Title: **A Novel Treatment for Acid Mine Drainage Utilizing Reclaimed Limestone Residual (RLR)**

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OBJECTIVE(s)

Reclaimed Limestone Residual (RLR) is a co-product of the steel making process, and is developed during the refining of crude iron products to steel. It has been shown to have redox capabilities that facilitate reduction, and also has significant acid neutralizing potential. The objective of the research was to determine the feasibility of utilizing (RLR) as a treatment media for Acid Mine Drainage (AMD), whereby RLR could be placed either as a geochemical filter, or in a drain or channel along which AMD flows, and this document reports the findings from the research that was conducted.

ACCOMPLISHMENTS TO DATE

Due to an elevation in pH by RLR the metals with the exception of Cr (VI) were removed from solution by precipitation as their metal hydroxides. The results from these tests also showed a removal of Cr (VI) from solution. Reactions between RLR and Cr (VI) were subsequently investigated by employing various batch and column testing techniques. The averaged results of these preliminary tests are shown in Figure 3 which shows the percentage of chromium reduced vs. the initial Cr (VI) concentration. For the lower concentration of 0.5 mg/l the reduction of Cr (VI) was almost 100% in both the 10-gram and 20-gram samples. As the concentration increased the reduction was less for both the 10 and 20-gram samples [2].

FUTURE WORK

To fully exploit the potential of RLR as an AMD treatment media, a rigorous investigation of the structure-reactivity relationship at the molecular level that facilitates these reactions is required before any modifications to its structure for added performance are considered. A two step objective is thus recommended.

In the first step an examination the microscale interactions that enable RLR to remove heavy metals such as chromium by other mechanisms beside those associated with precipitation reactions of other metals is required. Spectroscopic techniques to identify what new compounds are formed should be employed to enable a determination of how the structure of RLR has been

changed after these interactions if at all, and what particular constituents of RLR are primarily responsible for the interactions/mechanisms of interest.

After identification of these mechanisms we will in the second step attempt to synthesize nano-RLR to contain only those characteristics relevant to the removal of heavy metals, and if necessary the addition of other components that may enhance the efficiency of nano-RLR by acting as catalysts similar to the interaction of bimetallic compounds. In previous proposals, reviewers have been critical on the utilization of a steel slag by-product due to the environmental concerns over the trace elements (chromium, copper, zinc) in steel slag. Thus, to assuage this concern, the PI's aims to utilize the knowledge gained in step one of this study to synthesize nano-RLR without trace elements.

LIST OF PAPER PUBLISHED, U.S. PATENT/PATENT APPLICATION(S)

Ochola, C. E., and Moo-Young, H. K., (2004). Establishing and Elucidating Reduction as the Removal Mechanism of Cr (VI) by Reclaimed Limestone Residual RLR (Modified Steel Slag). *Environmental Science & Technology*. **38** (22): 6161-6165

STUDENTS SUPPORTED UNDER THIS GRANT

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