ALBERTA INNOVATES

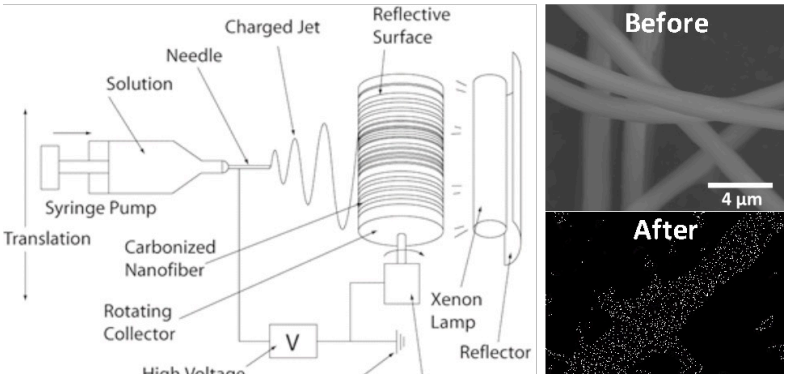
# CLEAN RESOURCES

BIOINDUSTRIAL INNOVATION

LIGNIN PURSUIT

## Development of Carbon Nanofibers from Electrospun Lignin using Intensive Pulsed Light

MEDAL lab at the University of Calgary is developing a novel carbon fiber manufacturing process utilizing lignin (byproduct of pulp and paper operations) as the precursor material. The lignin is treated such that large percentages can be used for electrospinning. Photo-electromagnetic treatment techniques replace conventional stabilization and carbonization in a tube furnace. This enables production of carbon nanofibers at a fraction of the cost, time and energy compared to present methods. Porous and hollow fibers can also be formed with ultrahigh surface areas. The successful fabrication of carbon nanofibers would result in commercially viable products in our simulated lab environment.




### FUNDING DETAILS

**RECIPIENT:**

University of Calgary – Simon Park

**PARTNERS:**

West Fraser

University of Calgary

NSERC

Trium Inc.

**TOTAL BUDGET:**

$517,500

**AI FUNDING:**

$253,500

**PROJECT DATES:**

March 2019 - March 2020

**PROJECT TRL:**

Start: 1

End: 6

## APPLICATION

The primary advantage of photo-electromagnetic carbon nanofiber manufacturing is the high efficiency. Furthermore, novel improvements in the electrical, chemical, mechanical and thermal properties offer a wide range of high value applications. The fibers can form membranes that can be used for electrode, battery and filter applications. Individual fibers can be used as mechanical reinforcement, sensors, insulators, vibration absorbers or fillers.

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### LIGNIN PURSUIT

## PROJECT GOALS

- Electrospinning using high concentrations of lignin by developing a new lignin treatment method.
- Stabilize and carbonize electrospun fibers using photo-electromagnetic techniques.
- Apply electrospun nanofiber membranes for battery and filter applications.
- Validate the potential GHG reduction of the proposed photo-electromagnetic stabilization and carbonization methods is greater than 50% compared to conventional methods.
- Validate environmental benefits including consuming lignin and sustainable carbon fiber manufacturing.
- Validate the lower production cost of the proposed method such that carbon fibers can be manufactured less than $9/kg.

## BENEFITS TO ALBERTA

- Consume waste lignin that builds up in pulp and paper mills to create value added products.
- Reduce the CAPEX/OPEX for carbon fiber manufacturing resulting in significant potential revenue and growth.
- Successful development of the project may lead Alberta to become a global supplier of carbon nanofibers and global leader in sustainable carbon fiber manufacturing.
- Partnerships with West Fraser Co., the University of Calgary, Innovate Calgary and Trium Inc. ensures that future production and potential employment opportunities remain in Alberta.
- Commercial users of the patented photo-electromagnetic techniques have the potential to reshape the industrial landscape and become industry leaders in low cost production.

**3 Publications**

**7 Students Trained**

**1 Patent**

**6 Project Jobs**

**10-100 Future Jobs**

**1 Spinoff Companies**

**1-3 kT/yr Future GHGs Reduced**

## CURRENT STATUS

### MARCH 2020

The MEDAL lab has developed a new method to produce carbon nanofibers via electrospinning and photo-electromagnetic treatment. An initial prototype of the carbon fibers has been manufactured. Tests have been conducted to demonstrate the feasibility for oil-water separation, electrodes for battery and sensor applications. We are now looking to optimize the process and scale-up to achieve commercially viable manufacturing processes.