

Cleaning Water with Electricity: The Importance of Electrode Materials for Depollution and Disinfection

SALOUMEH GHASEMIAN

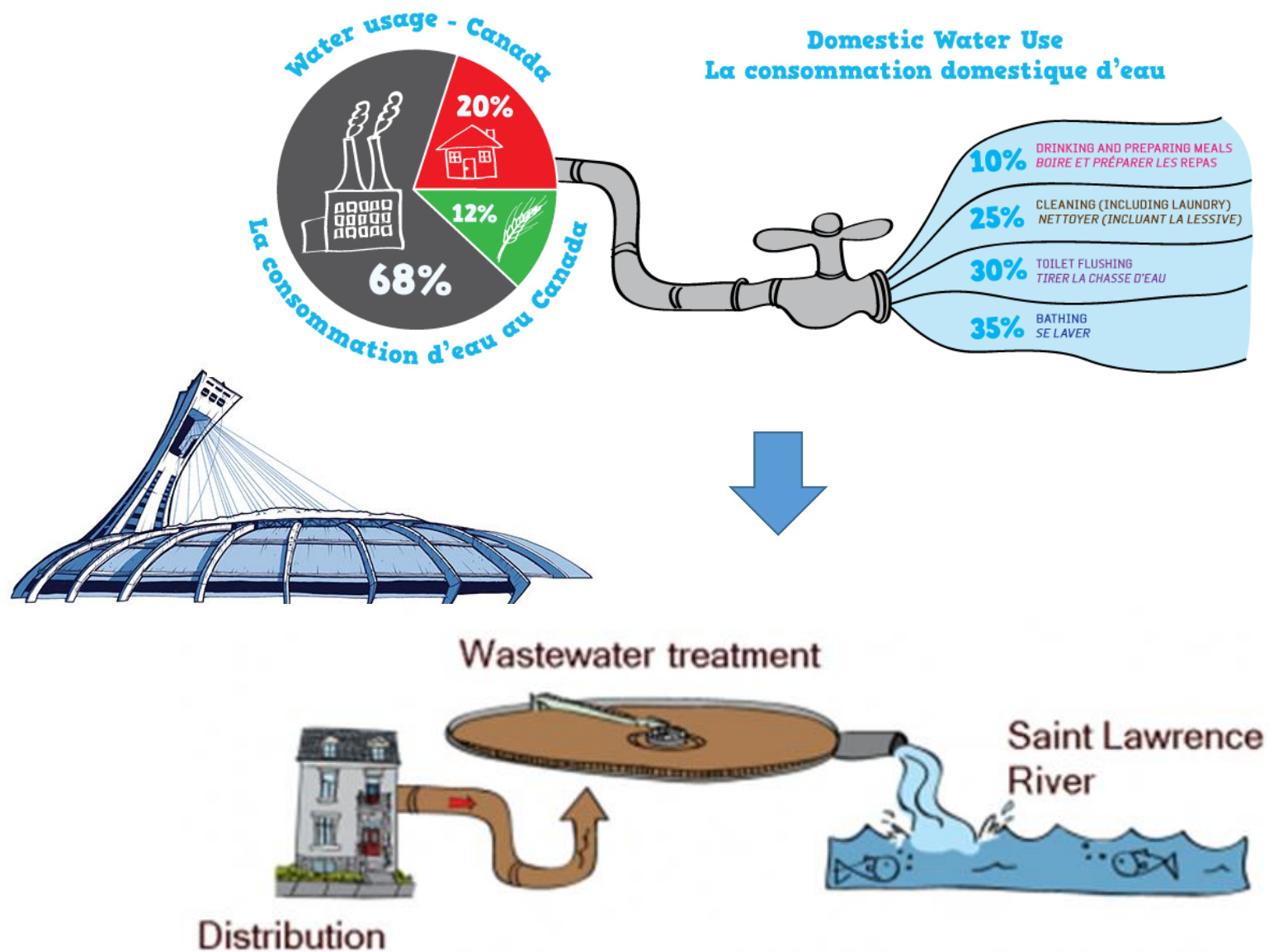
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Clean Water: Taken for Granted?

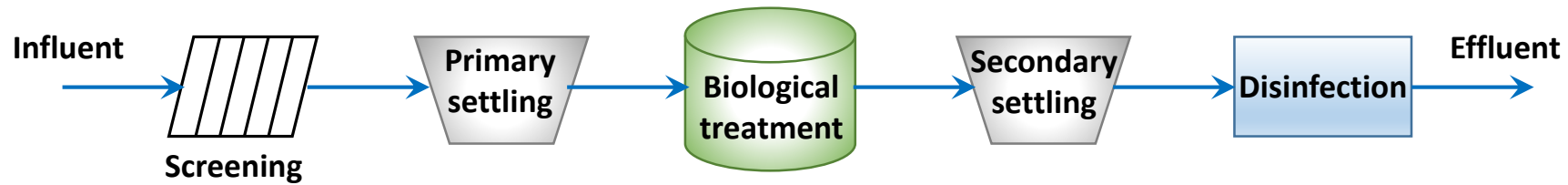


Unable to drink local water for 16 years 3:49

Where are we today?



