Streszczenie w języku angielskim

Modern medical diagnostics utilize a variety of techniques, such as computed tomography, ultrasonography, and magnetic resonance imaging (MRI). These imaging methods enable the acquisition of three-dimensional images of specific body parts or the entire organism. MRI, a non-invasive diagnostic technique for soft tissues, is characterized by excellent spatial resolution and typically relies on the magnetic properties of hydrogen nuclei. However, due to the high water content in soft tissues, it can often be challenging to distinguish between different tissues or detect pathological changes.

Current research aims to image specific cellular processes rather than just anatomical changes. To achieve this, it is necessary to develop contrast agents that are only active in the presence of a specific enzyme or within a particular pH range, typical of cancerous changes. ^{19}F MRI is particularly attractive for these applications due to its high sensitivity and the absence of natural background in the body. Since fluorine-19 is not naturally present in the human body, any detected signal originates exclusively from the introduced contrast agent.

This doctoral dissertation consists of a series of four thematically linked publications that include: i) a literature review on the latest advancements in the design of ^{19}F MRI probes; ii) studies of a model hydrazone switch for imaging pH gradients via ^{19}F MRI; and iii) the incorporation of paramagnetic agents into the switch structure; iv) the shift in pH of switching. Hydrazone-based contrast agents were developed, which undergo E/Z isomerization in response to pH changes. As a result, their magnetic properties, easily detectable via ^{1}H and ^{19}F NMR, change accordingly. Methods for modifying key switch properties, such as NMR magnetic characteristics and solubility, were developed. Probes were successfully designed to function through changes in NMR chemical shifts as well as relaxation times. Ultimately, the probes' efficacy was demonstrated by obtaining real ^{19}F MRI images that monitor pH gradients.

Key words: Molecular switches, fluorine, magnetic resonance, paramagnetic complexes