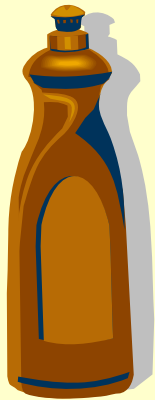


# Degradables in the Plastic Recycling Stream:

## The End of The World or A New Opportunity?



**SPI Symposia**

**14 June 2006**

**David Cornell**



**Association of Postconsumer Plastic Recyclers**

# **Recycling is a Business**

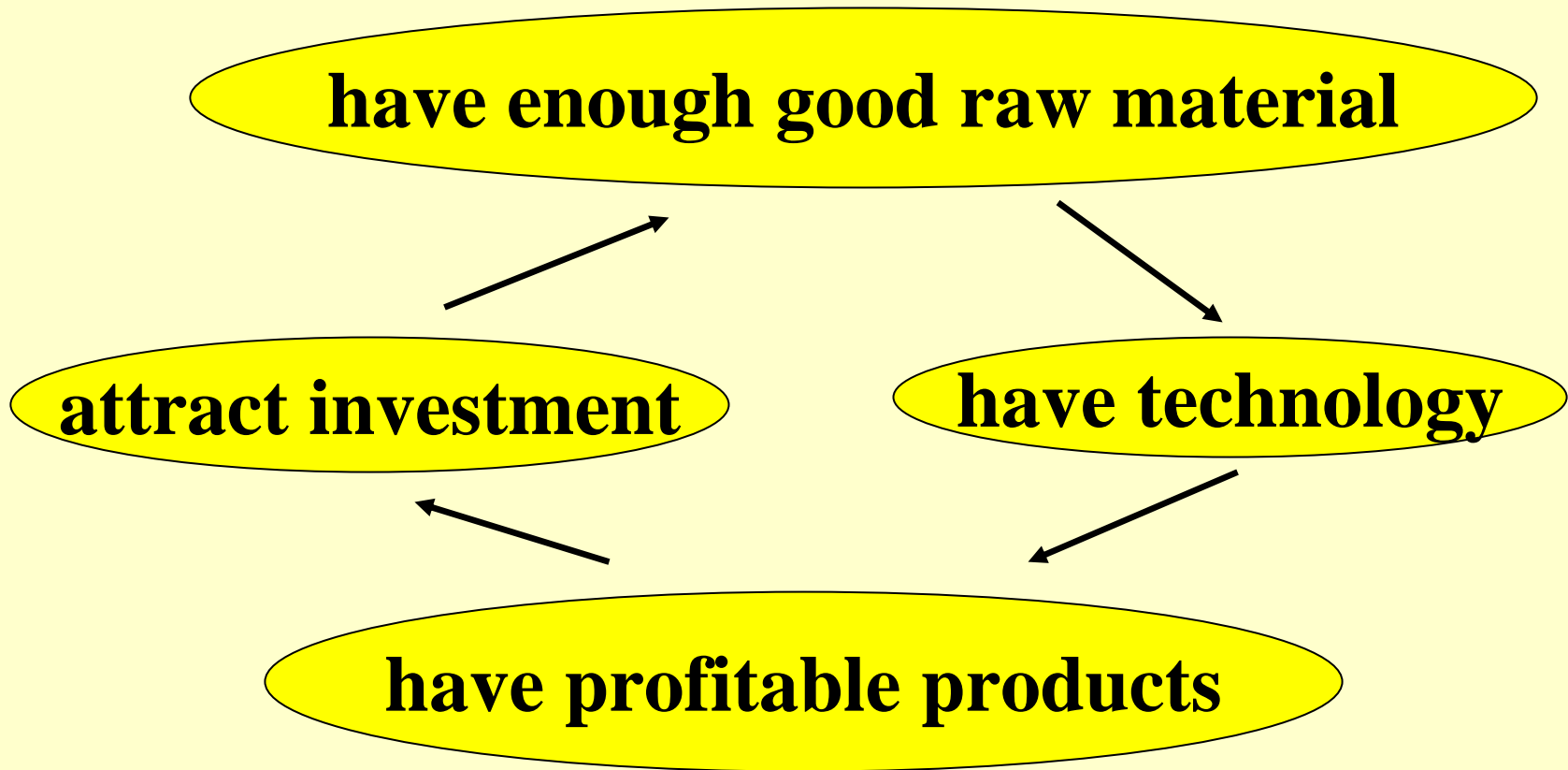
- **Recycling is not**
  - **The salvation of a Bad Hair Day**
  - **Protection from Space Invaders**
  - **The cure for the Common Cold**