Wastewater Treatment Methods



Advanced Oxidation Processes (AOPs)

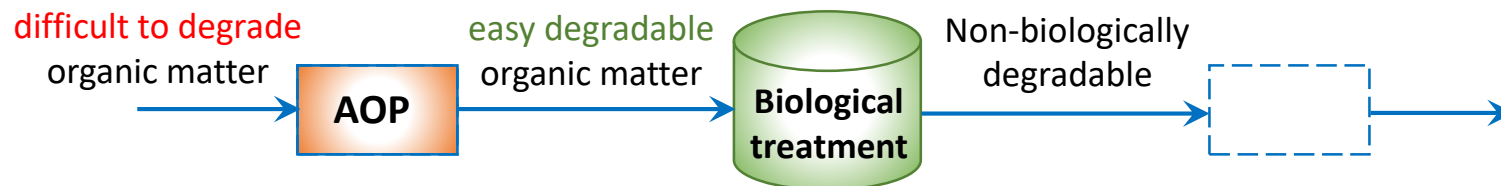
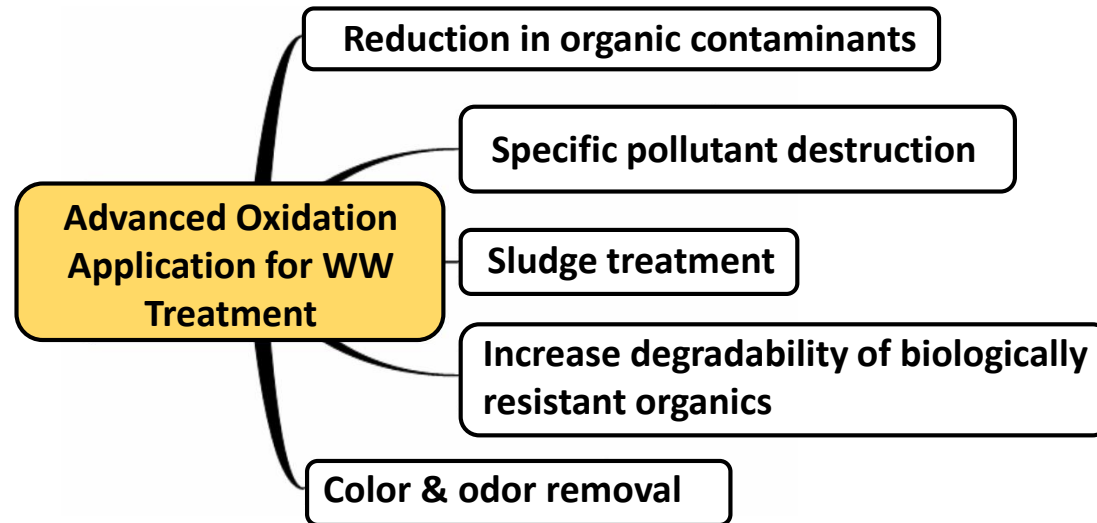
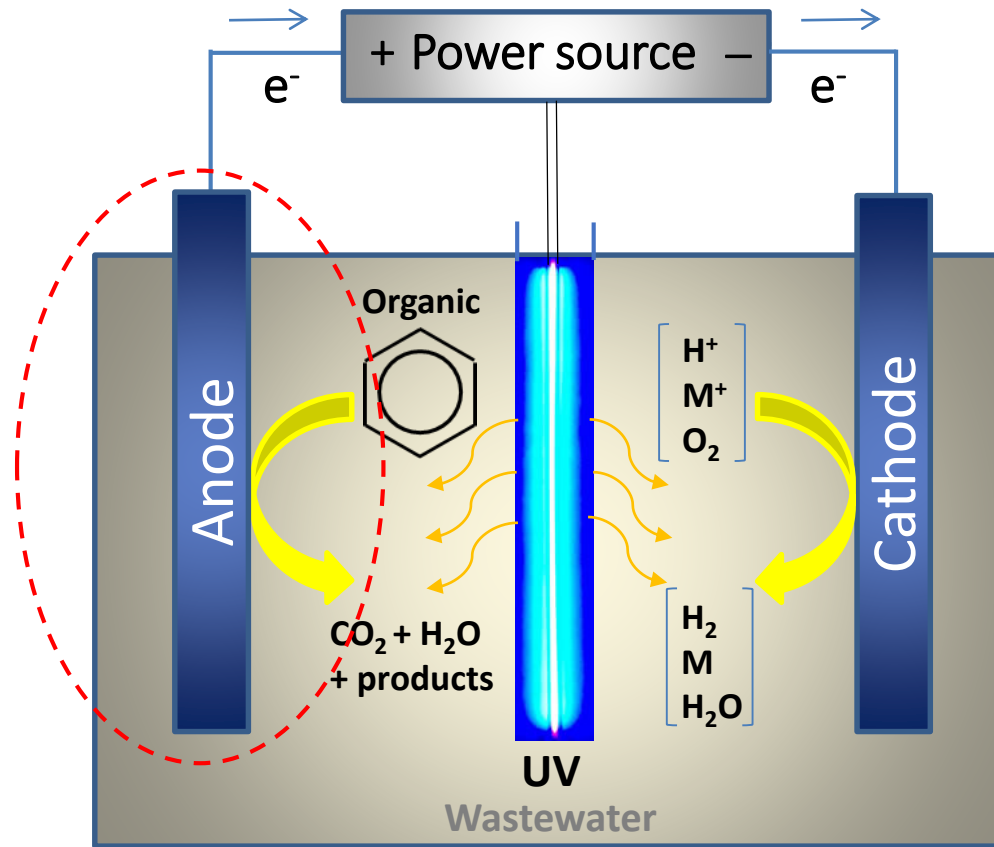


