Market-based performance requirements for barrier-treated specialty paper & board

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Oil & Grease Resistant Paper & Board

- *Markets – by segment & history*
- *Trends – growth by segment*

Regulatory updates

- *FDA – effective phase out C-8 in 2011*
- *EPA – continued PMN's for C-6*

Paper & Board Market Overview

- Overall North American Fluorochemical-treated tons:

  301,300 tpy all segments, all grades

  - 48,500 tpy popcorn
  - 68,000 tpy pet food
  - 184,800 tpy QSR/retail

  6.31 million lb/yr FC supplied for these tons

  - 1,010 klb/yr popcorn
  - 1,950 klb/yr pet food
  - 3,350 klb/yr QSR/retail

A Brief History

Before 1999: 90+% one supplier

- 10 million lb/yr sold into North America
- 90+% electrofluorination – surfactant-type

1999~2007

- Use drops to 3.5 million lb/yr in North America
- Switch to C-8 acrylate and then C-6 and C-2/C-3 types (PFPE)
- Chemistry moving from surfactant to polymer-type

2008~present

- Use just starting to tick up ~4+ million lb/yr
- C-8 phased out (Aug. 2011), C-6 acrylate phasing in by FDA & EPA, etc…

Retail trends

- QSR –
  - maybe >2% (greater than GDP)
  - # of checks flat, but $/check up
- Pet food
  - estimated >5% from 2011
  - aging pet population & boomer spending
- Popcorn
  - near 2% growth from 2011
  - new packaging/flavors

North American Market Status





Daikin America customer conversion by market segment:

- **Carpet** – Conversion completed in 2008.
- **Nonwoven** – Complete conversion by end of 2012.
- **Paper** – No phase out. Entered market with C6.
- **Textile** – Complete conversion by end of 2012.

Evolution of EPA policy on PFOA

- **Initial EPA response (2000-2005)**
  - Information collection (e.g., ECA proceeding)
  - Risk assessment (e.g., 2005 draft, SAB proceeding)
  - Site-specific assessments (e.g. 3M, DuPont MOUs)
- **Voluntary Phase Out (2006-2015)**
  - Voluntary PFOA Stewardship Program
  - Supporting research and development of alternatives
  - International cooperation on stewardship programs
- **Current Activities**
  - Long-Chain (C8 and Longer) Perfluorinated Chemicals Action Plan
    - Regulatory backstop for PFOA Stewardship Program
    - Targeting Regulation of imported articles (i.e., apparel, rugs, furniture, etc.)

C6 – New Direction

- U. S. EPA 2010/2015 Voluntary PFOA Stewardship Program
  - 95% Reduction of PFOA from plant emissions and products by 2010
    - - Daikin achieved 1 year early
  - Eliminate PFOA from plant emissions and products by 2015
    - - Daikin will achieve 3 years early (2012)

- EPA, FDA, BfR, CEPA, DSC, METI, and several other regulatory organizations have approved C6 as alternatives to C8's.
  - EPA has reviewed more than 100 Pre-manufacturing Notices (PMNs) since new information on C-6 became available and added the new chemicals to the TSCA Inventory
    - Daikin has successfully listed many, specifically engineered, C6 telomer chemistries.
    - Daikin has completed all testing required by EPA under TSCA.

FDA Update

- Most everyone familiar with 21CFR 176.170 & 176.180 – positive list style
  - 176.170 aqueous/fatty foods
  - 176.180 dry foods
- FDA began implementing FCN process in 2000
  - Allows live link to FDA
  - Should contain environmental assessment

http://www.fda.gov/Food/FoodIngredientsPackaging/FoodContactSubstancesFCS/ucm116567.htm

http://www.accessdata.fda.gov/scripts/fcn/fcnNavigation.cfm?rpt=opaListing

FDA Update

- FDA now works off of conditions A-J for FCN's
  - Table 2--Condition of useHigh temperature heat-sterilized (e.g., over 212 deg.F).
  - A - Boiling water sterilized.
  - B - Hot filled or pasteurized above 150 deg.F.
  - C - Hot filled or pasteurized below 150 deg.F.
  - D - Room temperature filled and stored (no thermal treatment in the container).
  - E - Refrigerated storage (no thermal treatment in the container).
  - F - Frozen storage (no thermal treatment in the container).
  - G - Frozen or refrigerated storage: Ready-prepared foods intended to be reheated in container at time of use:
  - H - Aqueous or oil-in-water emulsion of high- or low-fat or aqueous, high- or low-free oil or fat.
  - I - Irradiation
  - J - Cooking at temperatures exceeding 250 deg.F.

http://www.fda.gov/Food/FoodIngredientsPackaging/FoodContactSubstancesFCS/ucm109358.htm

Oil & Grease Resistant Paper & Board

Technical Aspects

- *End Use Applications*
- *Test Methods*
- *Methods of Application*
- *Types of Barrier Chemistries*
- *Use in Baking Sheet Papers*
- *Best Practices for the Use of FC*

Fluorochemical Treatment for Paper & Paperboard

Reason for Treatment

- To impart Oil & Grease Resistance (OGR) to food-contact papers and paperboard.
- This allows the seller of the finished product to present a clean & healthy image, thus protecting the brand value.

