

## Contaminant transport through porous media: An overview of experimental and numerical studies

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**Abstract.** The groundwater has been a major source of water supply throughout the ages. Around 50% of the rural as well as urban population in the developing countries like India depends on groundwater for drinking. The groundwater is also an important source in the agriculture and industrial sector. In many parts of the world, groundwater resources are under increasing threat from growing demands, wasteful use and contamination. A good planning and management practices are needed to face this challenge. A key to the management of groundwater is the ability to model the movement of fluids and contaminants in the subsurface environment. It is obvious that the contaminant source activities cannot be completely eliminated and perhaps our water bodies will continue to serve as receptors of vast quantities of waste. In such a scenario, the goal of water quality protection efforts must necessarily be the control and management of these sources to ensure that released pollutants will be sufficiently attenuated within the region of interest and the quality of water at points of withdrawal is not impaired. In order to understand the behaviour of contaminant transport through different types of media, several researchers are carrying out experimental investigations through laboratory and field studies. Many of them are working on the analytical and numerical studies to simulate the movement of contaminants in soil and groundwater of the contaminant transport. With the advent of high power computers especially, a numerical modelling has gained popularity and is indeed of particular relevance in this regard. This paper provides the state of the art of contaminant transport and reviews the allied research works carried out through experimental investigation or using the analytical solution and numerical method. The review involves the investigation in respect of both, saturated and unsaturated, porous media.

**Keywords:** contaminant transport; porous media; saturated; unsaturated; experimental investigation; analytical studies; numerical modelling; finite element methods (FEM); meshfree methods

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### 1. Introduction

Groundwater is a valuable natural resource. Its contamination is one of the most typical hydro-geological and environmental problems. In many parts of the world, groundwater resources are under increasing threat from growing demands, wasteful use and contamination. The fate and transport of solute in soils and groundwater has long been a focus of experimental and theoretical

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