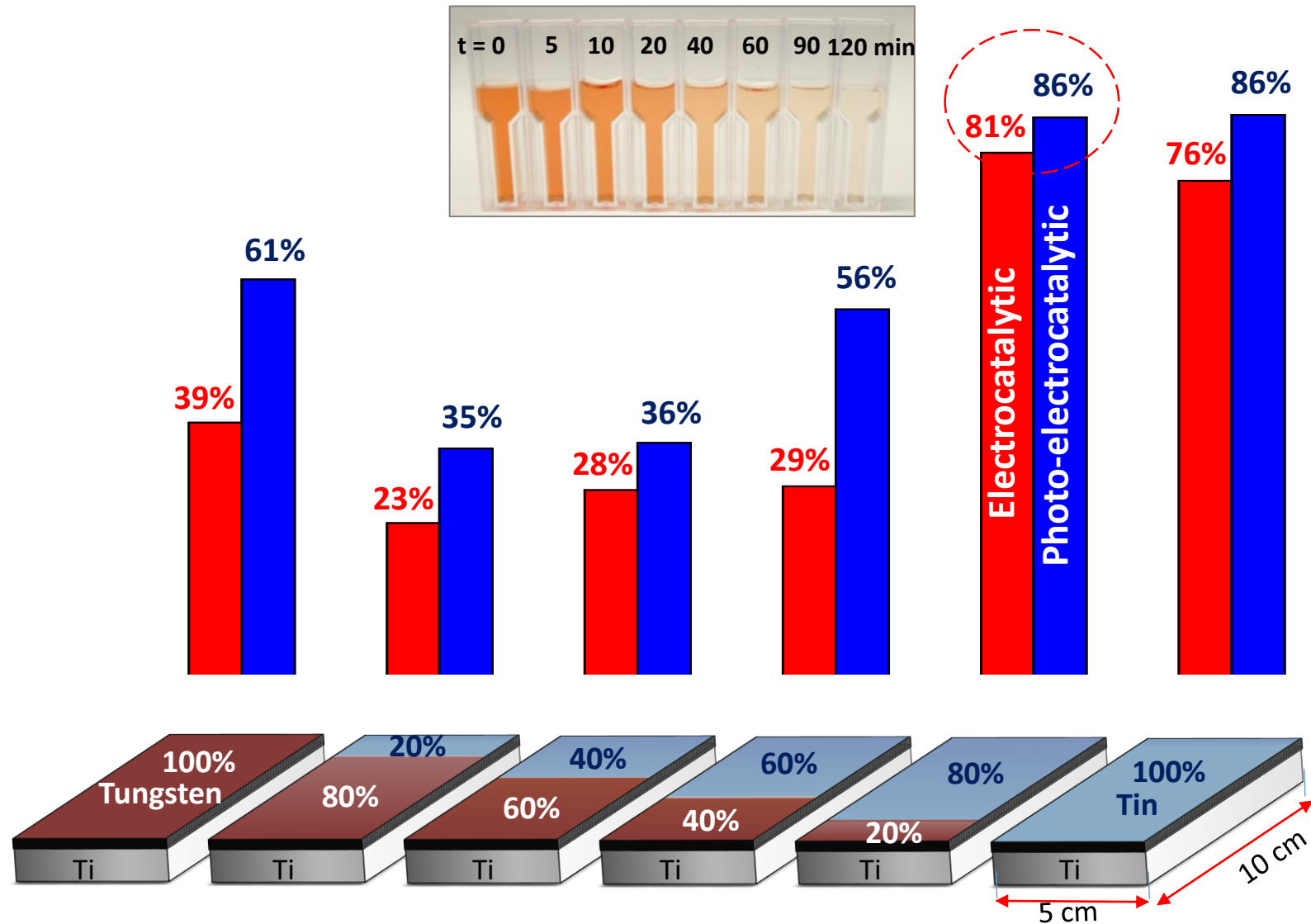
Photo-Electrochemical Oxidation Process



Typical electrochemical reactor for Waste Water treatment

Photo-Electro catalysis

Preparation and screening of anode coatings



What are the major threats to water quality?

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ANALYSIS | Drinking water contaminated by excreted drugs a growing concern

Researchers finding excreted drugs in drinking water

By Kelly Crowe, CBC News Posted: Sep 22, 2014 5:00 AM ET | Last Updated: Sep 22, 2014 10:23 PM ET

Sep. 22, 2014


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A vital dose of the week's news in health and medicine, from reporter Kelly Crowe and CBC Health. Deliver Friday mornings.

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Carbamazepine

Waterborne Pathogens

MOST DRUG RESIDUES IN WASTEWATER COME FROM HOUSEHOLDS, NOT HOSPITALS

Researchers in Germany focused on 50 frequently administered substances which are particularly associated with discharge to wastewater.

