Abstract

Spiral and scroll wave activity in chemical systems is a growing area of research, especially due to their close link with complex biological processes. The propagation of these waves in the heart tissue gives rise to arrhythmias, some of which can be life threatening. Their effective treatment requires the complete knowledge of these waveforms and their possible control. The Belousov-Zhabotinsky (BZ) reaction, an oscillatory, red-ox reaction, is widely used as a laboratory model for these studies. The BZ system is a simple homogeneous system that can sustain spiral and scroll waves under suitable conditions. Our aim is to investigate some unexplored aspects of spiral and scroll wave dynamics in chemical excitable media. All the experimental studies are based on the ferroin catalyzed BZ system. Our work focuses on the detailed dynamics of scroll wave pinning (anchoring to unexcitable heterogeneities), reconnection, and unpinning in the presence of external electric and thermal gradients. We also explore how the spiral wave dynamics depend on the excitability of the medium. In order to gain a better understanding of the experimental results, numerical simulations are carried out using simple reaction-diffusion models.