Enterprise Scale Extraction and Efficiency

Presented by Amanda Moore
Created by Gary Miertschin & James White, PhD
James White, PhD

2003: Ph.D. in mechanical engineering from MIT.
Developed novel nanotechnology and microfluidics.

2014: Began developing cannabis extraction technology and methods for medical marijuana extraction and isolation using supercritical CO₂.

2017: Founded Applied Extracts Inc.
Multiple patents being filed on extraction machinery and methods.

2004: Co-founder and CEO of Active Spectrum Inc.
Active Spectrum was acquired by Bruker Corp. of Billerica, MA. (6th largest scientific instrument company globally)

Invented and commercialized novel magnetic resonance scientific instruments (11 patents issued)

Focused on:
- cannabis refineries for large scale rare cannabinoid and industrial hemp extraction and isolation
- rare cannabinoids for the mass market (Initial targets: THCV, CBN)
2x25L Machine

- 400-600 grams/hr crude output
- 95-98% total decarboxylated cannabinoid recovery
AE Enterprise Level Supercritical CO$_2$ Machines (500 or 1000L)
2x250L Machines

- Large, enterprise scale machines
- 2x250 liter vessels → 10X larger
- Fully automated, industrial PLC controls
- Processes 2500-5000 lbs daily (1140Kg – 2280kg/day)
- 2.5 hour run time
- 2 employees per unit to operate
Question

What’s ↑ UP ↑ with the hemp market?
Opportunities for investment in processing offer high returns despite market adjustment.

• Expanding market size
  • > $2B current market size (estimate)
  • > 30% CAGR (estimate)

• Historically low costs for biomass at this time!
Hard Lessons Learned

Credit? Dead it - forget it

“Partnerships,”
“Promises,”
and “contracts”
mean nothing.

Trust no-bo-dy
Risks must be shared.

NOTORIOUS B.I.G.
"Never keep no weight on you."

Eroding prices for biomass.
$/Per % / Lb
*(Actual transaction prices)
Hard Lessons Learned

Corresponding drop in the sales price of winterized CBD crude. (Down to $350/liter ca Jan 2020)
So, as prices for biomass are being driven down → 90-95% drop in <6 months …

…margins on crude and distillate become crucial.
Are all extraction methods equal?

No, some methods are more equal than others.
Lowering Opex Costs

Every dollar burned in processing is a dollar lost forever.
Case Study: HEMP PROCESSOR IN JOHNSON CITY, TN

Operational Costs

 Equip: Cryo Eth. System & associated equipment $1.2M cap-ex.
 Processing time: 4,500lbs of biomass in 24 hrs (three 8-hour shifts).
 Yield: 200L of 70% CBD winterized crude
 Biomass: 50/50 split with farmer (4500 lbs biomass)
 Solvent cost: Solvent cost $4.60/ lb (hemp processed) = $20,700
 Labor cost: $560 (3 days)

Total Variable Costs = $21,260 or > $7,087 / day
Case Study: HEMP PROCESSOR IN MEDFORD, OR

- **Equip:** (3) AE CO$_2$ Systems & associated equipment $1.2$M
- **Processing time:** 4,500lbs of biomass in 24 hrs 120 hrs. (five 24hr. days)
- **Yield:** 265L – 75% CBD crude, winterized crude
- **Biomass:** 50/50 split with farmer (4500 lbs biomass)
- **Solvent cost:** Solvent cost $0.22/ lb (hemp processed) ($910)
- **Winterization:** Eth cost $2,320 for winterization
- **Labor cost:** $3,600

**Total Variable Costs = $6,830 or = $1,366/ day**
## Comparing Methods

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Ethanol case study</th>
<th>CO₂ case study</th>
<th>Difference (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Revenue to Processor (@ $350/l)</td>
<td>$35,000</td>
<td>$46,375</td>
<td>+33%</td>
</tr>
<tr>
<td>Solvent Costs</td>
<td>$20,700</td>
<td>$3,230</td>
<td>-84.4%</td>
</tr>
<tr>
<td>Labor Costs</td>
<td>$560</td>
<td>$3,600</td>
<td>+642%</td>
</tr>
<tr>
<td>Total Costs</td>
<td>$21,260</td>
<td>$6,830</td>
<td>-67.8%</td>
</tr>
<tr>
<td>Gross Profit</td>
<td>$13,740</td>
<td>$39,545</td>
<td>+287%</td>
</tr>
<tr>
<td>Gross Margin</td>
<td>39.2%</td>
<td>85.3%</td>
<td>+218%</td>
</tr>
</tbody>
</table>
Achieving Margins

- At about $214/L manufacturing costs ethanol extraction becomes unprofitable.
- At about $51/L manufacturing costs CO\textsubscript{2} extraction becomes unprofitable.
- How low can the market go?
Comparisons

Planning for profitability at <$150/L is a 2020 goal

66% Gross Margin is still high by “real world” standards

<table>
<thead>
<tr>
<th>Industry</th>
<th>Gross Margins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farming / Ag</td>
<td>11.36%</td>
</tr>
<tr>
<td>Food Processing</td>
<td>26.47%</td>
</tr>
<tr>
<td>Specialty Chemical</td>
<td>31.16%</td>
</tr>
<tr>
<td>Beverages (Alcohol)</td>
<td>46.60%</td>
</tr>
<tr>
<td>Health Care Products</td>
<td>57.83%</td>
</tr>
<tr>
<td>Drugs (Pharmaceutical)</td>
<td>70.26%</td>
</tr>
</tbody>
</table>
• Large, high efficiency, enterprise scale machines
• 2x250 liter vessels → 10X larger
• Fully automated, industrial controls
• Processes 2500 lbs (1140Kg)
• 2.5 hour run times
• 2 employees per unit to operate
• CO$_2$ consumption
  • 2000+ lbs / day
  • 100-ton bulk tank
  • Booster pump package
We are here to answer your questions