

Synopsis

**Thesis Title Influence of Micronized Biomass Silica as a Partial Replacement of
Cement in Recycled Aggregate Concrete**

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Construction industry is the one which consumes large amount aggregates in worldwide totals about 16.5 billion tons is being used in concrete. By accounting this in future, there is a need to find an alternative material for natural coarse aggregate (i.e) recycled concrete aggregate (RCA) from construction and demolition wastes. But there are some drawbacks in using RCA in concrete. The major problem of recycled aggregate concrete (RAC) is high strength reduction and more water absorption compared to that of conventional concrete. The aim of this project is to improve the performance of a RAC similar to the conventional concrete by incorporation of pozzolanic material in RAC. Micronized biomass silica (MBS), pozzolanic material is selected as a partial replacement of cement in the RAC. Before the incorporation of MBS in RAC, it is important to know about the optimum percentage of MBS. Hence, characterization of MBS has been studied through X-ray diffraction, SEM analysis, and compressive strength test have been done in cement paste and cement mortar by replacing various percentages of cement by MBS. From the results, optimum percentage of MBS was arrived. This optimum percentage is used in the RAC to improve its performance. Totally ten concrete mixes including three control concrete mixes, one RAC mix, three treated recycled aggregate concrete (TRAC) mix with and without optimum percentage of MBS along with a water cement ratio of 0.55, 0.5, 0.45 are casted to study the mechanical and durability properties of all the mentioned mixes. Later, Correlation between mechanical properties of TRAC with and without MBS was found and it was checked with the relationships provided by ACI and EC2 and found Euro code 2 predicts better than the ACI code. Further an attempt has been made to study structural behavior of reinforced recycled aggregate concrete beam because it is difficult to quantitatively estimate the effect of recycled aggregate on the structural behavior of reinforced concrete beams since each source of recycled aggregate will behave different from other sources. Hence, structural behavior of reinforced TRAC beam with and without MBS also studied through four point bending and finally it was compared with reinforced control concrete beam. The investigated properties include load-deflection, crack spacing, cracking load, ultimate load, cracking pattern, and failure modes. Finally, cracking moment and service load deflection was predicted using ACI and Eurocode2 and compared with the experimental values.

The main research contributions from the project are

- The optimum percentage of micronized biomass silica is concluded through various studies.

- Correlation between mechanical properties of treated recycled aggregate concrete with and without MBS was found and it was checked with the relationships provided by ACI and EC2 and found Euro code 2 predicts better than the ACI code.
- Durability properties were found to be improved when MBS was incorporated in the recycled aggregate concrete.
- Service load deflection for the treated recycled aggregate concrete with and without MBS were predicted and compared with experimental results.