The Role of Blending and Processing in Developing Reduced-Risk Cigarettes with Acceptable Smoking Qualities

By Fawky Abdallah, Ph.D.

The Role of Blending and Processing in Developing Reduced–Risk Cigarettes with Acceptable Smoking Qualities

A Presentation by

Fawky Abdallah, Ph.D.
President, Fawky Abdallah Company, Inc.

at

Open Meeting on

Evaluating the Scientific Evidence for Potential Reduced-Risk Tobacco Products

Organized by

Life Science Research Office (LSRO)

Bethesda, Maryland, USA
April 27, 2005

The Role of Blending and Processing in Developing Reduced–Risk Cigarettes with Acceptable Smoking Qualities

I. Introduction

II. Possible Tools

III. Manufacturing

IV. Product Development

V. The Challenge

I. Introduction

A. Major Factors

B. Safety vs. Acceptability

C. Regulations vs. Accountability

The Role of Blending and Processing in Developing Reduced–Risk Cigarettes with Acceptable Smoking Qualities

A. Major Factors

Tobacco Chemistry

Study varieties, cultural practices and biological factors that contribute to the chemistry of the leaf tobacco at harvest

Smoke Chemistry

Determine the thousands of components in the cigarette smoke and classify into those contributing to acceptability and those affecting safety

Smoking Qualities

Evaluate the sensory properties of the cigarette mainstream smoke (MSS) as determined by flavor (taste, smell and feel), mildness, burning qualities, etc.

B. Safety vs. Acceptability

- **It is now generally accepted that there is no safe cigarette and smoking should be considered a health hazard.**
- **Efforts to develop reduced-risk "safer" cigarettes reflect scientific and moral obligations toward those who choose to smoke.**
- **Researchers should recognize that the developed reduced-risk cigarettes maintain reasonably acceptable smoking qualities.**
- **Developing a "safer" cigarette with unacceptable smoking qualities will not contribute to safety if no one smokes it.**

C. Regulations vs. Accountability

- **Those who choose to smoke should know by now the health hazards of smoking.**
- **Besides abiding by the current warnings and other state and federal regulations, the cigarette industry should refrain from implying in any way the "benefits" of smoking.**
- **Smokers must be held accountable and there is no justification for those who smoke excessively because this is akin to substance abuse.**
- **Issuing more regulations is not the only answer to the ongoing problem of smoking and health.**

II. Possible Tools

A. Concept

B. Complexity

C. Methodology

A. Concept

- **All possible tools should be considered for developing reduced-risk tobacco products.**
- **Short-term efforts to eliminate one or several harmful constituents may not work.**
- **Development of reduced-risk cigarettes should be addressed with due consideration to:**
  1. **The inherent biological and metabolic mechanisms of the tobacco plant.**
  2. **The complex nature of the final product “mainstream smoke” with its thousands of component substances**

B. Complexity

- **Obstructing the formation of particular constituents that are considered harmful while avoiding the formation of new compounds that may also be harmful in the long-term**
- **The resulting chemical make-up should reflect equal distribution of all the pre-existing compounds, hence, a reasonably "balanced" product with reduced-risk could be developed.**
- **Eliminating harmful constituents may result in generating undesirable smoking qualities due to the formation of new compounds that are less acceptable though less harmful.**

C. Methodology

- **Long-term step-wise techniques should allow for a gradual adjustment in the make-up of plant constituents, which lead to reduced-risk products with acceptable smoking qualities.**
- **Over time and with more knowledge of the metabolic regulation and genetic engineering of the tobacco plant, biotechnology can be a promising tool for eliminating harmful constituents while preserving acceptability.**
- **Time and resources are needed to establish new methodologies for developing the sought-after reduced-risk cigarettes, however, the following proven tools will continue to play the major role:**
  1. **Tobacco plant: breeding, varieties, types and cultural practices**
  2. **Manufacturing, i.e. blending, processing, cigarette design**

III. Manufacturing

American Blended Cigarettes (ABC)