**It is a manufacturing business**

- **But it does have a social component**

# Recycling: The Business

Like all manufacturing, Plastics Recycling must



# What makes a Profitable Product?

- **A profitable product**
  - **Has total cost less than sales price**
  - **Has physical properties commensurate with price**
  - **Has aesthetic properties commensurate with price**
  - **Is consistent in attributes and available in adequate quantity**

# USA Postconsumer Rigid Plastic Packaging (bottles) Recycling

- Per The American Plastics Council
- **2004**

<b>PET</b>	<b>52.40% of rigid packaging PCR</b>
<b>HDPE</b>	<b>47.22% of rigid packaging PCR</b>
<b>PVC</b>	<b>0.05% of rigid packaging PCR</b>
<b>LDPE</b>	<b>0.02% of rigid packaging PCR</b>
<b>Polypropylene</b>	<b>0.31% of rigid packaging PCR</b>
<b>Polystyrene</b>	<b>&lt;0.01% of rigid packaging PCR</b>

# **Rigid Plastic Packaging Recycling**

**After PET and HDPE bottles,  
not much else matters**

**WHY?**

**Lack of Critical Mass  
Except for PET and HDPE**

# **PET and HDPE Plastics Recycling Scorecard**

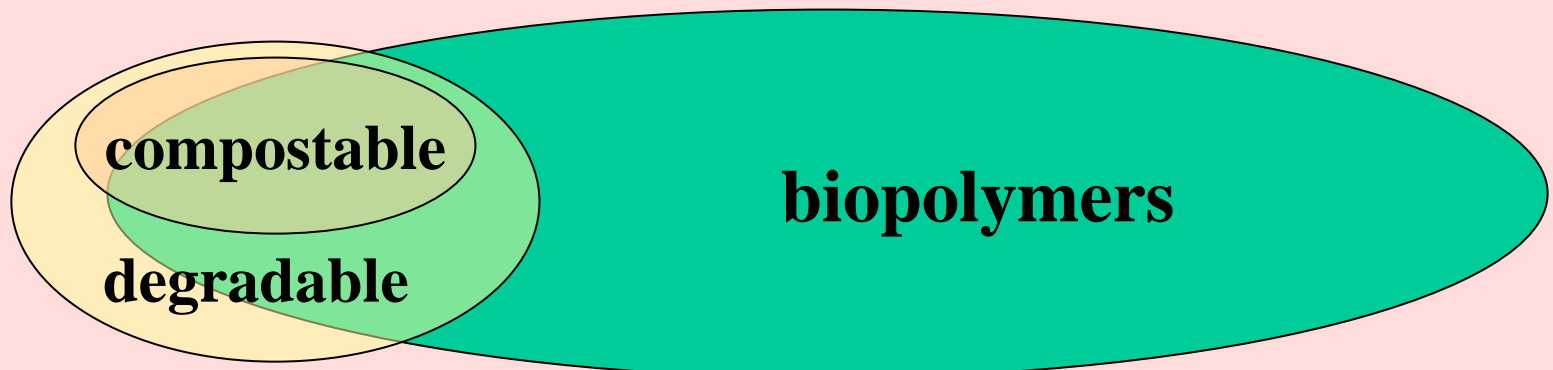
- Process technology                      Good**
- Profitable products                      Yes**
- Investors                                      Yes**
- Good raw material                      Would like more**

