1 Introduction

The goal is to describe the distribution of pollutant in the soil, which is degradated by native bacteria as well as specialized ones placed at seramis[1] particles. Prior to this thesis there exists a bachelor thesis [Fie10], which provides an analytical, two dimensional solution of a diffusion model. This thesis takes this model and achieves a three dimensional, analytical solution.

The mathematical part of the thesis consists of three main chapters showing the concept, fitting the model's parameters and simulating the environment. This three chapters are followed by the implementation chapters, which describe the fitting and simulating.

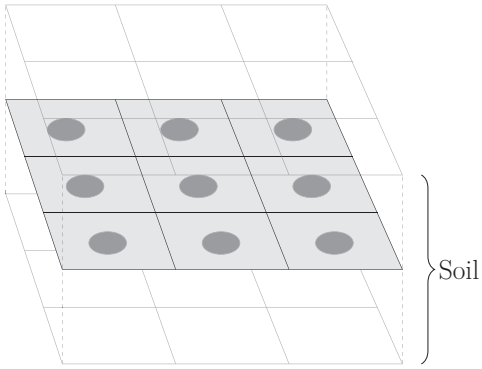

Figure 1.1: Geometry of an environment containing multiple seramis particles.

It is assumed that the specialized bacteria stay at the seramis particles' surfaces. Their population size stays constant and the degradation is fast. Therefore we can assume that diffusion is a limiting factor, the distribution of the pollutant is described by the 'Diffusion Equation' and the influx of pollutant into the seramis particles is described by the available pollutant at the seramis' boundary and the diffusion coefficent, which we keep constant (see Fick's law).

This model is comparable to the diffusion limited, numerical one used by [DOB+10] to model experimental data of benzoate degradation and achieves good results as long the assumption of being diffusion limited stays true.

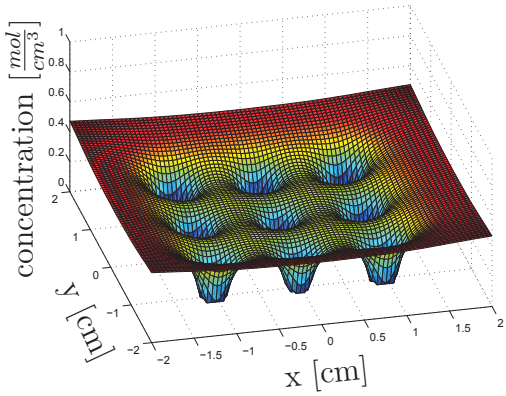

Figure 1.2: This plot corresponding to the xy-plane (gray surface) seen in fig. 1.1 shows negative singularities in concentration formed by the seramis particles.

Chapter 3, the first mathematical chapter, shows the concept by modelling the limit $t \to \infty$, which equals Laplace's equation in this case. Not having to consider the time simplifies the model. Neglecting the time axis also includes neglecting the native degradation, which would result into zero pollutant concentration regarding any circumstances.

The first chapter deals with the boundary values, which control the process, and the mutual influence, when modeling multiple cells (see fig. 1.2).

Chapter 4, the next step, deals with native degradation and the evolution in time. The

[1] SERAMIS clay granulate by Mars GmbH