Oct. 22, 2015

WATER TECHNOLOGY STAFF OCTOBER 22, 2015

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Photo-electrocatalytic Degradation of Carbamazepine

Effect of applied current

$[\text{CBZ}]_0 = 0.2 \text{ mg/L}$

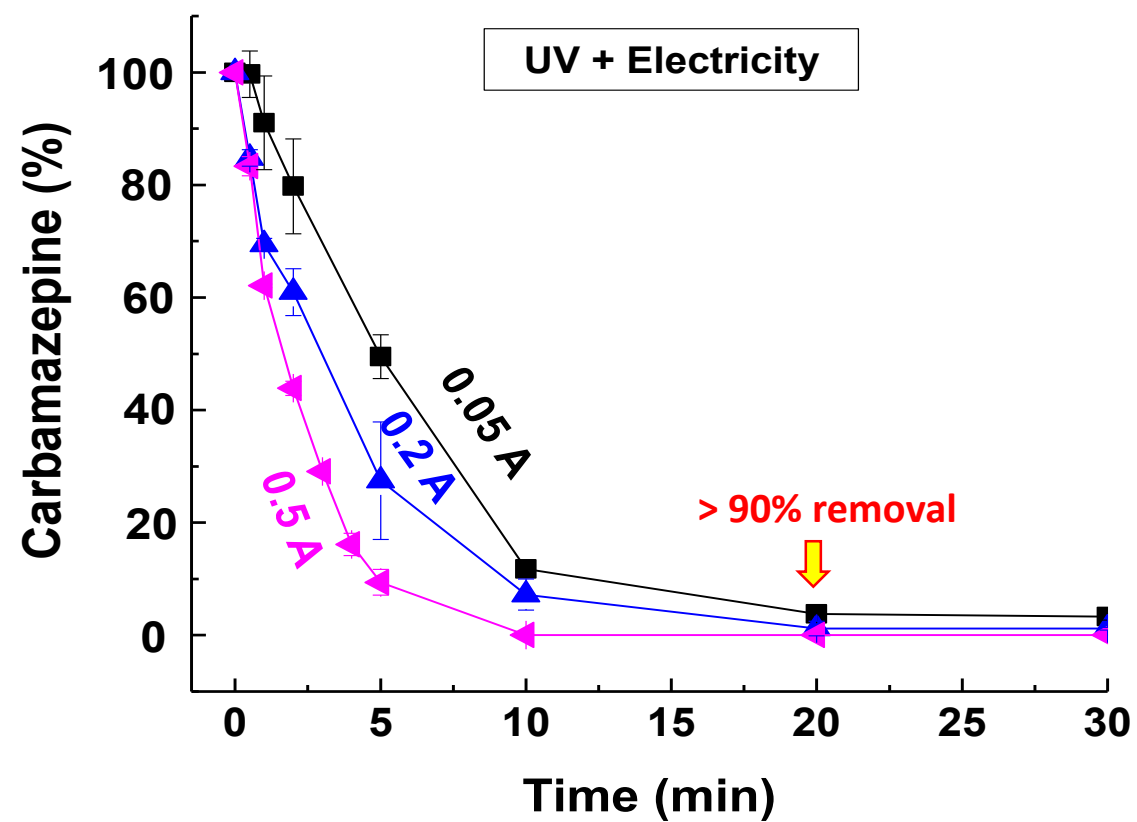
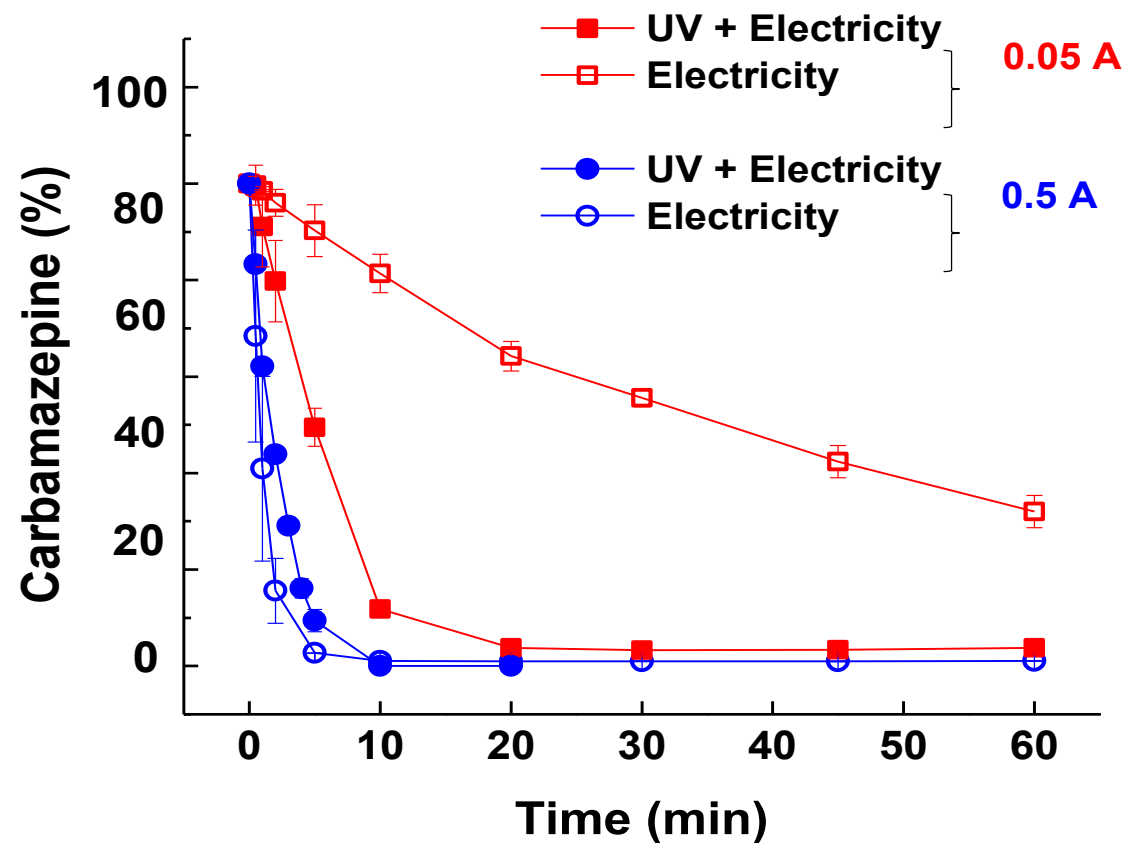


