Title: Development of the Taylor dispersion method for diffusion coefficient measurements

Author: mgr. inż. Anna Zagożdżon

Supervisors: prof. dr hab. Robert Hołyst

dr hab. Renata Małgorzata Gadzała-Kopciuch, prof. UMK

Abstract

Diffusion is a phenomenon present in many natural and industrial processes. The rate of diffusion is often a factor which limits the overall rate of chemical processes. The quantity describing the diffusion rate is the diffusion coefficient, required for an appropriate description of processes involving diffusion. Although several methods are used to measure diffusion coefficients, selection of the most suitable one is often a difficult task. Physicochemical properties of the sample, its amount, the accuracy of measurement or the availability of appropriate equipment can limit the applicability of the method. Therefore it is of great importance to improve the existing solutions and methods.

The aim of the research presented in this thesis is to develop the Taylor dispersion method for diffusion coefficient measurements. Increasing the accuracy of the method and decreasing the measurement time involved are the main subject of my study. In my work I have found a new equation describing the relation between the diffusion coefficient of the analyte and its concentration distribution measured as it flows through a coiled capillary.

Chapter 1 of this thesis introduces the reader to the diffusion theory and provides an overview of the existing methods for determination of diffusion coefficients. In Chapter 2, the theoretical fundamentals of the Taylor dispersion analysis and discussion concerning flow through a coiled capillary are presented. Chapter 3 contains information on the chemicals, equipment, procedures and technical details concerning the research presented. Chapter 4 includes experimental results as well as their discussion. Finally, Chapter 5 presents the conclusions of the investigation.