INVESTIGATION INFLUENCE ON QUALITY OF DIFFERENT CURING PREPARATION OF FLUE-CURED TOBACCO

V. Nikolova, D. Drachev
Tobacco and Tobacco Products Institute, Plovdiv, Bulgaria

ABSTRACT
The influence is investigated of different methods preliminary preparation of tobacco flue-cured leaves, local variety on continuation of curing process and quality. The material preparation expresses in: leaves with stem stretch – variant I; leaves with stem cross cut through – variant II and control. The curing was made in experimental curing chambers with electrical heating apparatus in standard regime of leaves of upper part of middle stalk position /C and B/. The parameters are investigated: time of process and moisture content, the curves of curing and curves of curing velocity are drawn. The indexes are determined: nicotine, reduced sugars, overall nitrogen, ashes, potassium and hexane extract in tobacco; nicotine and tars in tobacco smoke; cut tobacco density, conventional cigarette output, elasticity, strength and dry matter density. The results obtained of curing curves show shortening time of process. It’s maximum in variant with main vein cut through – 22 % and in variant with stretch – 5.5% compared to control. The dependence between moisture content and time of process has the same character – linear with different coefficients in equations. The process precipitation (process velocity du/dτ) is maximum in the stage of falling velocity for variant with cut through. The investigated methods of material preparation for curing prove visible changes to quality indexes of cured tobacco.

Introduction
The maximum expenditures for flue-cured tobacco production realize in process of its curing. Every lengthening of curing process lead to significant over expenditure of fuel and electric power, therefore the curing must conduct in economical and technological effective regimes (2). It’s known that the energy expenditures are the biggest during stage curing of stem because big thickness and small water separated surface of stem in comparison to blade. The process lengthens which lead to bigger fuel and electric power expenditures (1, 3).

The interest presents checking possibility for application of different material preparation in curing process conduction, in observing necessary technological requirements during yellowing and other stages. The special importance has the last stage of process in real curing and curing to the stem in this connection. The determined changes must expect connected to forming quality in dependence on changed curing conditions.

The investigations of some authors show significant process precipitation in material preparation, expressing in the possibility for more effective (shorter) moisture separation in curing process (4).

The dynamics of moisture content change of curing as its duration has an effect on definitely influence on bio chemical process in the “hungry exchange” of substances and its dissociation as in the following stage of color fixing and real cu-
The parallel running process of mass exchange and heat exchange connected to composition change have effect on definitely influence on quality by analogy as in tobacco curing in different technical maturity stage (8).

The main aim of present investigation is to determine influence of different flue-cured tobacco preparation for curing on process duration and main indexes connected to its quality.

**Materials and Methods**

The investigation was conducted with Virginia tobacco V0454 variety, 2003 crop. The material of middle stalk position (C and B) uses in technical maturity without damages of diseases and foes. The experiment was conducted in two variants of material preparation:

- **Variant I** – Leaves with stem stretch in about 50% decreasing vein thickness on 2/3 of leaf length (SP).
- **Variant II** – Leaves with stem cross cut through at intervals of 10 mm on depth 0.5 mm on 2/3 of leaf length (PR).

The curing is made in experimental curing chambers with electric heating apparatus for the same mass of tobacco (samples). The curing regime realizes according to Instructions for Virginia tobacco curing in the same conditions for control and variants. The investigated samples are taken at interval of four hours on the day to process end. The moisture content is determined of taken samples by determine decreasing mass of curing material.

The cured tobacco of different variants is investigated in respect of following indexes:

- **Tobacco chemical composition:**
  - Nicotine, % - ISO 15152;
  - Reduced sugars, % - ISO 15154;
  - Overall nitrogen, % - BSS 15836-88;
  - Mineral content (ashes), % - ISO 2817;
  - Hexane extract, % - by “SOXTEC”;
  - Potassium, % - BSS 17365-94

  The nicotine (mg/cig) and tars (mg/cig) smoke content was determined by regression dependences (10). The analysis is made for number of samples n≥4.

- **Physical indexes:**
  - Cut tobacco density, g/cm³;
  - Conventional cigarette output, num.cig/kg tobacco
  - Elasticity, m²
  - Strength, N (Modification method of Arto)
  - Dry matter density, kg/m³

  Statistical processing of results was made on the base of received data by program STATISTIKA which include different procedures for data processing. The adequate regression models were deduced describing dependencies between moisture content and process duration – U=f(h).

  The dynamics of moisture separation is expressed by curves of curing velocity – DU/Dr=f(u).

