

A.L.H. 12.9.80.

1. FUNDAMENTAL STUDIES

A. Temperature Effects

1. Heat transfer mechanisms/rates at the cellular level of tobaccos of different degrees of subdivision (green and dried tobacco).
2. Max. temp. (probably by grade) that tobacco may achieve without noticeable chemical loss and/or chemical/physical change. (Subjective response).
3. Effects of thermal shock -- heating or cooling tobaccos (over a range of moistures and expansions) too abruptly.
4. Green tobacco freeze-thaw effects (Aylmer).
5. "Case hardening" -- what is it?

B. Water - (Conditioning/Drying)

1. Water uptake and release mechanisms (Diffusion coefficients, green and redried boundry properties).
2. Bonding of water inter/intra cellularly and energy required to remove (i.e. break bonds/attractions) different "types" of water from tobacco.
3. Relationship between tobacco physical properties and moisture content.
4. Coupling effects including chemical change associated with water-temperature interactions.
5. Volatile loss (compounds other than water) associated with tobacco drying.

C. Expansion Mechanisms (Cellular and Bulk)

1. Mechanisms of tobacco expansion at cellular level.
 - what is expansion (temp., time, pressure, solvent).
 - what is limit of expansion? (elasticity, reversibility).
 - how is expanded tobacco fixed or set?
2. Effect on expanded tobacco of post expansion processing manipulations - heat, water agitation, storage (time, pressure), cutting, cuts per inch. (i.e. reversibility).

107473434

3. Relationship between tobacco physical properties and expansion (especially pliability and shatterability vs degradation).
4. Audity of tobacco size (attributed to expansion) from green leaf to cut tobacco.
5. What makes a solvent desirable/suitable as an expansion medium or agent?
6. Solvents and extraction (eg. sugar/nicotine in Diet).
7. Enhancing expansion through genetic engineering.
8. Is an external solvent (CO₂, Freon, H₂O) required as a driving force or agent of expansion or fixing?

D. Redried Tobacco Aging

1. How does redried tobacco change with time (by grade) -- physical, chemical (and subjective) both before and after further processing?
2. What influences aging processes -- time, seasonal changes, temp., humidity, grade? packing conditions drying.
3. Can aging be controlled? accelerated or forced under 'artificial' conditions?
4. Accelerated aging and flavour/aroma precursor development and enhancement.
eg. certain changes may be accelerated during forced aging while others (time dependent) may not, thus possible detrimental factors may be minimized.

E. Green Tobacco Drying

1. Basic: Why does redried tobacco 'smoke' differently than its corresponding green?
2. Are the 3 phases of redrying distinct? i.e. ¹water removal, ²heat treatment, ³water addition.
3. "Hard" vs "soft" drying (also see temp/water section).
4. Chemical loss and physical and chemical change during redrying.

107473435

5. Volatile collection, characterization and addback investigations (flavour and environment).
6. Pad effects of apron redryers -- top, middle, bottom.
7. Alternative drying approaches -- (rotary I.T.M.).
8. Reorder water/steam addition. Rate or method of moisture application may influence flavour retention (flash off).
9. Fluidized bed of green tobacco?

F. Steam and Tobacco

1. How do the various types (properties) of steam influence the processing of tobacco (conditioning, reorder etc)? when the two are in contact.

II. PROCESSING CONCERNS

A. Blending and Mixing

1. Determine the effectiveness of certain equipment on the mixing (or demixing) of tobacco -- green and redried eg. bins, cylinders, vibratory apparatus, air vey systems -- a mathematical treatment.

B. Separate Processing by Leaf Grades

1. Process grades or groups of similar grades in a recipe so as to accommodate and take advantage of their physical and chemical differences -- even though we process mainly flue cured.

C. Particle Degradation

1. A catalogue of mechanical/physical degradation including breakage with all forms of tobacco conveying, tumbling, cutting, and cigarette making machines.
2. Tobacco transport and product conditioning (H₂O temp).
eg. air veying in warm, moist environment.

107473436

III. CONTROL AND INSTRUMENTATION

1. Continuous Moisture Meters -- all degrees of temp. and moisture (10%-50%) and subdivisions from whole green leaf to cut tobacco smalls (and stems) must be considered.
2. In line and off line filling power measuring apparatus (modified Borgwaldt).
3. All aspects of process control thru measurement and instrumentation are of concern in process optimization.

IV. TOBACCO LITERATURE AND INFORMATION

1. Preparation of a Handbook of Tobacco Processing Technology to be used as the Industry Bible.

107473438