Typical End Uses

- Fast food wraps/folded carton
- Pizza boxes
- Bakery/confectionary papers
- Paper plates
- Boxes for oily mechanical parts
- Pet food bags
- Fresh produce shipping boxes
- Microwavable popcorn bags

Performance Test Methods

- **Measures of grease/solvent barrier performance**

Mill/General tests:

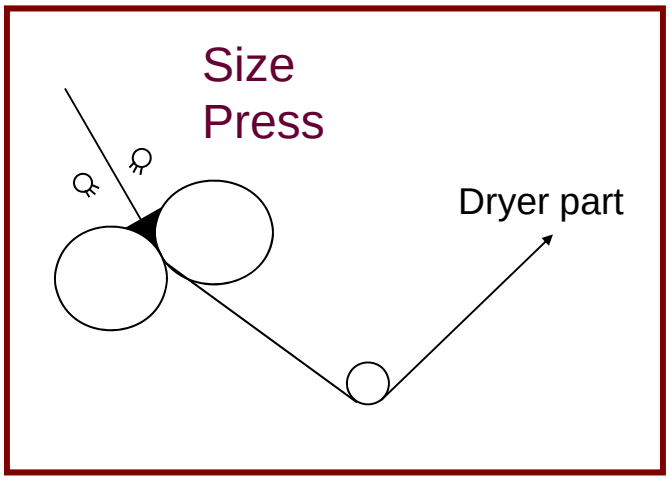
- Kit, folded Kit,
- Hot oil & saline
- RP-2, AGR
- Turpentine
- Charcoal Lighter Fluid
- Baking Tests
- Mill Specific

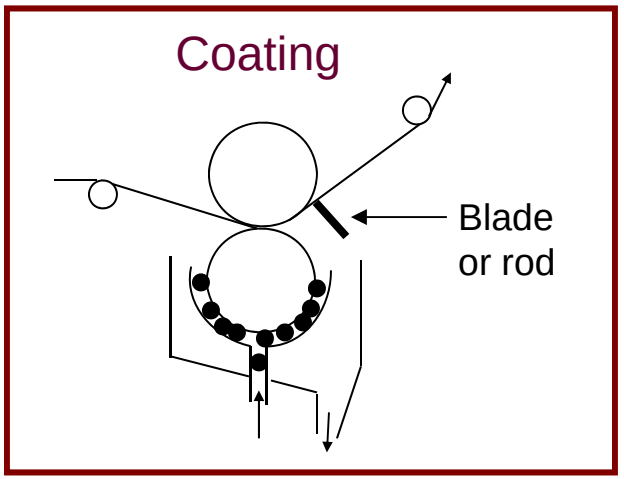
Real world tests:

- Jungle room
- Hot box
- Test Kitchen

Methods of Application

(1) Surface application by size press or calendar box or blade/rod coater





(2) Internal application by direct addition to pulp

- For applications that need folded performance
- Topic for a future presentation

Typical Barrier Chemistries In Use

The types of barrier chemistries in use:

Film (physical) barriers

- Hydrocarbon – LDPE, PP, Wax
- Synthetic – PVAc, PET, cPET, PVOH
- Latex – Acrylic, Styrene acrylic, SB, Vinyl acrylic
- Natural – Modified starches

Chemical barriers

- Perfluoroacrylate copolymers (PFA)
- Perfluoropolyethers (PFPE)

Other

- Pigment – hyper-platy kaolin

Use of FC in Grease Resistant Baking Papers

Types of Baking Sheet Substrates

- Silicone Treated Papers
  - Most Expensive
  - Easy Release
  - Withstands High Temperatures
  - Can Be Multi-use
- Parchment Paper
  - Slightly Less Expensive
  - Lower Performance

