

# Development of a stimuli-responsive microcapsule capable of recognizing and killing cancer cells through mechanical actuation

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## Abstract

Chemotherapy is one of the main approaches for cancer treatment but delivery of drugs to cancer cells relies on the systemic circulation where clinical observations have indicated that healthy cells are also killed by chemotherapeutic drugs. Thus, a need exists for the development of methods where chemotherapeutic drugs could be specifically delivered to cancer cells without harming healthy cells. Current drug delivery methods typically use microcapsules loaded with chemotherapeutic drugs for delivering needed doses of drug compounds to target cells. However, off-target effects remain where the microcapsule releases the chemotherapeutic drug near healthy cells which resulted in cell death and side effects to the patient. Thus, the objective of this research project lies in the development of stimuli-responsive microcapsule capable of both recognizing and killing cancer cells. The first part of the project would entail the profiling of cancer cell lines and primary tumour cells of various cancers through mass spectrometry enabled proteomics for understanding the ensemble of surface antigens on cancer cells. Such information is crucial for the development of molecular recognition properties of the proposed stimuli-responsive microcapsule device where an antibody would be developed for the surface antigen conserved on cancer cells. By using matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF MS) for profiling the proteome of cancer cells, information on the conservation of surface antigens might be available in the compendium of mass peaks profiled. This could be determined by annotation of the mass peaks obtained with the help of annotated proteome of cancer cells. Antibodies developed for recognizing the surface antigens on cancer cells would be incorporated into biocompatible polymeric microcapsule with stimuli-responsive properties. Upon recognition and binding of the cancer cells, a mechanical actuation system would be activated that results in the compression and lysis of the cancer cell with force exerted by the stimuli-responsive microcapsule. The stimulus for mechanical actuation comes from the recognition and binding of cancer cells by the antibodies on the microcapsule surface. Overall, this system provides specific targeted killing of cancer cells and avoids problems associated with the off-target effects of release of chemotherapeutic drugs near cancer cells.

**Keywords:** stimuli-responsive, mechanical actuation, antigen-antibody recognition, cancer cells, surface proteome,

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## Conflicts of interest

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