

Abstract

In this study a combination of basic oxygen furnace (BOF) slag and sugar cane bagasse (SCB) were assessed for their potential to remediate acid mine drainage (AMD). SCB was also individually assessed to determine its remedial potential.

Small-scale laboratory experiments were carried out to determine the effectiveness of this combination of BOF slag and SCB in removing sulfate and iron and raising the pH. In the small-scale laboratory experiments, four different configurations were used: the first configuration was packed with SCB in the first column and SCB in the second column, the second configuration was packed with SCB in the first column and BOF slag in the second column, the third configuration was packed with a mixture of SCB and BOF slag in the first and second columns and the fourth configuration was packed with BOF slag in the first column and SCB in the second column. The results that followed indicated that there is a potential for SCB and BOF slag to treat AMD.

These experiments occurred for two different residence times; a low residence time which was approximately 35.5 hours $\pm$ 5.5 and a high residence time which was approximately 78.5 hours $\pm$ 7.5. The removal of iron and sulfate as well as the increase in pH showed that all the configurations achieved some form of remediation. The highest percentage of sulfate removed in all the configurations was 86%, the highest percentage of iron removed was 99.99% and the highest pH value at the outlet was 12.82; all of these maxima were achieved for the higher residence times, indicating the impact that residence time has on these particular systems.

A one-way analysis of variance (ANOVA) within each of the configurations, and variance between the configurations was performed on the resulting data using the built-in function in Excel; this was done within the 95% confidence interval. These tests indicated that there was a statistical significance, when it came to raising the pH and removing iron between the columns that had no BOF slag and the columns that did, and by interpreting the graphs in the results section, it can be seen that it was the BOF slag that was responsible for the higher rise in the pH and for most columns the higher removal of iron. Initially indications appear to be optimal for configuration D (the first column containing BOF slag and the second column containing SCB) being the most suited to treat AMD, however when the residence times were

taken into account and the results found in Section 4 and ANOVA were interpreted more thoroughly, it gave an indication that configuration B (the first column containing SCB and the second column containing BOF slag) is the most suited to treating AMD. Configuration B has a high removal percentage of sulfate of 67% and maintains a removal of sulfate for over 55% for a longer period of time than configuration D. The start of breakthrough for configuration B took longer than that of any other configurations and as such the replacement of the remediating substances would not be as frequent.

The results show that these materials are able to treat synthetic AMD. They also show that the interoperating of BOF slag and SCB is better than the configuration containing only SCB. Results also indicate that higher residence times are more suited to treating AMD in removing a higher percentage of iron, sulfate and raising the pH. The results also indicate that configuration B is the most suited to treat AMD.