Project No: __RU-15_____

Annual Report Comprehensive

January 1 2018 – December 31 2018

Project title: An Extensive Study on Utilization of Rice Hulls Ash in Concrete

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Principle UC Investigators: None.

Cooperators: None.

Level of 2018 funding: $35,814

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Objectives and Experiments Conducted, by location, to Accomplish Objectives:

Project Objectives: This research project has three main goals: (1) To investigate the long term durability of concrete containing rice hulls ash (RHA); (2) to study the impact of RHA on commonly used chemical admixtures for concrete; (3) to compare performance of RHA with that of other commonly used SCMs, such as silica fume, metakaolin, and slag.

Experimental procedures completed: All the following experiments were conducted at CSU-Chico.

1- Production of Rice Hulls Ash: Rice hulls was obtained from The Sun Valley Rice Co. The hulls was immersed in water for 24 hours. Then it was dried at 100°C. Rice hulls was then set on fire in a 31 gallon perforated steel trash can. Hulls was then burned in a ceramic kiln at 600°C for one hour to produce RHA. The ash was ground in a laboratory ball mill for 60 min. to produce the powder. Figure 1 shows the RHA production process. The same procedure was used to prepare rice straw ash (RSA).
2- Mortar samples containing 10% RHA were made. Compressive strength of these samples was measured at 7, 28, and 91 days. Results were compared to those samples without RHA. It should be noted that a higher water content was used for samples containing RHA. This was because RHA absorbs some water.
3- Heat of hydration of samples were measured using an isothermal calorimeter.

