

Aqueous surfactant solutions for dust suppression in open pit mines: the influence of different soil textures on wettability

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Watering is one of the most commonly applied techniques to control fugitive dust emissions from unpaved roads of open pit mines. Research has thereby shown that surfactants can improve the dust suppression effectiveness of water. However, the influence of the soil's particle size distribution on the wetting performance of surfactants has not yet been sufficiently investigated. The objective of this study was to investigate the wettability of different soil textures (i.e. the degree of wetting) by applying different aqueous surfactant solutions. Five different soil samples were wetted with two non-ionic (Triton X 100, Surfynol 61), two anionic (SDS, SDBS), one cationic (CTAB) and one amphoteric (CAPB) surfactant at varying concentrations. Distilled water was selected as a control. Testing of these materials was performed using the standard capillary rise and drop penetration test. The tests showed that the use of aqueous surfactant solutions can lead to both, improvement and deterioration of soil wettability in comparison to distilled water. Soils with a high clay content were generally harder to wet than soils with a high sand content. Soils with a high sand content often showed a deterioration of their wettability by adding surfactants. In contrast, the wettability of soils with high clay content tended to improve. The wetting performance of the tested anionic surfactants was rather weak compared to distilled water, whereas the wetting performance of the cationic and amphoteric surfactant increased with increasing clay content. Thus, the application of cationic and amphoteric surfactants is particularly recommended for fine-grained soil types. Hence, mine operators are advised to analyse the particle size distribution of road surfaces and soils prior to the application of surfactants.