



Contents.

1. Introduction.	5
2. Literature review.	7
2.1. Mixing Indices.	7
2.2. Mixing with Deformation.	10
2.3. Mixing with Diffusion and Reaction.	12
2.4. Efficiency of Mixing.	23
2.5. Stability of Laminar Flows.	31
2.6. Application of Chemical Test Reactions to Investigate Mixing.	34
3. Mechanisms of Laminar Mixing.	39
3.1. Molecular Diffusion in Deformed Liquid Elements.	39
3.2. Effects of Physical Properties of Mixed Media on the Course of Mixing.	51
4. Stability of an Axisymmetric, Laminar Flow of Two Liquids.	55
4.1. Experimental System and Experimental Procedure.	55
4.2. Mixing of Liquids of Equal Viscosities and Densities.	57
4.3. Mixing of Liquids Differing in Viscosity and Density.	61
4.4. Stability Analysis of the Core-Annular Flow.	65
5. Application of Integral Methods to Model Micromixing in Very Viscous Liquids.	75
5.1. Micromixing as Evolution of Concentration Moments.	76
5.2. An Integral Method for Mixing and Chemical Reaction in Deformed Diffusion Layers.	86
6. An Experimental Method for Investigation of Micromixing in Very Viscous Liquids.	100
6.1. Description of the Test Reaction System.	100
6.2. Properties of Polyethylenepolypropylene Glycol.	102
6.2.1. Molecular Structure.	102
6.2.2. Viscosity of Aqueous Solutions.	102
6.2.3. Density of Aqueous Solutions.	104
6.2.4. Chemical Activity.	105
6.2.5. Alkalinity of Aqueous Solutions.	107
6.3. Measurements of Coefficients of Molecular Diffusivity in Aqueous Solutions of Polyethylenepolypropylene Glycol.	109
6.4. Measurements of Rate Constant of Alkaline Ester Hydrolysis in Aqueous Solutions of Polyethylenepolypropylene Glycol.	115

6.5. An Analytical Method to Determine Concentration of Ethyl Chloro- acetate.	118
7. Investigation of Mixing with the Test Reactions in a Semi-Batch Reactor.	120
7.1. Experimental System and Experimental Procedure.	120
7.2. Experimental results.	122
7.2.1. Effect of the Feeding Time on the Product Distribution.	122
7.2.2. Effect of the Rotational Speed on the Product Distribution	124
7.2.3.Effect of the Initial Volume Ratio on the Product Distribution.	126
7.2.4. Effect of the Viscosity Ratio on the Product Distribution.	128
7.3. Modelling of Micromixing in the Semi-Batch Reactor.	130
8. Investigation of Mixing with the Test Reactions in a Batch Reactor.	135
8.1. Experimental System and Experimental Procedure.	135
8.2. Experimental results.	138
8.2.1. Effect of the Rotational Speed on the Product Distribution	138
8.2.2. Effect of the Initial Volume Ratio on the Product Distribution.	141
8.2.3. Effect of the Viscosity Ratio on the Product Distribution.	143
8.2.4. Effect of a Local Disturbance of a Unidirectional Cuette Flow on the Product Distribution.	145
8.2.5. Effect of a Local Disturbance of a Periodic Cuette Flow on the Product Distribution.	150
8.3. Modelling of Micromixing in the Batch Reactor.	153
9. Methodology of Determination of Energetic Efficiency of Mixing.	159
10. Numerical Simulations of Mass Transfer Process in On-Line Mixers.	167
10.1. Description of Investigated Systems.	167
10.2. Conversion and Selectivity Computations.	168
10.3. Degrees of Segregation.	172
11. Conclusions.	175
12. Appendix A.	178
13. Appendix B.	179
14. Appendix C.	181
15. Appendix D.	185
16. Appendix E.	186
17. Notation.	191
18. References.	199