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Study on the Surface-Physicochemical-Property Changing of Bentonite by Adapting a New Soil Stabilizer

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Surface-physicochemical-property of clays has been proved to have direct influence on its mechanic behavior. Specific surface area (SSA) is one of the most important factors for surface-physicochemical-property assessment. The smaller SSA tends higher strength (shear strength, unconfined compressive strength and tensile strength) under different water contents of soil.

In this paper, a new soil stabilizer (Tung oil-based sulfonated) is developed and applied to improve the properties of Ca-bentonite. The differences of specific surface area, fractal dimension and micro geometric morphology between raw Ca-bentonite samples and modified ones are investigated based on the data acquired from water vapor, nitrogen adsorption experiments and SEM experiments. Results show that the SSA including external SSA and total SSA of treated samples decrease largely and apparently when compared to that of the raw samples. Furthermore, the higher volume ratio between soil stabilizer and water, the more decrease in SSA. Compared to the ones of raw Ca-bentonite, the external SSA and total SSA of the modified Ca-bentonite samples decrease by 48.5% and 25.2%, respectively, when the volume ratio was 1:50. This result implies that the connection of montmorillonite particles becomes more tightly after the treatment by the soil stabilizer.

In addition, an obvious decreasing trend is found in fractal dimension by analysis of water vapor adsorption isotherms. This finding indicates that the pore surface tends to be smoother by the chemical action among particles bonds, more condensable in aggregates and shorter space between the interlayer of montmorillonite. SEM results display that the new soil stabilizer developed a quantity of lamellar aggregates but did not change the structure of montmorillonite. Based on all mentioned above, the results of fractal dimension analysis are verified. Consequently, this study shows that the new soil stabilizer (Tung oil-based sulfonated) has obvious effects on improving the physicochemical properties of bentonite. The findings of this study further indicate that the mechanic behavior of bentonite could be improved by adapting this new soil stabilizer.

Keywords: new soil stabilizer; tung oil-based sulfonated; Ca-bentonite; specific surface area; fractal dimension; SEM