Notice of the Final Oral Examination for the Degree of Master of Applied Science of

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BEng (University of Victoria, 2017)

“A Smart Bandage for the Automatic Detection and Treatment of P. Aeruginosa Infections in Burns”

Department of Mechanical Engineering

Tuesday, August 25, 2020
10:00 A.M.
Remote Defence

Supervisory Committee:
Dr. Mohsen Akbari, Department of Mechanical Engineering, University of Victoria (Supervisor)
Dr. Yang Shi, Department of Mechanical Engineering, UVic (Member)

External Examiner:
Dr. Lisa Reynolds, Department of Biochemistry and Microbiology, UVic

Chair of Oral Examination:
Dr. Dzifa Dordunoo, School of Nursing, UVic

Dr. Stephen Evans, Acting Dean, Faculty of Graduate Studies
Abstract

Infection of thermal injuries by bacteria is a growing concern in the healthcare community, leading to increased rates of morbidity and mortality. *P. Aeruginosa*, a rod-shaped, gram negative bacteria is one of the bacterial species most commonly found in infected burns. Detecting infections in burns is still a somewhat archaic process involving visual inspection, in which dressings have to be removed (also causing more pain and discomfort to patients) before samples are sent to a laboratory for analysis. Timely in situ detection systems, which limit disturbances to the wound area, could drastically improve patient comfort and healing outcomes. While established infections, with fully developed biofilms, are difficult to treat, loose bacteria early on in an infection and biofilm formation are more likely to fall easy prey to antibiotics, if the appropriate drugs are administered in a timely manner. In this thesis a smart wound management system, geared towards detecting and eliminating *P. Aeruginosa* infections in burns is presented. Both non-functionalized general purpose electrodes, paired with an affordable open source potentiostat, for electrochemical analysis, and on demand drug releasing elements were developed by layering conductive materials onto everyday cotton threads. The sensing elements were thoroughly characterized with the detection of a *P. Aeruginosa* biomarker over a range of physiologically relevant concentrations and conditions. The ability of the thread based sensors to detect live bacteria and be integrated in textile wound dressings was demonstrated. Controlled drug release was also demonstrated through the development of several drug release profiles. The presented technology has the potential to greatly improve patient outcomes in burn wards and provides a platform for tackling other infectious organisms with the further development of more thread based tools.