BROWN & WILLIAMSON TOBACCO CORPORATION

RESEARCH & DEVELOPMENT

INTERNAL CORRESPONDENCE

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SUBJECT: Proposed Development Program for Dispersible Cigarette Filters /20-488

Background:

Discarded cigarette butts do not pose an environmental problem of the first order, but they cause aesthetic annoyance when thrown away carelessly. A possible solution to lessen this problem is the production of cigarette filters which would disperse very quickly when discarded. At present, cigarette butts take at least nine months to a year to disappear through weathering microbiological action. Much of the work in this area by our affiliates has been concentrated on:

- Developing alternate fibers to CA, such as PHB (Poly Hydroxy Butryic Acid), which will degrade much faster.
- Incorporating water and acetone soluble inorganic salts viz. copper chloride, lithium etc. into CA. which will solubilize and expedite the degradation.
- Extruding CA flakes with starch (a readily bio-degradable material) and hydroxypropyl cellulose.
- Developing filter packed with shredded paper pulp as the filtering material.
- Developing paper and specially treated paper filters which readily disperse in water.

Additionally, BATCF participates on behalf of the Group Members in the newly formed CORESTA task force on "Degradability of Cigarette Butts"

In a nutshell, the emphasis has been on modifying (chemically or physically) or replacing the filtering medium, cellulose acetate to improve the filter degradability.

Proposal:

B&W plans to contribute to the existing program within the Group (and not repeat what has been accomplished earlier or already in progress). Our objective is to develop dispersible filters which would drastically improve the degradability of discarded cigarette butts. Based on the recommendations from M. L. Reynolds and discussions with colleagues at BATCF and BATCO working on similar projects, the following is proposed as B&W's strategy toward development of dispersible filters in 1994:

I. METHOD DEVELOPMENT

Development of a Test for Defining Dispersibility/Degradability of Filters

Generally, tests for filter dispersibility have so far been based on visual inspection and are very subjective. Typically, test filter rods along with the control are kept outdoors and their pictures taken and compared at certain time periods to observe when the degradation begins. Two other tests have also been used:

- Soil Burial - filter rods and acetate yarns are buried completely or partially in soil and inspected at certain time intervals for marked erosion of fiber surface and measured for loss of strength of yarn to indicate degradability
- Water Immersion - acetate yarns and filter rods are kept in aqueous environments and visually inspected for dispersibility (qualitative test); also to assess biodegradability, the samples are placed in an oxygen saturated nutrient solution incubated with a specific bacteria culture or mixture and after different period the oxygen consumption in the aqueous solution is measured (quantitative test).

Three other standard methods have been developed by ASTM to measure bio-degradability of a polymer. However, no standard method exists specifically for cigarette butts. The CORESTA task force is currently addressing this issue.

We need to develop a scientific method for measuring the filter dispersibility and based on this method define what we mean by a dispersible filter. We would also need to define the target period of disintegration (number of hours or days) for the filters in order to be qualified dispersible or readily degradable.

I suggest developing the following combination of test methods:

- Water immersion test to measure how quickly the plug wrap and tipping come apart.

- Accelerated weathering (Weatherometer) to simulate accelerated repetition of naturally occurring environmental conditions. The machine is used to reproduce the damage caused by sunlight, rain and dew on materials placed outdoors. The variable that can be manipulated include rainfall, condensation, temperature, and sunshine. This instrument is currently used by BATCO.

II. EVALUATION OF VARIOUS PROPOSED DISPERSIBLE FILTERS

Tipping and Plugwrap Adhesive Evaluation

We need to identify, evaluate and qualify plugwrap and tipping adhesives that will come apart within 24 hours in water. This a necessary first step for exposure of the filter material for disintegration. Besides, when the tipping and plugwrap wash away, the perception of litter is somewhat diminished. Any adhesive to be developed must satisfy the requirements of both current and anticipated cigarette production speeds (9000 - 12000 cigarettes per minute). The adhesive materials developed must possess adequate flow, drying speed, cohesiveness, bonding strength, viscosity stability, machinability and other rheological characteristics. This would require working with National and Fuller and evaluating test materials on cigarette machines first at DC and later at Macon's high speed machines. National has developed a water dispersible hot melt adhesive, CYCLOFLEX for plug wrap. Fuller claims to have a water dispersible tipping adhesive which will run on our equipment at Macon and in commercial use in some parts of the world. Kimberly-Clark has evaluated a tipping adhesive supplied from Fuller which comes apart in 24 hours.

Based on the preliminary investigation, getting plug wrap off the filter will be more of a challenge than the tipping. Use of starch based natural adhesives as opposed to traditionally used synthetic emulsions (PVA based glues) should significantly improve the filter dispersibility.

Evaluation of CA Filters Made with Mechanically Sub-divided Plugs

Filters made of multiple smaller plugs rather than one of regular length would disperse faster after the tipping and plug wrap come apart. Dual filters and triple cavity filters are already used for charcoal brands. Initially, such filters could be hand made and tested in a weatherometer or outdoors for dispersibility. Later, if successful, cigarette and/or filter rod making machines at DC or Macon will need to be modified for making multiple cuts on the filter rods and attaching individual plugs to the tobacco column. This will be an engineering challenge for Macon. Collaboration with Eastman or Hoechst-Celanese in pursuing this idea might be appropriate.

Evaluation of Shredded Porous Cellulose Acetate (SPCA) Filters

B&W has a 1974 patent, US 3,800,808, on a filter material made from shredded porous cellulose acetate. As per the patent, the shreds are formed by casting a dope of the cellulose acetate dissolved in solvent and plasticizer in which starch and saline solution are present. The starch swells and introduces porosity into the CA structure. The cast sheet is then washed to remove the salt and enzymatically treated to remove the starch and thus form the porous structure. The cellulose acetate material in shred form has a surface area of from about 0.6 to 3.0 square meters per gram, a mean pore diameter of from about 2 to 20 microns, and a porosity of between 65 and 90 percent. Consequently, the filter is formed of a bed or rod of shreds of porous CA having a low packing density and an increased surface area which will readily disperse after the tipping and plug wrap are removed. Also, the material, itself, is likely to be more dispersible and degradable than acetate fibers. The shreds could be made of desired width and thickness (similar to the size of tobacco) so that they be formed into filter elements by employing the standard cigarette making machinery.

Evaluation of Samples from Eastman and Hoechst-Celanese

Both Eastman and Hoechst-Celanese have various studies underway to improve the degradability of acetate fibers and develop water soluble plasticizers. Any samples developed by them in this regard and available to us for evaluation must be examined using our in-house testing procedures.

At this point B&W should not get into a joint venture with the tow suppliers or with other polymer producers for developing an alternate fiber to cellulose acetate.

Finally, time permitting, breakthrough ideas such as the one mentioned below should be pursued.

Evaluation of CA Filters Containing Seeds

The idea is to make a filter containing seeds which germinate and thus swell and disperse the fibers if exposed to enough water. Also presence of any vegetation over the discarded cigarette butts would be construed as a reduction in the perception of litter. The seeds could be sprinkled onto the tow immediately after it passes through the plasticizer booth in a same way as charcoal is added to the charcoal filters. The drop rate of seeds has to be precisely controlled so that a limited number drop per unit length of the tow. After smoking the cigarettes, the discarded cigarette butts would be left outdoors and also placed inside the weatherometer and inspected periodically.

I see the whole program requiring roughly three fourth of a scientist's time.

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