

APR PLASTIC BOTTLE INNOVATIONS PROGRAM

AOR Fall Forum: 3 October 2007

Association of Oregon Recyclers

- ◆ American Chemistry Council, ACC
- ◆ Association of Postconsumer Plastics Reclaimers, APR

APR PLASTIC BOTTLE INNOVATIONS PROGRAM

- ◆ Design for Recycling Guidelines
- ◆ Testing: Critical Issues and Criteria
- ◆ Testing Method Protocols
- ◆ Critical Guidance Document Testing
- ◆ Innovation Recognition Program

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Design for Recycling Guidelines

Un – Recyclable

◆ Bottles that

- Upset the recycling process (process)
- Render the product unfit for intended end uses (product)

are considered “un recyclable”.

APR – Design for Recycling

- ◆ APR wants more, good bottles.
- ◆ More bottles means innovation, some helpful and some not to recycling.
- ◆ APR wants the rate of change of bottles to match the abilities of reclaimers.
- ◆ **INNOVATION IS GOOD**

APR – Design for Recycling

HDPE Bottles

Please **avoid**

- ◆ PP and LDPE exceeding 5% of container
- ◆ Including PVC as part of HDPE bottles
 - Such as shrink labels.
- ◆ Water-soluble inks that bleed in hot water.
- ◆ Anything that smokes or fumes during extrusion.

APR – Design for Recycling HDPE Bottles

Please **avoid**

- ◆ Loading HDPE with so much CaCO_3 and color that the **bottle sinks** in tap water.
- ◆ “Helping us” with white PET bottles that look like HDPE bottles
- ◆ Using too much EVOH
- ◆ Using barrier layers that degrade our product.

APR – Design for Recycling

PET Bottle

Please **avoid**

- ◆ Any inclusion of **any PVC** with PET, such as labels or closure liners
- ◆ Printing systems that **bleed inks** in 180° F water

APR – Design for Recycling PET

Please **do** make sure

- ◆ All **labels and closures float** in water, including shrink labels
- ◆ All **adhesives detach** from PET at 180°F and float as part of the floating label.
- ◆ Paper labels minimized
- ◆ Barrier layers can be “**liberated**” in the recycling process.

APR – Design for Recycling PET

Please help us.

❖ **AVOID** materials that are used with PET or look like PET bottles that **soften** and melt at 325°F can really hurt the PET drying process.

❖ These are “**low melters**” and hurt productivity

APR – Design for Recycling PET

Regarding **color**:

- ◆ Clear, green, or light blue all have markets
- ◆ Amber will, we hope, have markets as beer sales grow. Please include amber recycled PET in the next beer bottle.
- ◆ Other transparent colors. Please don't. All you are doing is making trash.

APR – Design for Recycling PET

Regarding **nylon**:

- ◆ Nylons discolor PET with repeated processing.
- ◆ Nylon layers are removed, generally, in recycling
- ◆ Nylon dispersions cannot be removed and will yellow recycled PET. Sorry about that.
- ◆ The “fix”, toners, are costly and darken PET

APR – Design for Recycling PET

Regarding **additives**:

- ◆ Additives (scavengers, screens, etc) increase the volume of PET used, and that is good.
- ◆ Additives that create **color and haze** after repeated meltings are **not good**.
- ◆ Please fix the problem **before** introducing bottles with the additives.

APR – Design for Recycling PET

Please **avoid**

- ◆ Innovations that cause the recycled PET to **yellow or haze when remelted** twice.

- ◆ Innovations that **slow down** the solid stating process.

But, it's only a few bottles!

- ◆ **Dilution is not the solution** to poorly designed bottles. But it sure helps in the short term.
- ◆ Wine into sewage is sewage
Sewage in wine is also sewage

Bad bottles + good bottles, still bad bottles

APR – Testing Program

- ◆ Basic Check List
- ◆ Criteria to Consider for new innovations
- ◆ Critical Issues for various innovations
- ◆ Recyclability testing protocols
 - PET barrier coatings
 - Bleeding labels
 - Labels and adhesives
- ◆ All at website, **plasticsrecycling.org**

APR – Testing Program

◆ Critical Guidance Documents

- PET
- HDPE

We can do more, but HDPE and PET are 95% of the bottles produced

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PET & HDPE Critical Guidance

- ◆ Limited number of critical, testable properties
- ◆ Define test samples and test methods
- ◆ Provide critical guidance values for interpreting test results
- ◆ Set the stage for further investigations
- ◆ **Documents are not a specifications**

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PET & HDPE Critical Guidance

- ◆ Does not imply in its definitions, procedures, or values fitness for use, market acceptability, or any guarantee or warranty
- ◆ Inability of an innovative bottle to meet specific critical values does not imply recycling failure, but significant issues might exist

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PET & HDPE Critical Guidance

- ◆ PET testing is at **0%, 25%, and 50%** innovation material
- ◆ HDPE testing is at **0%, 50% and 100%** innovation material
- ◆ **Critical Guidance Documents** are subsets of **General Guidance Documents** which include specific end uses, such as bottle-to-bottle recycling.

