Summary

Aquifer system is mainly polluted by man-made activities such as misuse of pesticides and dumping of chemical wastes and spillage of liquid chemicals etc. When these pesticides and chemical wastes pass through the vadose zone or subsurface zone, where colloidal particles are present in ubiquitous amount, facilitates their transport to greater depths and longer distances. However, the way by which contaminant transport occurs needs a well defined study as it has been acknowledged that the mobile colloids in the subsurface act as carriers of contaminants to the ground water. Earlier models of contaminant transport described it as a two phase system in which contaminants partition between the immobile solid matrix and the mobile aqueous phase. But after adsorption on soil colloids which is solid phase, the mobility of colloidal particles facilitates the transport of inorganic and low water soluble hydrophobic organic contaminants through the vadose zone layer to the ground water. Investigations on the subsurface zone assume importance as it is vital source for the life on the earth.

Chapter 1 gives an introduction to the focus of thesis work and theories related to the colloidal properties and its transport and the literature available on the topic of research.

Chapter 2 gives information on the sampling sites and the geology. This chapter provides basic information on the characterization of soil, such as organic carbon determination, cation exchange capacity, soil texture etc. The colloids isolated from soil by centrifugation and coagulation technique have been discussed and the optimum relative centrifugal force required to separate the non colloidal particulates was determined to be 25.12. A brief introduction on the static light scattering technique has been discussed in this chapter. The intensity of light scattering gives the size of the particle and scattering intensity varies with angle. The concentration of colloids in the suspension was determined using dry weight method. The experimental procedure involving the adsorption of alizarin red and methylene blue dyes and toxic metals and their transport in a soil column has been discussed.

Enrichment of toxic metals in <63 μm sediments was determined and the geoaccumulation index was calculated to assess the impact of anthropogenic activities.

Chapter 3 describes the results of the experiments and interpretation. It comprises the lithology sequence of sediments of four type sections of Mahi river. The colloids isolated from sediments of all these sections and from three sites along Mini river have been characterized for concentration, size distribution and Electrical conductivity. The electrical conductivity of two samples of Rayka section was lower than other samples. The size distribution analysis implies the presence of colloids of different sizes in each sample except few which showed mono dispersity. The colloids were made up of minerals such as quartz, calcite and kaolinite and this pattern of mineral composition was found in all the samples being taken for analysis. The quantification of soil colloids in mobilization experiments reflect the release of colloids being held firmly on sediment surface, in response to passing of water. This suggests the possibility of movement of colloids during rainy season and surface runoff. The transport of alizarin red dye and toxic metals suggested their sensitivity to low ionic strength solution and enchanced transport of dye was observed at high pH conditions. The release rate of toxic metals corroborated well with their adsorption on colloids and the release rate increased with their adsorption on colloids. This suggests that strong adsorption of contaminants on colloids would contribute to their rate of release depending on the chemical conditions prevailing in the environment. Better understanding of transport of contaminants in soils and aquifers is important to evaluate and remediate contaminated soils and aquifer system.

The last section in this chapter describes the removal of dyes and Cr(VI) from aqueous solution by adsorptive method with humic acid as an adsorbent. The adsorbed amount of contaminants shows their potential as an effective adsorbent.

Chapter 4 covers the conclusion related to this study undertaken.

Chapter 5 contains references cited in the text.