Vita

Candidate's name: Connor Patrick O'Brien

Universities Attended:
University of New Brunswick (2020)
Bachelor of Science

University of New Brunswick (2021)
Masters of Science

Publications:

Connor O'Brien and Anna Ignaszak. "Advances in the Electrochemical Treatment (EChT) of Cancers and Tumours: A Review Exploring the Current Trends, Advancements, and Mechanisms of Electrolytic Tumour Ablation." *ChemElectroChem*, July 20, 2020: https://doi.org/10.1002/celc.202000887.

Connor O'Brien, Kathleen Varty, and Anna Ignaszak. "The Electrochemical Detection of Bioterrorism Agents: A Review of the Detection, Diagnostics, and Implementation of Sensors in Biosafety Programs for Class A Bioweapons." *Nature Microsystems & Nanoengineering* 7, no. 1 (December 10, 2021): 16. https://doi.org/10.1038/s41378-021-00242-5.

Kathleen Varty, Connor O'Brien, and Anna Ignaszak. "Breast Cancer Aptamers: Current Sensing Targets, Available Aptamers, and Their Evaluation for Clinical Use in Diagnostics." *Cancers* 13, no. 16 (August 6, 2021): 3984. https://doi.org/10.3390/cancers13163984.

The Covalent grafting of polypyrrole to a carbon backbone via electrochemically aided atom transfer radical polymerization (eATRP) technique for supercapacitor applications

UNIVERSITY OF NEW BRUNSWICK

THESIS DEFENCE AND EXAMINATION

in Partial Fulfillment

of the Requirement for the Degree of
Master of Science

by

Connor P. O'Brien

in the Department of Chemistry

U.N.B., Fredericton, N.B.

Friday, September 3rd, 2021
11:00 a.m.

Via MS TEAMS

Examining Committee

Dr. Anna Ignaszak	Supervisor
Dr. James Tait	Internal Examiner
Dr. Allison Enright	Int-Ext Examiner
Dr. John Neville	Chair of Oral Examination

Abstract

Capacitors are devices that store energy by way of electric field. Supercapacitors, capacitors that can store between 10 and 100 times more energy than electrolytic capacitors but function at lower voltage limits, are of particular interest as they can accept and deliver charge at a quicker rate and can tolerate many more charge/discharge cycles than batteries. These supercapacitors have garnered particular interest over the last decade. This is perhaps unsurprising as we look to move away from large clunky energy storage devices and toward lightweight, durable, and efficient ways of storing and moving our energy. In order to create an effective supercapacitor, a synthetic pathway employing electrochemically mediated atom transfer radical polymerization was designed to covalently attach polypyrrole (PPy) to a carbon-based capacitive backbone. Products were then converted into an ink and grafted onto screen printed electrodes for electrochemical testing. The final product displayed a capacitance of 173.6F/g, a 46.5% increase over pure PPy. After simultaneous 0.6, 0.7, 0.8, and 1.0 V degradation tests, the product maintained 82% retention of capacitance, more than double the retention of pure PPy. Charging times and total system resistivity remained low, as expected for supercapacitive materials.