Scaling Industrially
Turning Plastic Pollution Into Added-Value Products

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R&D Director
BioCellection Inc.
Our Mission

We create opportunity by creating new value from plastic waste.
Why are we Targeting Polyethylene? (LLDPE, LDPE, HDPE)

Post-Consumer Films
- Recycled: 3%
- Landfill: 97%

Post-Industrial Films
- Recycled: 21%
- Landfill: 79%

Chemical Sciences Roundtable: Closing the Loop on the Plastics Dilemma
Waste Valorization

**Cost of waste conversion < Market price of products**

Dictated by market demand, determination of prices & regulations

<table>
<thead>
<tr>
<th>Recycled LDPE</th>
<th>Virgin LDPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Low margins</td>
<td>• Low resin cost</td>
</tr>
<tr>
<td>• Low product quality</td>
<td>• Little or no incentives</td>
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<tr>
<td>• Color limitations</td>
<td>to not use</td>
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<tr>
<td>• Small (but growing)</td>
<td></td>
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<tr>
<td>market</td>
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Chemical Sciences Roundtable: Closing the Loop on the Plastics Dilemma
Oxidative Breakdown of PE

Initiation:

\[ R' \]

Propagation:

\[ R' + O_2 \rightarrow RO_2 \]

\[ RO_2 + RH \rightarrow RO_2H + R' \]

Termination:

\[ R' + R' \rightarrow R-R \]

Thermal Oxidative Breakdown of PE

\[
\begin{align*}
&\text{Simplified mechanism} \\
\end{align*}
\]
BioCellection turns PE plastic into *virgin-grade* chemicals

**BioCellection Process**
Thermo-oxidative conversion of polyethylene waste

**Plastic Feedstock**
HDPE, LDPE, LLDPE No. 2 and 4

**Added-value Chemical Intermediates**
BioCellection Process

Post-consumer PE films

Reactor

Major Products

Dicarboxylic acids
Adipic Acid as a Chemical Intermediate

Polyesters

Adipic acid

Polyurethanes

Nylon 66

Esters
Adipic Acid as a Feedstock

**ADIPIC ACID**

Sales (US$ Million)  
Avg. Price (US$/MT)  
Approx. Market Projections

Year

2018 2019 2020 2021 2022 2023 2024 2025

Sales (US$ million)  
Avg. Price (US$/MT)

2018 2019 2020 2021 2022 2023 2024 2025

Approx. Market Projections

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Current Adipic Acid Production

Crude Oil $\xrightarrow{\text{H}_2}$苯 $\xrightarrow{\text{O}_2}$ 环己烷

$\text{HO-CO-} + \text{N}_2\text{O} \xrightarrow{\text{HNO}_3-\text{N}_2\text{O}} \text{OH}$

Approx. Adipic Acid Manufacturing Cost (2018)

- Raw Material Cost: 84%
- Energy Cost: 7%
- Other: 9%

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Current Adipic Acid Production

Crude Oil

\[
\text{HO} \quad \text{O} \quad \text{C} \quad \text{O} \\
\text{HO} \quad \text{C} \quad \text{O} \\
\text{HO} \quad \text{C} \quad \text{O}
\]

Raw Material cost: ~ 84%

Recycled LLDPE, LDPE, HDPE

\[
\text{HO} \quad \text{C} \quad \text{O} \\
\text{HO} \quad \text{C} \quad \text{O} \\
\text{HO} \quad \text{C} \quad \text{O}
\]

Cost of feedstock: $0/MT
Current Adipic Acid Production

Cost of waste conversion < (Market price of products + $ paid for PE waste)

Crude Oil

Raw Material cost: ~ 84%

Recycled LLDPE, LDPE, HDPE

Cost of feedstock: $0/MT
BioCellection’s Progress

100 mL: 0.0025Kg PE/Day
250 mL: 0.0125Kg PE/Day
10 Liters: 0.5 Kg PE/Day
100 Liters: 50 Kg PE/Day
10L batch & continuous reactions
Market Validation

Product Generation

Customer Feedback

R&D

Partner Industries
Benefits to Customers

Recovery Facility

- Saves money by diverting waste away from landfill
- Increased competitiveness through higher recycling rate
- Consistent, non-fluctuating national waste disposal option

Chemical Industry

- Possible cost savings through lower feedstock price
- Reduced price volatility due to lower dependency on oil
- Sourcing sustainably will satisfy their customers

DIFFERENT FROM ALTERNATIVES

Our process uses less energy than pyrolysis, yet tolerates higher contamination than mechanical recycling.
Join the Fight

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Thank you for Listening!