Photo-electrocatalysis vs. Electrocatalysis

Effect of applied current

$[\text{CBZ}]_0 = 0.2 \text{ mg/L}$



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Health Rate My Hospital

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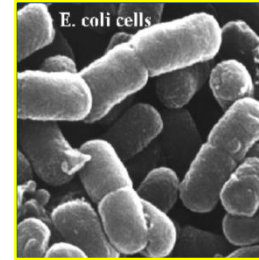
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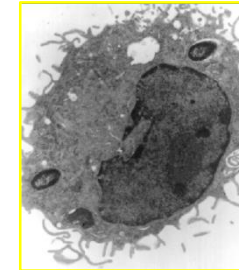


Carbamazepine

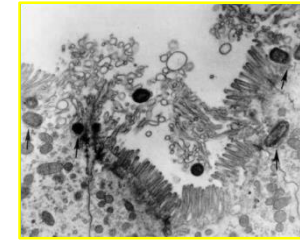
Waterborne Pathogens



E. coli



Shigella



Salmonella



Vibrio cholerae

Pathogenic Bacteria

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Inside Walkerton: Canada's worst-ever E. coli contamination

The shock, the investigation and the aftermath

CBC News Posted: May 10, 2010 1:23 PM ET | Last Updated: May 17, 2010 4:45 PM ET

Canada's worst-ever outbreak of E. coli contamination took hold 10 years ago in a typically quiet town in the rural heartland of Bruce County, Ont.

The community of Walkerton, population less than 5,000 at the time, saw 2,300 people fall ill, and seven die, after breakdowns in the local water system. The region's public health officer later said the catastrophe was probably preventable.

Here is a timeline of the events:

