Mass Transfer in Multicomponent Mixtures

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Foreword

It was twenty years ago. A little before that, I had left the Equipment Engineering Department of Shell Research in Amsterdam for a less hectic job at Delft University. At least, so I thought at that moment. In my former section at Shell we had worked on catalytic crackers, on polymerisation reactors, on cleaning of oil tankers and other exciting developments, but I had found managing this a bit too much. There I was, with a lower salary, teaching separation processes to second year students, and running the undergraduate laboratory with one hundredth of my Shell budget. I had written a little book on Separation Processes, and sent it to friends in Amsterdam.

One of the pieces of equipment that we had in Shell Research was (what was then) the largest distillation test column in the world. It was two and a half metres in diameter and some twenty metres high. The column was so big that we could only run it in the summer: the reboiler used the complete capacity of our boiler house. The operating pressure could be varied between vacuum and fifteen atmospheres. We had a beautiful time trying out all kinds of trays and packings. In time we started to get interested in trying to understand not only distillation of binary mixtures, but also of mixtures with more components. We started to gather measurements and to try to understand them. However, much of what we saw was baffling, to say the least. Only gradually did we realise that our binary mass transfer tools were not adequate; that we needed to try something different. That something was a young graduate from Manchester who had picked up wild ideas on mass transfer doing his PhD. His name was Krishna. I left Shell just after he arrived.

One day, Krishna came along at home to visit me. He had read my book and told me politely that my approach to mass transfer was not all that good. I was a little vexed because I was professor, he was not, and besides, I had copied my ideas from well-known handbooks. Even so, I did try to listen, and three weeks later went back to him for more explanation. It was all about *multicomponent* mass transfer, it had connections with thermodynamics and was quite different from anything I knew.. I had difficulties in following what he was telling me, and I can remember: ‘Hans, if you really want to understand this, we should give a course together.’ That is where this book started.

We are now twenty years, fifteen PhD students, twenty-three courses and some thousand participants further. The course has evolved and so has the book. It now has examples from membrane technology, reaction engineering, sorption processes, biotechnology; from mixtures of gases or liquids, but also porous media and

polymers. The basics have not changed: they are still almost the same as presented by James Clerk Maxwell in 1866 and (more clearly) by Josef Stefan in 1872. (Maxwell is the one of the theory of electrical and magnetic fields, and Stefan the one associated with the name of Boltzmann.) I am a little ashamed when I look in editions of the *Encyclopaedia Britannica* from around 1900 and see how well diffusion was then understood. It feels as if it has taken me more than a century to pick up the brilliant but simple ideas of these two long-dead scientists. Krish and I hope this book will help you to do that a bit more quickly.

Hans Wesselingh
Groningen, May 2000

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