**Compostables = Degradables = Biopolymers**

**But**

**Not all biopolymers will degrade  
and some degradables are not bio-based.**

**Overall, we look at biopolymers as the  
more inclusive class of new materials**



# Biopolymers Recycling

- **Packaging Biopolymers (PLA, PHA, and others)**
  - **Will not fix the Social Security shortfalls**
  - **Save the planet from asteroids**
  - **Reverse aging, grow hair, or cure flat feet**
- **Biopolymers are just another set of thermoplastics, subject to the same economic & performance rules as are other thermoplastics**

# **Biopolymers**

## **Plastics Recycling Scorecard**

- **Process technology**      **Can probably use PET PCR technology**
- **Profitable products**      **None defined, yet.  
Recycled resin must be worth at least \$0.40+/lb flake to cover costs**
- **Investors**      **Possible, virgin makers**
- **Good raw material**      **Opps, not enough**

# Plastics Recycling

- **Why have not Polypropylene bottles (190 M lbs/year) or PVC bottles (113 M lbs/year) been successfully recycled?**
  - **Technology, investors, products: all OK**
- **Not enough supply.**

## **NO CRITICAL MASS**

- **Need at least 400 M annual pounds of recognizable containers to get needed supply**

## **HDPE History Lesson – mid 1980's**

- **400,000,000 lbs of HDPE milk bottles used**  
**x 30% of population with recycling options, then**  
**x 40% participation rate**  
**x 70% recognition of milk bottles**

**=**

**35 M lbs of bottles for recycling, enough for two lines of business for middle-sized reclaimers to stay in business in the early years**

## **Biopolymer Projection - current**

- **If 400,000,000 lbs of new polymer bottles  
x 60% of population with recycling options  
x 50% participation rate  
x 40% recognition of biopolymer bottles, maybe  
=  
48 M lbs of bottles for recycling, enough for one  
middle-sized independent reclaimer**

# Biodegradable Polymer Forecast

- *Per Business Communications Co., 2005*
- **Global (USA and all other markets)**
- **All packaging (bottles, thermoforms, cups, loose fill, etc)**
- **In 2010**
- **82 M annual pounds of demand for packaging**  
**~ 30 M pounds of rigid packaging**
- **TOO LITTLE material, if the forecast is correct**

## **Biopolymer Projection - future**

- **Even 60,000,000 lbs, new USA polymer bottles**  
**x 60% of population with recycling options**  
**x 50% participation rate**  
**x 50% recognition of biopolymer bottles**  
**(very generous)**

**=**

**9 M lbs of bottles for recycling,**  
**not nearly enough to be an independent**  
**business opportunity**

# Biopolymer Recycling Future

- **Can biopolymers make a recycling business?**
  - **Not with the current plastics recycling business model**
  - **Too few potential bottles for many years**
  - **Critical Mass not in foreseeable future, just as it has not been for PVC or PP**

