concrete usage in Ethiopia is expanding at a faster rate than before. Cement is the most important and costly ingredient in this respect. The construction industry is currently challenged by cement scarcity and stock market inflation. Scholars' trays, on the other hand, will use natural pozzolan material to substitute cement. Apart from that, Metakaolin has pozzolanic characteristics. According to the industrial mineral occurrence map, Ethiopia kaolin may be found in abundance. Some of them include Debretabor, so it is good to utilize Metakaolin as cement replacement material. In this study, the capability of Ethiopian Metakaolin as a partial substitute for cement in C-25 concrete production with 0%, 5%, 10%, 15%, and 20% replacement of PPC by MA with 0.49 percent water to cement ratio is investigated. The study examines; the chemical properties of MA, Physical properties of cement paste, workability, compressive strength, water absorption, density and sulfate attack of concrete was investigated. The chemical composition of Metakaolin was examined and the summation of  $\text{SiO}_2$ ,  $\text{AlO}_3$ , and  $\text{FeO}_3$  is 86.25% and the ash was classified class N pozzolan. The normal consistency percent of water increases as the MA replacement amount increase and both initial and final setting time rang increase as the MA replacement amount increase. On the 28th day, the compressive strength of concrete with MA replacement of 5%, 10%, and 15% exceeds the goal mean strength (33.5Mpa) with compressive strength enhancements of 2.23 %, 4.05 %, and 2.23 %, respectively. Similarly, on the 56th day, 5 %, 10%, and 15% replacement enhance concrete strength by 2.06 %, 3.06 %, and 1.2 %, respectively. The MA mixed concrete has improved significantly in terms of water absorption and sulphate attack, with a 15% replacement level. MA content Metakaolin could possibly replace cement up to 15%, according to the studies. The study's findings will help to offset cement price increases while also boosting house affordability without significantly degrading.

**Keywords :** metakaolin, compressive strength, sulphate attack, water absorption, N pozzolan

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