

## ABSTRACT

Magneto-mechanical and related phenomena displayed by iron oxide nanoparticles (IONPs) in an applied alternating magnetic field are of great interest due to their promising applications in nanomedicine, especially regarding the eradication of cancer cells. Most studies on the biological effects of magneto-mechanical actuation of endocytosed IONPs in various cell lines are often contradictory. This inconsistency could be due to the inability to accurately define and compare basic experimental magnetic field parameters such as field intensity, frequency and gradient, sample exposure time and cell type etc. Moreover, although the toxicity of IONPs has been reported, the exact mechanisms and factors governing their degradation are still lacking. This is of great importance not only in terms of toxicity, but also to evaluate the durability of their physicochemical properties with emphasis on their responsivity to magnetic stimuli, which is a fundamental pre-requisite for the implementation of these materials in medical practice, yet it is jeopardized by the IONPs' interaction with the complex biological environment. Taking all the above into consideration, this thesis examines how variable magnetic fields in terms of frequency, intensity and gradient affect the growth rate of one specific human colon cancer line (HT29), incubated with commercial ferrofluids consisting of a magnetite core with average hydrodynamic sizes of 100 and 200 nm. Additionally, a model for the in vivo degradation of the IONPs is being followed to gain insight on the changes of the magnetic properties of the particles in citrate buffers which mimic the lysosomal conditions. Our results reveal the multifactorial nature of cellular responses to applied magnetic fields and IONPs, and outline the necessity of focusing on more controlled and reproducible experimental parameters in order to be able to generate models predicting those responses.