**(200M lbs of virgin polymer sales is insufficient)**

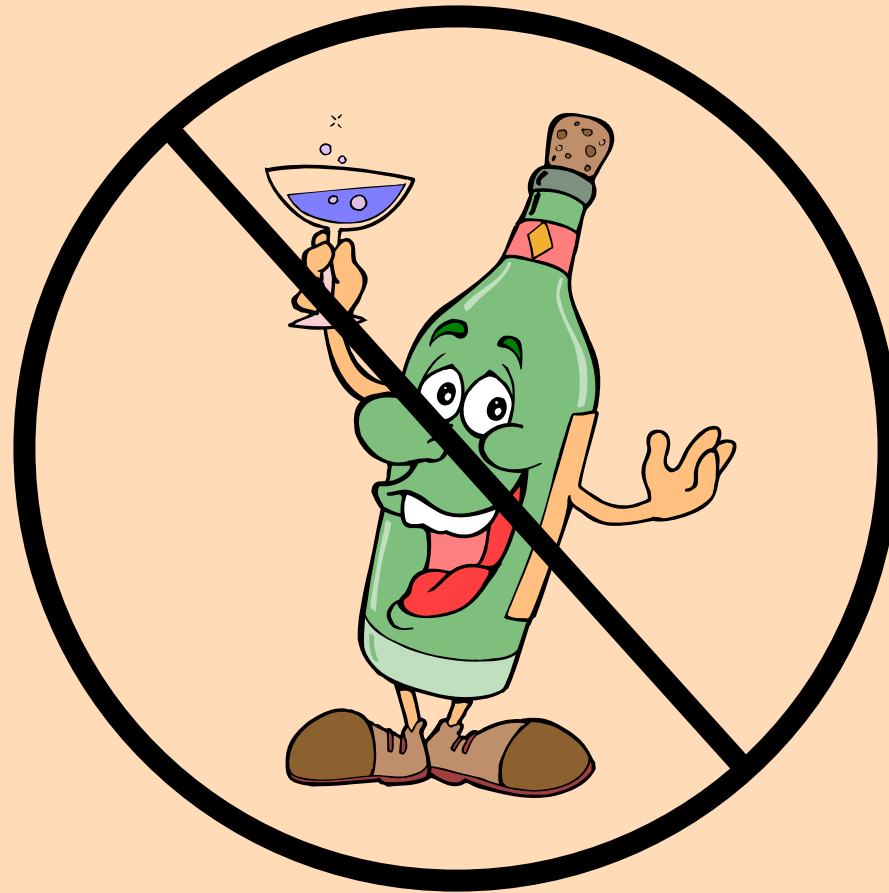
# Biopolymer Recycling Future

- **Can biopolymers “beat the system”?**
    - **Maybe, if automatic sorting can lower the level of needed critical mass**
    - **BUT, the established convention is that material that requires a special separate sort must pay for that sort**
- \$0.01/lb bottles sort cost @ 5% biopolymer in special stream could equal up to \$0.20/lb extra to sort biopolymer.**
- Biopolymers must pay collection & sort costs.**

# Biopolymer Recycling Future

- **What will be the impact of biopolymer bottles on current rigid plastics recycling?**
- **Like any new thermoplastic introduction,**
  - **First, a potential nuisance**
  - **Next, a possible technical problem**
  - **Finally, an opportunity when meeting critical mass requirement**

# Why are some bottles “not recyclable”?



# Un - Recyclable

- **Bottles are considered “un recyclable” if**
  - **Upset the recycling process**
  - **Render the product unfit for intended end uses**

# Biopolymers and HDPE

- **With some confirming data,**
  - **HDPE can “probably” tolerate some biopolymers at low level, <2% or so, for physical properties and appearance.**
  - **Maybe will see problems with out gassing of sorbed water and die buildup and extrusion streaks**
- **But, biopolymers sink in water and will separate from HDPE, usually.**

# Biopolymers and PET

- **Both biopolymers and PET sink in water**
- **Biopolymers are not miscible in PET, so will cause hazing of clear PET at low levels, such as above 0.1%. Color and crystallization characteristics are still concerns.**
- **Biopolymers generally melt at low temperatures, relative to PET, and can create sticking problems in PET dryers**

## **And what about biological degradation?**

- **Any biopolymer that is partly degraded when collected for mechanical recycling is not worth much as the polymer properties will no longer be consistent.**

## **What about mixed plastics recycling?**

- **No large scale, truly mixed plastics (no sorting done) recycling businesses have been sustainable. Small operations do exist.**
- **Properties of truly mixed plastics are too variable and unexceptional and cost too high to be interesting.**

## **Conclusion**

- **Biopolymers are unlikely to justify an independent recycling business any time soon.**
- **Biopolymers could be a nuisance to HDPE reclaimers, creating a yield loss with some economic cost**
- **Biopolymers could be a problem for PET reclaimers, creating degraded PET product quality and serious economic cost**

# Take away

- **The world is not ending.**
- **Biopolymers are likely not a new business opportunity for stand-alone reclaiming any time soon.**
- **Biopolymers may be an opportunity for current reclaimers as a sideline if the value exceeds costs and the presence does not disrupt current operations.**

## Take away

- **Until critical mass is achieved, biopolymers will likely represent some level of cost and problems to reclaimers and must pay their own way in collection, sorting, and processing.**
- **Biopolymers should be target product applications not currently included for recycling.**

**Thank you**

**Questions?**