Exact solution for two-phase non-equilibrium mass transfer of air sparging

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Abstract. The exact solution is presented here to evaluate the non-equilibrium mass transfer at the interface between the dissolved and air phase during air sparging. The solution has been developed for solving the contaminant concentrations in both aqueous phase and air phase. The solution is derived by solving the couple system of differential equations in the dissolved and gas phase. The mass transfer in air sparging is relatively fast and a common assumption is to use Henry's law to describe the mass transfer at the interface based on assumption of equilibrium condition. In this solution, the mass transfer is described based on non-equilibrium formula of two-film theory where mass transfer coefficient and surface area are included. Also, groundwater advection is considered where most air sparging model assumed that the dissolved phase is stationary due to slow movement of groundwater. In addition, the solution is valid for air channel and for discrete air bubbles where the surface area is different in both forms. Finally, the exact solution was compared with numerical solution and they matched well at all points on tested domain.

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