GC3 Webinar Series

October 8, 2013

Accelerating Commercialization of Green Chemistry Technologies at GreenCentre Canada

Rui Resendes, Executive Director, GreenCentre Canada
Webinar Discussion Instructions

• Due to the number of participants on the Webinar, all lines will be muted.

• If you wish to ask a question, please type your question in the Q&A box located in the drop down control panel at the top of the screen.

• All questions will be answered at the end of the presentation.
Chemistry is at the heart of everything we do
It underpins our quality of life
Our daily routines and the products we use are all made possible by the chemical industry.
DILEMMA:
The chemical industry presents us with our most profound sustainability challenges
DILEMMA:

How can we continue to enjoy our quality of life without damaging the environment?
SOLUTION:

Green Chemistry

Damage to environment

Depletion of resources

Human Health Concerns
Green Chemistry - It's Not A Choice

IS IT THE FIRST?

... NO, THE 7 BILLIONTH
The GreenCentre Team

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The GreenCentre Mission

- Our mission is: **Changing Chemistry, Changing The World**

- Specifically, we identify, develop and deploy “game-changing” Green Chemistry innovations to advance the human condition

- By *human condition* we are referring to:
  - human health
  - environmental sustainability
  - economic prosperity
In-house laboratories and technical team

10,000 sq ft. facility

State of the art equipment
Commercialization Services

- Technology Assessment
- Product & Application Development
- IP Management
- Business Development
- Scale-up Manufacturing
- Licensing & NewCo creation
DISCLOSURE

We accept early-stage technology disclosures from academic institutions and entrepreneurs.

For academics, our principle point of contact is the technology transfer/industry liaison officer.

GreenCentre will execute all necessary confidentiality agreements and ensure that project submissions are kept confidential.
ANALYSIS

Under a 90-day exclusive option, we conduct a thorough technological assessment.

GreenCentre’s industry partners provide input.

Analysis is shared with the institution.

Possible outcomes: return, proof-of-principle funding or in-licensing.
LICENSING

We will sign an exclusive license with the institution

There are no upfront costs; we cover all development and IP costs going forward

We return a large portion of all net licensing proceeds to the institution/inventors

Institution/inventors share in all licensing returns
**DEVELOPMENT**

GreenCentre makes the investments needed to close the market gap:

- Process optimization
- Field-test proof of utility
- Scale-up of product candidates
- Application development
- Pre-commercial sales

GreenCentre will license the technology or create start-ups and start sending licensing revenue back to the inventors.
Hands-On Industrial Sponsors
An International Technology Pipeline
Enabling the Future of Sustainability
Highlights To Date

- In less than 5 years we have assembled a world-class team, built a state-of-the-art facility, developed international networks and have become a globally recognized leader in Green Chemistry commercialization.
- We have executed 6 out-licenses, created 3 companies and 80 direct jobs in Canada and have leveraged public investment dollar-for-dollar.
- Our ability to reduce technological and commercial risk has re-kindled interest in Clean-tech investment.
Goal is to create an ecosystem where all participants in commercialization process understand each other, the value of Green Chemistry and how to work together.

Building strong stakeholder relationships requires effective communication.

Communication strategy also seeks to:

- improve public understanding and perception of Green Chemistry;
- improve resource allocation and policy frameworks to advance Green Chemistry.
Hug A Chemist

Green Chemistry Awareness Campaign

Save our planet
HUG A CHEMIST
not a tree

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Green Centre Canada
changing chemistry, changing the world

Switchable Water
Switchable Water (SW)

• CO₂-switchable water-soluble additive proving a reversible change in ionic strength of water

• Part of GreenCentre’s Jessop portfolio

• Addition of CO₂ converts additive to a salt, increasing ionic strength

• Removal of CO₂ (by bubbling air), reverts the additive to it’s non-ionic state
Switchable Water (SW)

- Potential Application Targets:
  - Desalination (osmosis)
  - Separating water-soluble organics
  - Switchable polyacrylamide surrogate:
    - increase water viscosity
    - flocculation
  - Biphasic catalyst recovery
  - Low foaming surfactants/emulsifier/additive/emulsion breaker
Sustainable Clean Water
One of the greatest challenges facing humanity is abundant access to clean water for human consumption, agriculture and industry.

Innovative technologies are needed to address this challenge of the 21st century.

Forward Water Technologies aims to revolutionize the production of fresh water by tapping into an abundant source of water, our oceans.
Desalination Market

$13 B
Projected 2013 worldwide market

Major Players
IDE Technologies, Degremont (Suez), Hyflux, Veolia, Acciona Agua, and Doosan Heavy
Reverse Osmosis (RO) Desalination

Pressure

Semi-Permeable RO Membrane

Salt Water

Water Flow

Fresh Water
Reverse Osmosis (RO) Desalination

- High Pressure
- High Energy
- High Membrane Fouling
In FO desalination, a concentrated draw solution is used to “pull” water through the membrane instead of an applied pressure.
Forward Osmosis (FO) Desalination

However, now we are left with two salty solutions, where the salt must be removed by another, energy-intensive, process to recover clean water.
This is where Forward Water Technologies’

**Switchable Water Technology**

may be employed for a greener desalination process
Switchable Water Desalination

Salt Water

Semi-Permeable FO Membrane

Switchable Additive Solution
Switchable Water Desalination

- Low Pressure
- Low Energy
- Low Membrane Fouling
Switchable Water Desalination

- Semi-Permeable FO Membrane
- Spontaneous Water Flow
- Switchable Additive Solution
Switchable Water Desalination

Semi-Permeable FO Membrane

Switchable Additive Solution

Switchable Additive Solution
Switchable Water Desalination

Semi-Permeable FO Membrane

N\textsubscript{2} or Air

Switchable Additive Solution
Switchable Water Desalination

Semi-Permeable FO Membrane

Fresh Water

N₂ or Air
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Moving Beyond Canada
GreenCenter USA

- Last year, as part of our growth strategy, we created a US subsidiary – GreenCenter USA (GCU)

- Since that time, GCU has received its 501 c(3) designation, has been working with US researchers and entrepreneurs and has been assembling a broad stakeholder group to support the expansion of the GreenCentre model into the US

- We are at the beginning of this journey but progress is being made

- Please feel free to contact me to learn more about GreenCenter USA
GreenCentre is a member of Ontario Network of Excellence and is supported by the Government of Ontario.

GreenCentre is a member of Centres of Excellence for Commercialization and Research (CECR) and is supported by the Government of Canada’s Networks of Centres of Excellence.
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The audio recording and slides shown during this presentation will be available to GC3 Members on the GC3 Website: http://www.greenchemistryandcommerce.org

Non- GC3 Member Attendees who would like to view these slides please contact Sarah Shields at sarah_shields@uml.edu

**Upcoming GC3 Webinars**

**InnoCentive: Using Crowdsourcing to Solve Green Chemistry Challenges & Create New Market Opportunities**
Alph Bingham, Founder & Board Member, InnoCentive
Wednesday, October 23, 2013
2pm Eastern/11am Pacific

**Advancing Green Chemistry Innovation in the Pharmaceutical Industry: The GCI Pharmaceutical Roundtable’s Research Grant Program**
Julie Manley, ACS Green Chemistry Institute
Others/Date/Time TBA

**LAUNCH: How Nike, USAID and the State Department are Using Challenge Driven Innovation to Advance Sustainable Materials**
Nike
Others/Date/Time TBA