May 15, 2000

Walkerton tragedy 3:15

TRAGIC MEMORIES 4:22

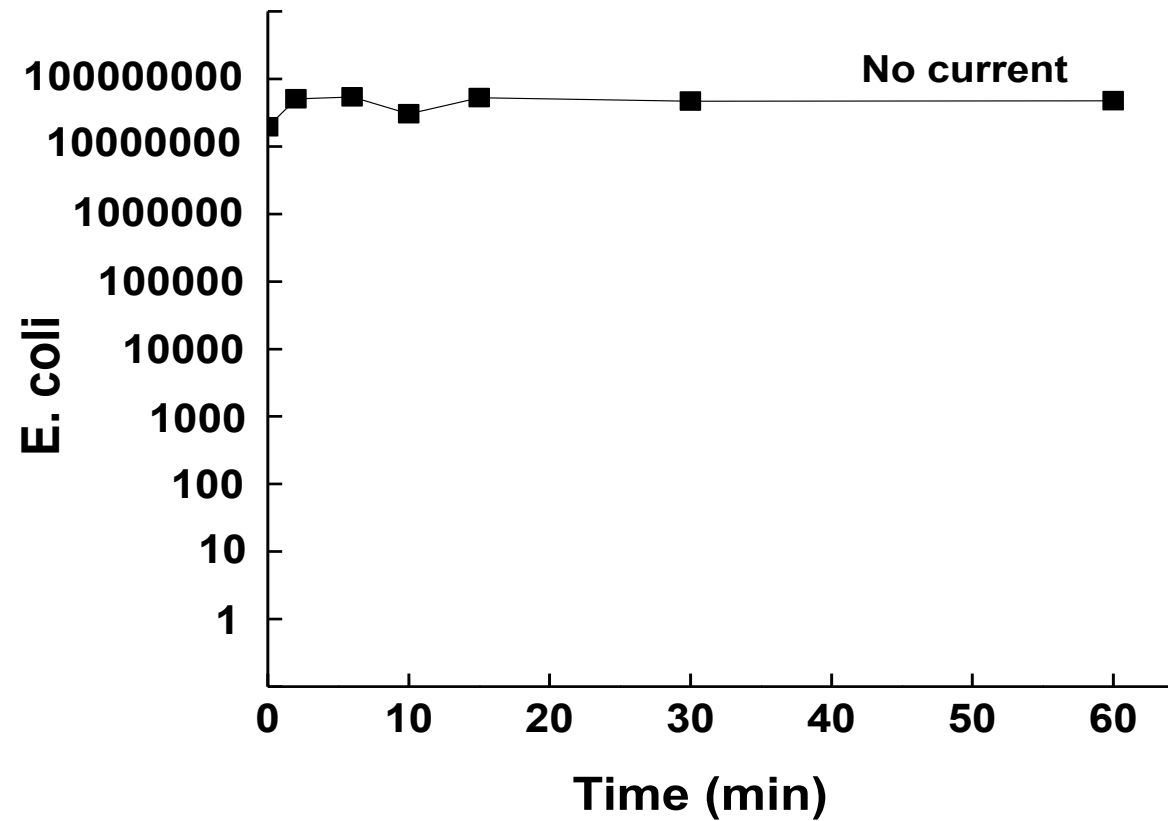
REGIONS

British Columbia	Kitchener-Waterloo
Kamloops	Hamilton
Calgary	Toronto
Edmonton	Ottawa
Saskatchewan	Montreal
Saskatoon	New Brunswick
Manitoba	Prince Edward Island
Thunder Bay	Nova Scotia
Sudbury	Newfoundland & Labrador
Windsor	

Electrochemical Inactivation of *E. coli*

Effect of applied current

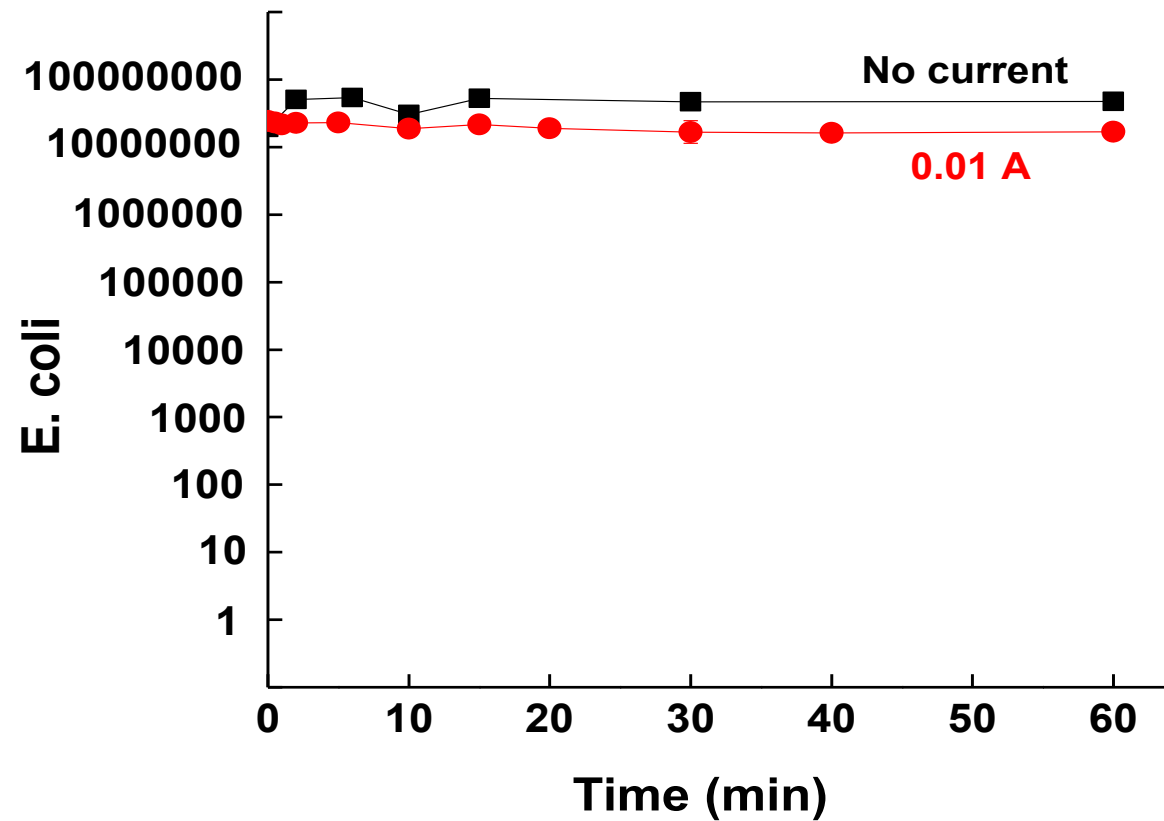
$[E. coli]_0 = 10^7$ CFU/mL; $[NaCl] = 0.1$ M