- **Recent advances in ABC manufacturing technology present several readily available tools that can be used in developing reduced-risk cigarettes with acceptable smoking qualities.**
- **These advances cover two major areas:**
  - **A. Primary Operation Blending and Processing**
  - **B. Secondary Operation Cigarette Making and Packing**
- **In my presentation today, I will explain in detail the role of blending and processing.**

A. Primary Operation

1. Foundation Blend	Selection of component grades of flue-cured, burley and oriental
2. Extenders	a. Reconstituted sheet b. Stems c. Expanded cut tobacco
3. Additives	Casings, flavorings and humectants
4. Processing	Burley and total blend

1. Foundation Blend

Following are the major factors to be considered in the selection of the component grades:

a. Blend chemistry	**Nicotine, sugars, nitrogenous compounds, etc.**
b. Physical properties	**Filling value and processing ability**
c. Smoke chemistry	**Tar, nicotine and harmful compounds: carbon monoxide, nitrosamines, benzo-a-pyrines, etc.**
d. Smoking qualities	**Sensory properties and burning qualities**
e. Economics	**Cost, availability and continuity**

2. Extenders

a. Reconstituted Sheet

Recon is now used extensively as an effective tool in ABC product development, because of its contribution to:

- **Physical Properties. Recon sheet has more filling value, which means less tobacco mass, which in turn leads to faster burn rate, less puffs per cigarette and reduced tar in mg per cigarette.**
- **Smoke Chemistry. The tar delivery of the recon is 20 to 30% less than that of the original byproducts (stems and scraps). At the current inclusion levels up to 25% or more, recon reduces the tar in the MSS by up to 30%. Recon is claimed to deliver less CO and to reduce the tar bioactivity.**
- **Smoking Qualities. The use of recon in the blend maintains the cigarette overall sensory properties and signature flavor.**

2. Extenders Cont'd

b. Stems

Cut-rolled expanded stems (CRES) of flue-cured and burley have more filling value and are less harsh than the traditional CRS.

c. Expanded Cut Tobacco

- **ECT Reduces cigarette weight while preserving the tobacco taste and increases filling value, hence, more cigarettes per unit weight.**
- **More filling value causes faster burn rate, which reduces the number of puffs and, in turn, reduces the deliveries of tar, nicotine and harmful compounds.**
- **ECT is added at 5 to 10% in full flavor cigarettes and 10 to 15% or more in light and ultra-light cigarettes.**

3. Additives

- **Casings, flavorings and humectants are collectively called additives or added "ingredients". Additives also cover any ingredients that may be used during cigarette making and packing.**
- **The interest in reduced-risk cigarettes will lead to the development of new additives, which can contribute to:**
  a. **Improving processing ability, filling value and moisture-holding capacity; resulting in increasing burn rate and decreasing the puffs per cigarette, which in turn decrease the delivery of tar, nicotine and harmful compounds in the cigarette MSS.**
  b. **Improving smoking qualities and enhancing the flavor attributes of both the mainstream and side stream smoke of the reduced-risk cigarettes**

4. Processing

- **An ABC primary processing covers two major operations:**

a. Burley

Blending of burley grades

Casing and Toasting (Heat Treatment)

b. Total Blend

Blending of flue-cured, cased and toasted burley, oriental and recon

Casing and Soft Drying

Cutting and addition of expanded cut tobacco

Drying and Cooling

Flavoring or Top Dressing

Option: Top Casing may be applied before cutting.

4. Processing Cont'd

- **Burley Casing & Toasting (Heat Treatment)**

Casing	**Mainly reducing sugars, cocoa, licorice, fruit concentrate and glycerine** **Application: 10% or more (dry leaf basis)**
Toasting	**Heat Treatment in an apron-type dryer (toaster) in four stages: Heat Up, Drying, Expansion and Chemical Reactions or Flavor Development**
Major Role	**Initiates amino-sugar reactions, which improve the pack aroma and smoke flavor**

