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Effect of Cement Addition on Arsenic Sorption of Soil-bentonite Cutoff Walls

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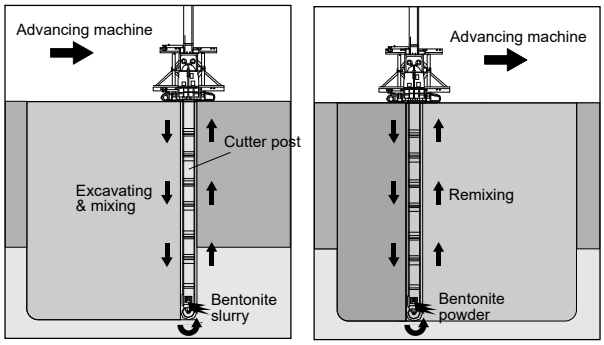
Vertical cutoff wall is widely used in contaminated sites and embankment for preventing contaminants migration or seepage flow. Soil-bentonite (SB), a mixture of in situ soil and bentonite, is one of barrier materials commonly used in the vertical cutoff wall. For the construction of SB cutoff walls, application of a construction machine used in the Trench cutting & Re-mixing Deep wall (TRD) method is proposed as shown in Figure 1. The SB cutoff walls constructed in this manner has the following advantages, comparing with other barrier materials: 1) extremely low hydraulic conductivity due to the swelling of montmorillonite in bentonite, 2) high deformability even after its construction which can maintain the soundness against seismic excitation, 3) high sorption capacity against chemicals 4) high homogeneity regardless of geological conditions at a site, and 5) no material deterioration for a long period of time.

However, because of low strength, SB cutoff wall still has some limitations in its application when a certain level of strength is required. Since the SB only consists of in situ soil and bentonite, its strength cannot increase significantly unlike soil-cement mixture. According to previous researches, SB has quite poor strength mechanical performance. Even after long-term consolidation and aging, the typical shear strength of SB cut-off wall is 10 kPa (Evans and Ryan 2005).

Although there have been already several studies about strength improvement of SB, the main method is focused on using cementitious material as another main content rather than additive. The content of cementitious material in the previous studies are over 10% up to 20%. For example, in the United States, cement-bentonite (CB) slurry cutoff wall with 15% cement has been studied (Jefferies 2005). This method can significantly improve the strength, but the amended SB materials lose its deformability, which is the key function of the SB cutoff walls. There are few researches about soil-cement-bentonite cutoff walls for moderate strength and hydraulic conductivity.

Besides, previous studies mainly focused on large amount cementitious material to greatly improve the strength and stiffness of SB without enough attention to possible influence on sorption capacity. Since cementitious material should lead an alkaline condition which benefits the barrier performance of bentonite, it may also bring influences due to lower swelling capacity of bentonite. Therefore, in this study, we investigated the effects of cement addition on the barrier performance of SB, with relatively low content ratio of cement material.



1) Trench cutting with the addition of bentonite slurry
2) Re-mixing the bentonite powder in the trench

Figure 1. Construction of SB cutoff wall.

REFERENCES

Evans, J. & Ryan, C. (2005): *ASCE Geo-Frontiers*, 130-142, 3779-3787.
Jefferies, S. (2012): *Grouting and Deep Mixing*, 1-24.