Electrochemical Inactivation of *E. coli*

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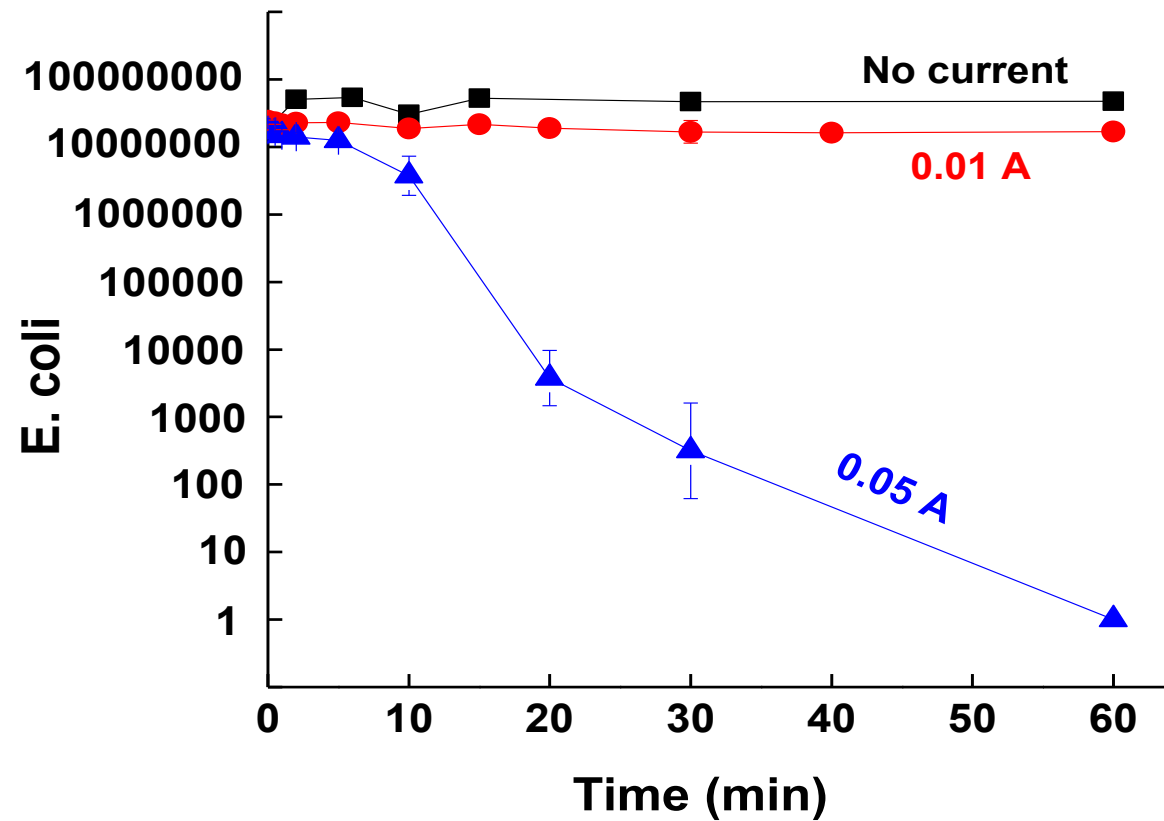
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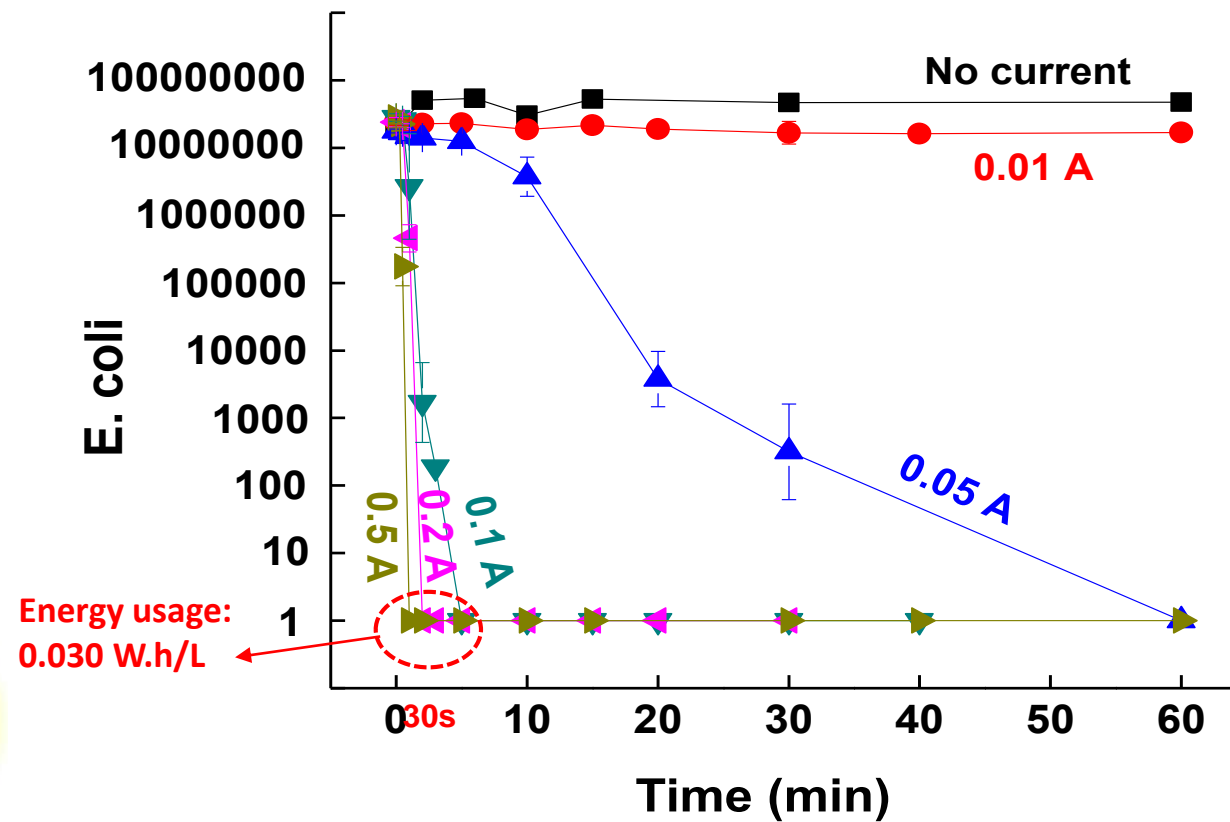
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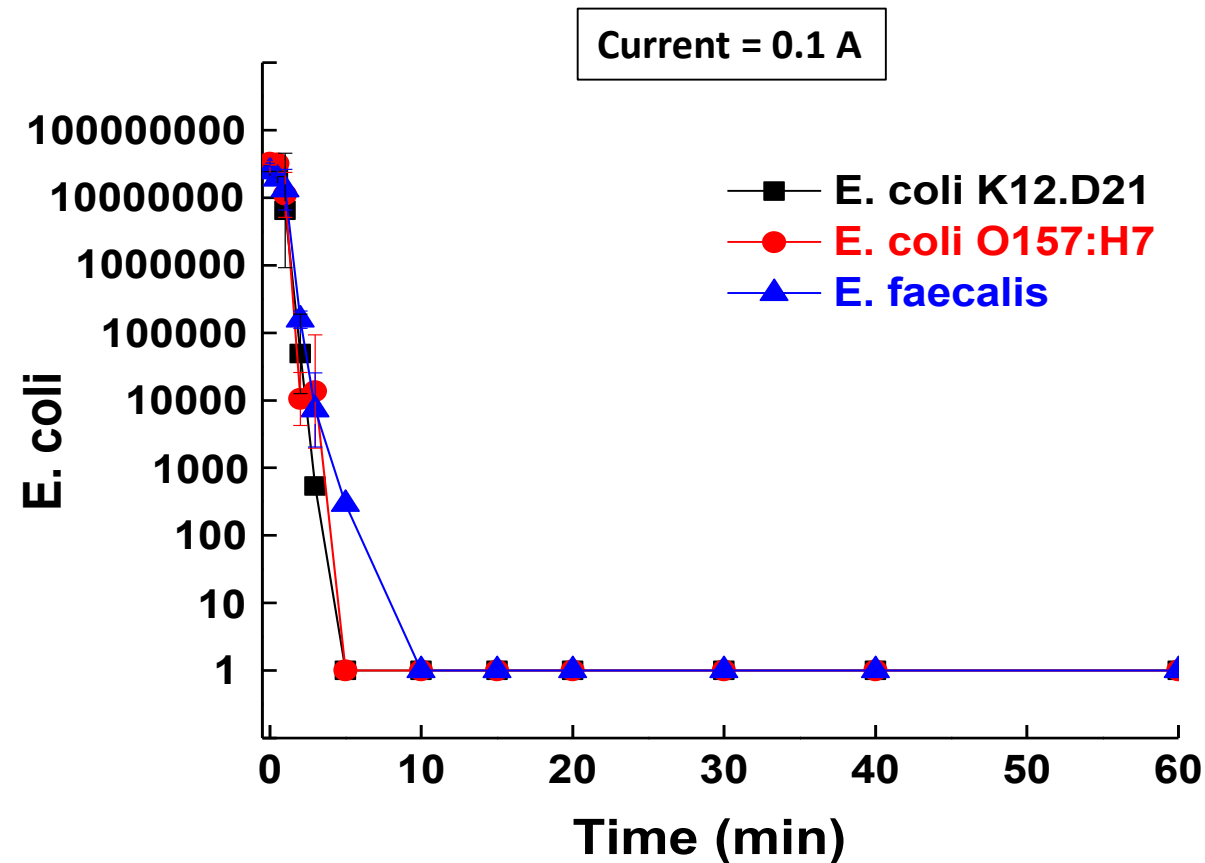
$[E. coli]_0 = 10^7$ CFU/mL; $[NaCl] = 0.1$ M