4. Processing Cont'd

- **Total Blend Light Casing & Soft Drying**

Casing	**Mainly sugars, molasses, fruit concentrates, cocoa, licorice, propylene glycol** **Application: 5 to 10% (dry leaf basis)**
Drying	**Removal of excess water in a rotary drying cylinder**
Major Role	**Reduces harshness and irritation while maintaining the basic tobacco character and impact**

B. Secondary Operation

Cigarette Making	
Tobacco column	**Moisture content, weight, density, filling value, firmness, pressure drop, etc.**
Design configuration	**Cigarette paper, porosity, filter, tipping, ventilation, perforation, etc.**
Cigarette Packing	**Packing and packaging materials**

IV. Product Development

A. New Target

B. New Direction

C. Cigarette Design

D. Blending & Processing

E. Sensory Testing

F. Smoking Behavior

A. New Target

Development of reduced-risk “safer” cigarettes with:

- **Reduced yield of harmful compounds, such as nitrosamines, benzo-a-pyrine, phenols, etc.**
- **Lower deliveries of tar, nicotine and CO**
- **Acceptable smoking qualities**

B. New Direction

Collective effort with a multi-disciplinary approach to:

- **Conduct researches in biotechnology and genetic engineering**
- **Work on breeding and cultural practices for the new varieties**
- **Make blend changes in the grades of each sub-blend**
- **Adjust extenders and additives to improve processing-ability and enhance smoking qualities**
- **Modify cigarette design configuration:**
  - **Tobacco rod's weight, filling value, density, etc.**
  - **Cigarette paper, filter, tipping, plug wrapper, etc.**

C. Cigarette Design

- **Cigarette design can play an important role in developing reduced-risk cigarettes with acceptable smoking qualities.**
- **For many years, reducing tar was handled mainly by modifying the cigarette design, using alternative cig. paper, porosity, filter, tipping, ventilation, perforation, etc. This led to reducing the average tar and nicotine deliveries in MSS of all cigarettes sold in USA by more than 40% over the last 40 years. Using cigarette design to develop reduced-risk cigarettes has reached a plateau.**
- **Developing reduced-risk cigarettes with acceptable smoking qualities also require the proper use of adequate blending and processing techniques.**

D. Blending and Processing

Following steps are used in developing reduced-risk cigarettes with acceptable smoking qualities:

Blend: Replace some of the full flavor grades that are high in harmful compounds with lower yield grades

Extenders: Increase the ratio of recon, expanded cut tobacco and/or cut-rolled expanded stems (CRES)

Additives: Adjust the formula and ratio of the casings, flavorings and humectants to enhance the flavor of the cigarette MSS

Processing: Develop techniques to improve the processing ability, filling value and moisture-holding capacity

E. Sensory Testing

- **There have been numerous research studies on the chemistry and biological activity of cigarette smoke; however, the most advanced chemical devices cannot "sense" the qualitative aspect of MSS in terms of its sensory properties as perceived by the smoker.**
- **Recent efforts to develop reduced-risk ABC products with acceptable smoking qualities have revitalized the important role of sensory testing.**
- **Adequate smoking panels should be used as a measuring device parallel to the chemical and physical testing devices now being used in product development.**

F. Smoking Behavior

- **Studies on smoking behavior will also play an important role in any effort to develop reduced-risk cigarettes with acceptable smoking qualities.**
- **Besides smoking qualities per se, the safety of the newly developed reduced-risk cigarettes depends on how and to what extent the smokers will actually smoke the cigarettes.**
- **The behavior and sensory response of prospective smokers will determine the degree of safety that each of the developed reduced-risk cigarettes is actually providing.**

V. The Challenge

- **Developing reduced–risk cigarettes with acceptable smoking qualities presents a real challenge to those working in tobacco research and product development.**
- **This challenge should be met by well-coordinated studies by all concerned parties, instead of separate and unrelated research programs that usually lead to contradictory results.**
- **In order to meet the challenge, I suggest the implementation of:**
  - **A Protocol for Product Development by the industry; and**
  - **Parallel Programs for research at state and national levels.**

Thanks for your attention.

I will now entertain your questions or comments.

Fawky Abdallah