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# ENHANCING PHYSICAL PROPERTIES OF RECYCLED AGGREGATES WITH RICE HUSK ASH-CEMENT MIXTURE

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## DECLARATION OF THE CANDIDATE

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## DECLARATION OF THE SUPERVISORS

The above candidate has carried out research for the Masters dissertation under our supervision.

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(Dr. S. Karunarathne, Project Supervisor)

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(Dr. D. Nanayakkara, Project Co-Supervisor)

# ABSTRACT


## Enhancing Physical Properties of Recycled Aggregates with Rice Husk Ash-Cement Mixture

The high water absorption of recycled coarse aggregates (RCA) is a major drawback when it is considered as an alternative material for natural coarse aggregates (NCA). It is mainly due to the porous old attached mortar on the surface of RCA. This study presents an effective method to treat the surface of RCA in order to improve its physical properties. The surface of RCA was coated with slurries that contained varying proportions of rice husk ash (RHA), water and lime or cement. The slurry ratios used in the research varied from 0.625 to 2.00. The solid composition of the slurry was varied as required by varying the RHA to lime or cement composition. The treated recycled coarse aggregate (TRCA) coated with a RHA-lime slurry had been cured for 24 hours and the TRCA coated with RHA-cement slurry had been cured for 3, 7, 14 and 28 days. The water absorption of each scenario was analyzed for the respective curing ages. It was observed that the RHA-lime slurry gives a very weak coating around the surface of RCA than that given when RHA-cement slurry is used to coat RCA. Therefore RHA-cement slurry is recommended to treat RCA. When analyzing the results it could be seen that with the increase of RHA present in the slurry the water absorption of the TRCA increases and when the slurry gets thinner the water absorption of TRCA achieves a minimum and as the slurry gets even thinner it increases once again. When RCA was coated with slurry containing 100% cement the optimum slurry ratio that gave the minimum water absorption of TRCA was 1.500 and when a mixture of RHA and cement was used in the slurry the optimum slurry ratio that gave the minimum water absorption of TRCA was 0.875. In most scenarios the highest reduction in the water absorption of TRCA was achieved at a curing age of 7 days. A grade 30 concrete was made with three selected scenarios of TRCA coated with the RHA-cement slurry, RCA and NCA. The concrete scenarios made with the TRCA and NCA obtained strengths greater than 30 $N/mm^2$ after 28 days of curing, except that made with RCA. The proposed treatment method can be used to reduce the water absorption of RCA from 6.01% to 3.53-4.44 %. Furthermore when RCA is treated by using this treatment method the negative impact RCA has on the fresh and hardened concrete properties can also be negated.



Keywords: Recycled coarse aggregates (RCA), treated recycled coarse aggregates (TRCA), Rice husk ash (RHA), slurry ratio, cement

## DEDICATION

I dedicate this book to my husband for being there with me from the beginning of this adventure till the end, for listening to all my hues and cries, for being ever so patient to my rapidly changing mood swings and for being the most effective but unofficial team player in this study.

I would also like to dedicate this book to my mother for her endless support and baking given to me.

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# LIST OF ABBREVIATIONS

COWAM: Construction Waste Management in Sri Lanka

NCA: Natural coarse aggregates

RCA: Recycled coarse aggregates

RHA: Rice husk ash

TRCA: Treated recycled coarse aggregates