ADSORPTION OF COPPER AND ZINC WITH ALKALI-ACTIVATED BLAST FURNACE SLAG FROM MINE WATER

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Metal contamination is an alarming problem near mining areas all over the world. Released wastewaters and mining water loose different metals to environment affecting lakes, rivers and other water sources (Jain and Das, 2017). In this study, alkali-activated blast furnace slag was used as an adsorbent for mine effluent treatment. Alkali-activation was conducted by reacting ground granulated blast furnace slag and a mixture of sodium hydroxide and silicate. Water samples are obtained from the last pumping point of infiltration water. Metal content of this water is still above the environmental safety level and the water should be recirculated and repurified. The aim of this work is to find a method to purify the mine water at this testing point to reach the environmental safety level. Then water will be releasable back to the lake.

Alkali-activated materials are widely tested and used in different kind of purification applications. These adsorbent materials are known since beginning of 1900 century but interest towards this kind of research has grown during the few last decades. There are a lot of possibilities for water research and purification processes with alkali-activated materials due to their strong and insoluble form and wide range of feasible materials available (Provis, 2014). Alkali-activated blast furnace slag was selected to be an adsorbent material for this work because it is cheap and easy to produce. It has also relatively good metal removing capacity. Same kinds of adsorbent materials have been tested for metals like nickel successfully (Luukkonen et al., 2016). This encouraged us to study more specific mining waters containing copper and zinc.

Based on our preliminary study, the removal of copper and zinc with alkali-activated material seems to be effective when handling the mine water from the metal mine. The studied water samples had the pH typically under two. When applying alkali-activated blast furnace slag adsorbent the pH of the mine effluent pH raised strongly. The metal removal mechanism was then likely to be a combination of adsorption and precipitation. With pH adjustment with acid, the removal of copper and zinc occured mainly via adsorption (Figure 1)

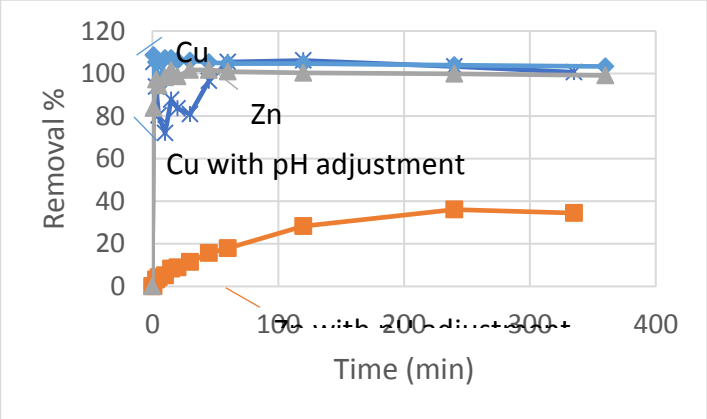

Figure 1 – Removal of copper and zinc from mine water with alkali-activated blast furnace slag with respect to contact time.

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