

Jirayu Kongsomkaew 2009: Surface Wettability using Contact Angle Measurement of Mixed Nonaqueous Phase Liquid Contamination. Master of Engineering (Environmental Engineering), Major Field: Environmental Engineering, Department of Environmental Engineering. Thesis Advisor: Assistant Professor Cheema Soralump, Ph.D. 110 pages.

This research was conducted to study the wettability of solid surface from the digital image. The change in wettability was measured by visualizing and measuring contact angle with Adobe Photoshop CS2 (trial version) program. The contamination in subsurface is NAPL (nonaqueous phase liquid). In the field, NAPL contamination could be in the form of mixture between light NAPL (LNAPL) and dense NAPL (DNAPL). In this research, toluene represented LNAPL and trichloroethylene (TCE) represented DNAPL. The silicon wafer and quartz wafer were used as the solid surface and represented soil surface. Because of, Silicon is the element that meets the most in the earth crust. The study consisted of 3 parts; TCE and toluene dissolution, the surface wettability when NAPL adhere to the surface surrounded by solute NAPL only and surrounded by mixed NAPL and the surface wettability when the surface has contaminated with NAPL and the surface has no contamination surrounded by air.

The cosolvent of TCE and Toluene in the water compare with only TCE dissolution and only Toluene dissolution was insignificant different. The cosolvent and pure NAPL dissolution were dissolved until the concentration into water reach to the solubility in 1 hour. The contact angle of TCE and Toluene on silicon or quartz surface surrounded by liquid. In case, one NAPL contamination on silicon or quartz surface, at the beginning the contact angle of TCE NAPL and toluene NAPL were considered strongly water-wet with contact angle less than 65 degrees. And the case, mixed NAPL contamination on silicon or quartz surface, the contact angle of TCE NAPL and Toluene NAPL were considered intermediate wet with contact angle 65 to 105 degrees, when experiments proceeded it was found that NAPL could make the surface properties of solid surface change to strongly oil-wet and after 756 hours, it leveled off. And quartz was water wetting solid more than silicon. Hence, the images were taken until the contact angle leveled off. Mass of NAPL was decreased and small. Because there was mass transferred in the experimental system. That NAPL could make the concentration and contact angle change. The contact angle of water on silicon and quartz surface has no contamination surrounded by air. Contact angles were measured during 155.4 to 168.1 degrees. The surface of silicon and quartz was hydrophilic. And the contact angle of water on silicon and quartz surface has contaminated with NAPL. Contact angles were measured during 107.0 to 115.6 degrees. The surface of silicon and quartz was hydrophobic and silicon was water wetting solid more than quartz. The result was found that NAPL could make the surface properties of solid surface change. So the wetting characteristics could change when the saturated soil had NAPL adhere the surface.

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Thesis Advisor's signature

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