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PET Critical Guidance

- ◆ Test Blends
- ◆ Sample A: 100% from control bottles (virgin resin)
- ◆ Sample B: 75% control bottle/25% innovation bottle
- ◆ Sample C: 50% control bottle/50% innovation bottle

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PET Critical Guidance

- ◆ Controls are from named commercial resins from North America.
- ◆ Two sets of controls named for PET:
 - Water resin bottles
 - CSD resin bottles

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PET Critical Guidance

- ◆ Bottles are processed per a specific procedure of grinding, sorting, washing, separating, drying, pelletizing, and solid state polymerizing.
- ◆ Testing is done at various steps of the process.
- ◆ Test PET ultimately receives same thermal history as would recycled resin.

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PET Critical Guidance

- ◆ Test #1 **IV drop** – first melt, of flake
 - Drop of under 0.02 dl/gm vs. control OK
 - Drop of over 0.04 dl/gm vs. control likely a problem

- ◆ Test #2 **Filterability** – 250 mesh
 - Less than 10% pressure increase vs. control, minimum time and rate.

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PET Critical Guidance

◆ Test #3 Solid stating rate

(vs. control, same conditions, min temperature, defined starting time)

- Less than 0.04 IV units delta vs. control after 8 hours, OK
- Less than 0.075 units delta vs. control after 15 hours, OK

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PET Critical Guidance

- ◆ Prepare 0.80 dl/gm IV pellets
- ◆ Test #4 **Melting point** after 1st quench,
 - 235°C to 255°C OK
- ◆ Prepare 3 mm plaques – second melt
- ◆ (will use this material to make bottles in GENERAL GUIDANCE DOCUMENT)

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PET Critical Guidance

◆ On 3 mm plaques,

◆ Test #5 **Color**

- L^* , absolute, in transmission, > 82
- b^* , delta to control, in transmission
 - ◆ < 1.5 units, OK
 - ◆ > 5.5 units, needs study

◆ Test #6 **Haze**

- $< 9.5\%$, OK; $> 14\%$, noticeable

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PET Critical Guidance

- ◆ On 3 mm plaques
- ◆ Test #7 **Black specks** – 50 plaques, vs. control
 - < 10% increase
- ◆ In General
 - **No fuming, smoking, sticking**

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PET Critical Guidance

- ◆ Test #1 IV drop
- ◆ Test #2 Filterability
- ◆ Test #3 Solid stating rate
- ◆ Test #4 Melting point
- ◆ Test #5 Color
- ◆ Test #6 Haze
- ◆ Test #7 Black specks

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HDPE Critical Guidance

- ◆ Test 100% Innovation Bottle, except when cited, then 50% innovation bottle/50% control.
- ◆ Controls, when used, are “typical HDPE PCR”

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HDPE Critical Guidance

- ◆ Bottles are processed per a specific procedure of grinding, sorting, washing, separation, and pelletization.
- ◆ For natural HDPE, $L^* > 63$, $a^* > -4.5$, and $b^* < 13$ on plaques, reflectance
- ◆ **Ash**, $< 0.10\%$
- ◆ **Melt Index**
 - Homopolymer, 0.5 to 0.9 gms/10 min.
 - Copolymer, 0.2 to 0.7 gms/10 min.

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HDPE Critical Guidance

◆ Density

- +/- 0.010 gm/cm³ compared to 100% typical PCR control.
- Always less than 0.995 gm/cm³

◆ % Polypropylene

- < 4%

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HDPE Critical Guidance

◆ Screen pack **Filterability**

for 50% innovation/50% typical PCR
vs. 100% typical HDPE PCR, 150 mesh,

- Less than 10% pressure increase vs. control, minimum time and rate.

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HDPE Critical Guidance

- ◆ **Volatiles** - for 50% innovation/50% control vs. 100% typical HDPE PCR control,
fixed hot exposure under vacuum,
 - < 0.1% difference compared to control

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HDPE Critical Guidance

- ◆ General – for 100% Innovation Bottle
- ◆ No more **smoking, fuming, sticking, black speck generation** than for typical PCR control

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HDPE Critical Guidance

- ◆ Test #1 Color (natural HDPE)
- ◆ Test #2 Ash
- ◆ Test #3 Melt Index
- ◆ Test #4 Density
- ◆ Test #5 % polypropylene
- ◆ Test #6 Filterability
- ◆ Test #7 Volatiles

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PET & HDPE Critical Guidance

- ◆ **MEETING THESE GUIDELINES DOES NOT OBLIGATE APR MEMBERS TO BUY BOTTLES CONTAINING THE INNOVATION**
- ◆ A test at 5 times the expected developed market penetration is frequently used to reflect actual recycling impact

APR Innovation Program

Champions for Change

- ◆ Champions for Change Testing Program
 - A program of co-operative testing between innovators and reclaimers.
 - A step to APR's Confirmation Letter
 - The Critical Issues and Critical Guidance Documents provide a framework for evaluation

APR Innovation Program

Recognition

- ◆ **Design for Recyclability Award**
 - For deliberate efforts to enhance recyclability
- ◆ **Partner for Change Award**
 - For participation in Champions program
- ◆ **Critical Guidance Recognition Award**
 - For meeting guidance criteria
- ◆ **Confirmation Letter**
 - APR's recycling 'no objection' letter

APR PLASTIC BOTTLE INNOVATIONS PROGRAM

- ◆ APR wants more, good bottles
- ◆ APR is providing means to define what 'good' means
- ◆ APR recognizes accomplishment
- ◆ More good bottles means better bale prices.

Thank you