Similar Disinfection Effect with Various Bacteria

Effect of bacteria type

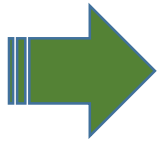
$[\text{Bacteria}]_0 = 10^7 \text{ CFU/mL}$; $[\text{NaCl}] = 0.1 \text{ M}$

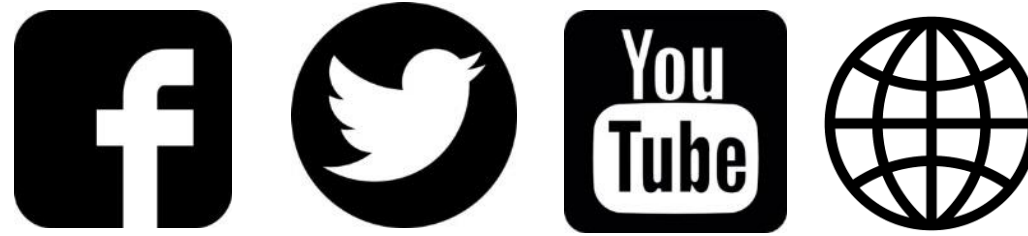


What can we accomplish with this technology?

Treating wastewater with photo-electrocatalytic method using mixed metal-oxide electrode (anode) can remove:

- Organics such as dyes
- Pharmaceuticals
- Bacteria
- Pathogens





Thank you.
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