**Results and Discussion**

The results of all curing samples show significant process precipitation as whole in result of less mass of curing material and more intensive heat exchange and mass exchange in experimental curing chambers in comparison to curing chamber in production conditions. Because of the same regimes of curing process conduction we can consider that in this case curing process moulds this one in production conditions.

The curing curves are drawn on the base of obtained results presented on Fig. 1.

Data of diagram presentation of process show significant shortening duration of curing sample with cross cut through of stem in comparison to control (16h). Process precipitation also observes in work with main vein stretch but it is more insignificant (4h).

The deduced regression equations presented on Fig. 1 show linear dependence between tobacco moisture content and curing duration in high values of correlation coefficients (R² over 0.9 and error below 1%) for the three equations.
Conditions create for more quickly separation of adsorption and osmotic connected moisture because mechanical separation of stem in respective preparation. It must expect that time of process will reduce in the same rate for production conditions in result of application respective material preparation for curing. It’s obvious that the variant II is the best in this respect for this case.

The curves of curing velocity are drawn by diagram differentiation characterizing the dynamics of moisture separation from curing material. They are presented on Figures 2, 3 and 4.

It can determine moment of finish yellowing stage which coincide with end of period constant curing velocity and beginning of stage real curing i.e. period of falling velocity (7).

As data show the maximum process yellowing precipitation finds in variant II /duration 26 hours – moisture content 1.8 kg/kg/ and the maximum is duration of yellowing for control – 40 hours in 2.2 kg/kg moisture content.

The results show increasing curing velocity \(\frac{du}{d\tau}\) for experimental samples. The velocity is maximum for variant with stem cross cut through – 2.1 \(\frac{du}{d\tau}\) and minimum – 1.3 \(\frac{du}{d\tau}\) for control. Therefore the material preparation made precipitates the process in the two stages – constant and
falling curing velocity. The total process precipitation was indicated above.

**Tobacco chemical composition**

Data for tobacco chemical composition are presented in Table 2.

They show changes what occur in chemical composition in result of moisture separation. More significant are deviations in variant with stem cut through compared to control and more concrete in respect of nicotine, reduced sugars and ashes. In data comparison between two variants the differences are less compared to control. It must note that in respect of tobacco smoke the differences don’t exist between control and variants. The deviation observes only for nicotine for variant II. Therefore composition of components decreases which have negative importance for quality.

**Physical indexes**

The results for samples physical indexes are presented in Table 3.

Data show leaf compacting in curing for the two variants /SP and PR/ in result the filling ability expressed like conventional cigarette output decreases compared to control. The results in respect of indexes elasticity and strength are by analogy i.e. the elasticity and strength decrease. The statistical processing of these indexes show availability of reliable differences in its values determined by Student criterion. The statistical authenticity for difference doesn’t exist among variants.

In respect of dry matter the results confirm narrow limitations in which its value moves (1350 to 1650 kg/m³) independently to tobacco type and method of it processing (9). Therefore the applied methods for ma-

**TABLE 2**

<table>
<thead>
<tr>
<th>Tobacco chemical indexes</th>
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<tbody>
<tr>
<td>Sample</td>
</tr>
<tr>
<td>Tobacco chemical composition</td>
</tr>
<tr>
<td>Nicotine, %</td>
</tr>
<tr>
<td>Reduced sugars, %</td>
</tr>
<tr>
<td>Overall nitrogen, %</td>
</tr>
<tr>
<td>Ashes, %</td>
</tr>
<tr>
<td>Potassium, %</td>
</tr>
<tr>
<td>Hexane extract, %</td>
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<tr>
<td>Smoke chemical composition</td>
</tr>
<tr>
<td>Nicotine in smoke, mg/cig</td>
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<tr>
<td>Tars, mg/cig</td>
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</tbody>
</table>
Tobacco physical indexes

<table>
<thead>
<tr>
<th>Sample</th>
<th>Cut tobacco density, g/cm³</th>
<th>Conventional cigarette output, num. cig/kg tob.</th>
<th>Elasticity, m²</th>
<th>Strength, N</th>
<th>Dry matter density, kg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kontrola</td>
<td>0.229</td>
<td>1293</td>
<td>0.8</td>
<td>5.24</td>
<td>1642</td>
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<tr>
<td>SP</td>
<td>0.252</td>
<td>1175</td>
<td>0.6</td>
<td>4.29</td>
<td>1574</td>
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<tr>
<td>PR</td>
<td>0.291</td>
<td>1018</td>
<td>0.7</td>
<td>4.26</td>
<td>1555</td>
</tr>
</tbody>
</table>

4.1. Components decreasing which have negative importance for quality.
4.2. Cut tobacco density increasing in respect of decreasing cigarette output and elasticity and strength decreasing.

REFERENCES