Use of FC in Grease Resistant Baking Papers

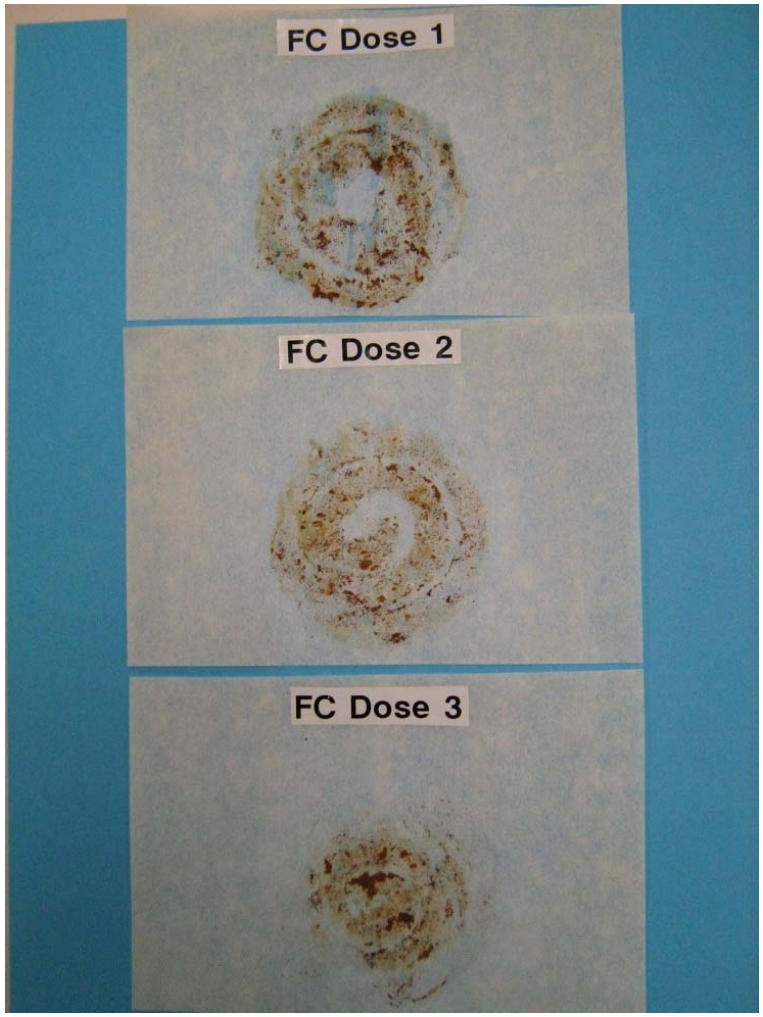
Types of Baking Sheet Substrates

- Quilon Treated Papers
  - Least Expensive
  - Limited to Certain Foods
  - Browns/Chars at High Temperatures
  - Not Multi-use
  - Single Chemical Source

- FC Treated papers
  - Low Cost
  - Good Performance on Certain Foods
  - Full Performance Range to be Determined
  - Potential for Multi-use
  - Readily Available Chemical

FC-Treated Baking Sheet Performance Results

Cinnamon Bun Results



More Robust Performance Tests

- Cinnamon Buns - provide basic Pass / Fail test.
- Next level – more demanding foods with butter, oil and/or sticky ingredients.
- Interest in determining how FC's can be used to meet these requirements.

More Robust Performance Tests

Other Foods:

- Sliced Potatoes / French Fries
- Bread and rolls
- Caramel Cookies
- Macaroons

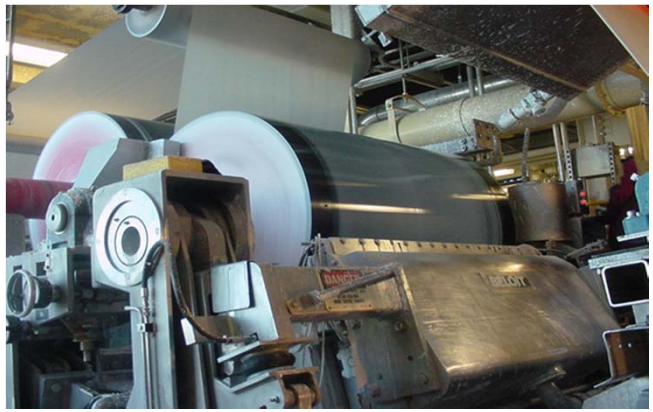
Non-food Screening test:

Wax Pick Test – generic test to replace foods.

Best Practices – Fluorochemicals (Neat)

Addition Points:

- Suction side of pump going to the size press.
- Top of run tank.
- Do not dose starch cook tank – high temperatures can be detrimental to performance.



Other Recommendations:

- No pre-mixing or recirculation unless advised.
- Proper storage – no freezing.
- Hard water – less than 200 ppm
- Minimize chelant usage – EDTA or DPTA if necessary.

Best Practices – Defoamers

Addition Points:

- Suction side of pump going to the size press .
- Same location with FC line added through a T-connection.
- Top of run tank with adequate agitation.

Other Recommendations:

- Do not overdose.
- Start DF prior to FC addition.
  - ❖ Foam is easier to prevent than to remove.

Best Practices – Defoamer Types

Good foam prevention / control has been observed with:

- Ethoxylated Tall Oil + Hydrophobic Amorphous Silica.
- Glycol Concentrate.
- Fatty Alcohol Alkoxylate.
- Others – consult your chemical supplier.

Best Practices – Pumps for Neat FC

Use low shear type pumps:

- Progressive cavity.
- Air diaphram.
- Peristaltic.

Avoid high shear type pumps:

- Centrifugal.
- Gear.

Best Practices – Miscellaneous

- **Eliminate long drops of size press solution.**
  - Chemical addition.
  - Return lines.
- **Moderate agitation in the run tank.**
  - Avoid air entrainment.
  - Reduce foaming.
- **Minimize filler use at wet-end.**
  - Competes for FC – absorption.
- **Control / Minimize wet-end sizing**
  - AKD – little or no problems.
  - ASA – possible problems at high usage.
  - Rosin – bad interactions with FC.
- **Eliminate or by-pass vibrating screens**
  - Source of foam generation.

Following these recommendations and best practices will allow the papermaker to produce various greaseproof papers and boards in an productive and cost-efficient manner. Consult with us for more specific information.

Thank you for your attention

Questions and Comments.

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