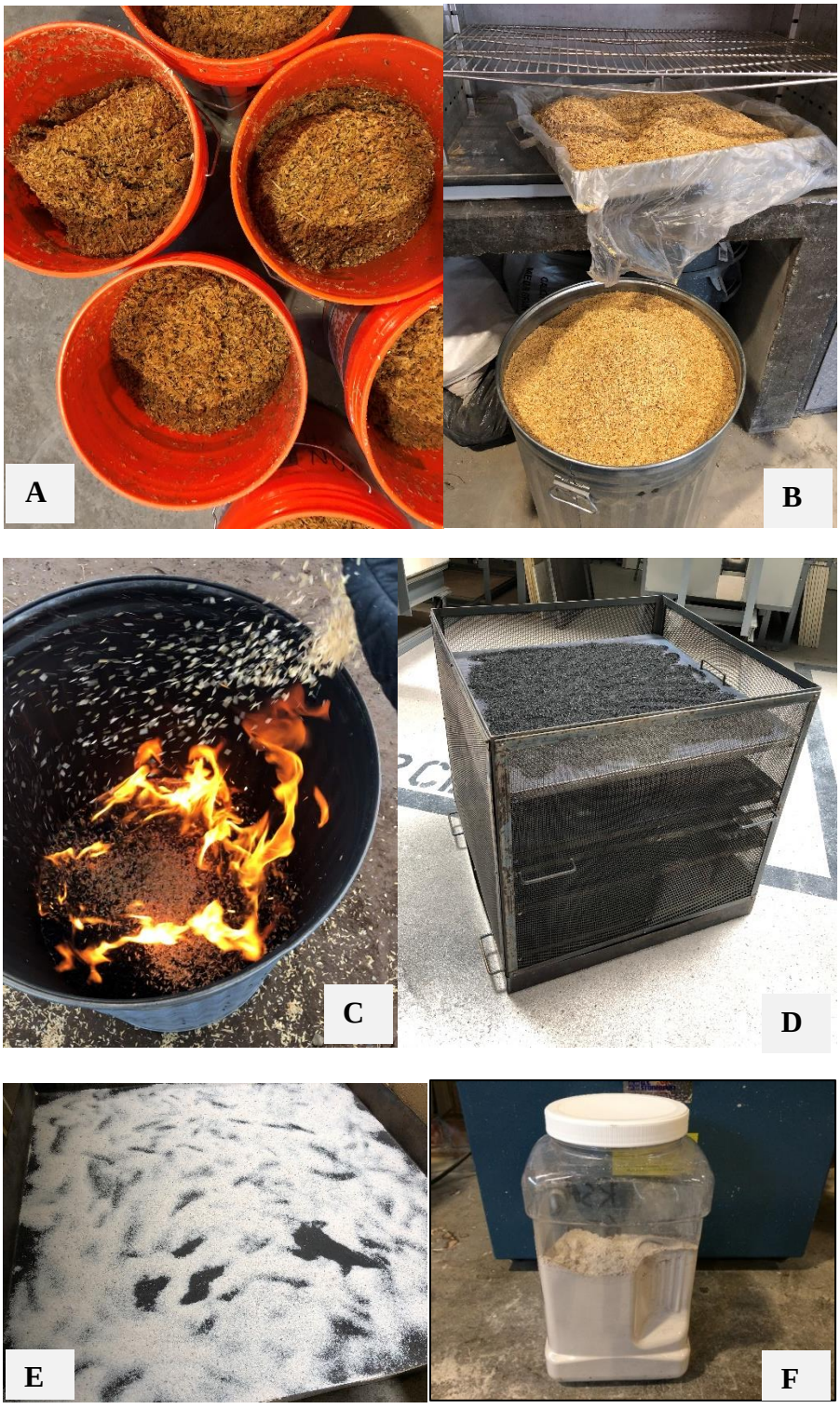

Figure 1. (A) Washed hulls; (B) hulls dried after washing; (C) hulls initial burning; (D) hulls after initial burning; (E) hulls ash burned at 600C in the kiln; (F) powder RHA

Summary of research findings:

This research project started in July 2018. RHA was produced and experimental samples were prepared. However, the Camp fire tragic situation caused Chico State campus closure. Most of ongoing experimental procedures discontinued and new experiments could not be started during that time. Therefore, most of the experiments should be repeated. More RHA already been produced; it is planned to prepare new test samples starting first week of Jan.

However, based on initial data obtained prior to the Camp fire, adding RHA in concrete will increase strength; this is shown in figure 2. Adding RHA in concrete was found to reduce workability. More data and results will be shared in Feb. 2019 with the board.

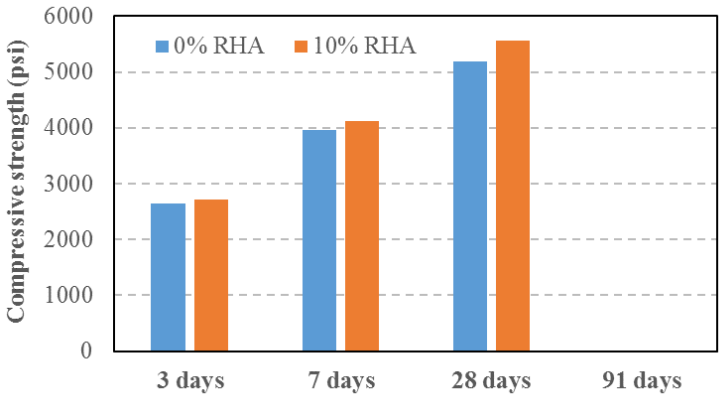

Figure 2: Compressive strength of samples with and without RHA

Presentations and Publications:

The project leader, Feraidon Ataie, attended a forum as a panelist during American Concrete Institute (ACI) convention in Oct. 2018. The subject of the forum was “Life after fly ash: What is the alternative”. The project leader discussed the potential of rice straw ash and rice hulls ash utilization in concrete. The presentation was well received by the audience.

Concise General Summary of Current Year's Results:

Rice hulls ash (RHA) was produced. Samples were made with and without RHA. Compressive strength of samples containing RHA was compared to those without RHA. It was found that adding RHA increase compressive strength, but decrease workability of concrete.

Due to the Camp fire tragedy, Chico State campus was closed for two weeks when no experiments could be continued or prepared. Most of the experiments should be repeated. Preparation of RHA has already began; samples will be prepared starting in Jan. Results will be shared with the board in Feb. 2019.