3.2 Contaminant transformation

Sorption

Biodegradation

Ion exchange

Precipitation

3.2 Contaminant transformation

Contaminants can be transformed into other compounds, ionic species, or elemental forms by both microbial and chemical processes in the subsurface. Degradation rates for organic compounds vary by several orders of magnitude for both microbial and abiotic reactions, even for compounds with similar structures. Thus, to predict the behavior of contaminants in aquifers, reaction rates need to be known for each compound of interest under environmental conditions specific to the aquifer. Contaminants usually degrade by sequences of reactions that occur under different environmental conditions. In some cases, these reactions may terminate before producing stable, harmless end products, leaving hazardous intermediate byproducts. The term "degradation" usually refers to complete transformation all the way to stable, harmless end products, whereas the term "transformation" refers to partial degradation**.**

The Concept of Sorption

Sorption can be defined as the interaction of a contaminant with a solid. More specifically, the term can be further divided into adsorption and absorption. The former refers to an excess contaminant concentration at the surface of a solid while the latter implies a more or less uniform penetration of the solid by a contaminant.

Concept of Biodegradation

Due to leakages, spills, improper disposal and accidents during transport, organic compounds have become subsurface contaminants that threaten important drinking water resources. One strategy to remediate such polluted subsurface environments is to make use of the degradative capacity of bacteria. It is often sufficient to supply the subsurface with nutrients such as nitrogen and phosphorus, and aerobic treatments are still dominating. However, anaerobic processes have advantages such as low biomass production and good electron acceptor availability, and they are sometimes the only possible solution.

Ion exchange Process

Definition: Exchange of ions in clays for ions in solution, with charge balance maintained. Layer silicate clays adsorb metallic and organic cations by ion exchange. This method

reduces the concentration of one ion and increases the concentration of another.

Effect on Contaminants: Can remove contaminant ions from solution, particularly when clay is present, and thus slow their removal by pumping.

Precipitation process

Definition:

Reactions that dissolve or precipitate solids such as natural minerals.

Effect on Contaminants:

Primary control on the chemical composition. Can increase or decrease the concentrations of dissolved constituents, including some types of contaminants.