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

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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 $du/d\tau$) 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-

ring. 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 fluecured 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 $n \geq 4$.

Physical indexes:
-Cut tobacco density, g/cm^3;
-Conventional cigarette output, num.cig/kg tobacco
-Elasticity, m^2
-Strength, N (Modification method of Arto)
-Dry matter density, kg/m^3

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 – $DU/D\tau=f(u)$.

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 (R^2 over 0.9 and error below 1%) for the three equations.

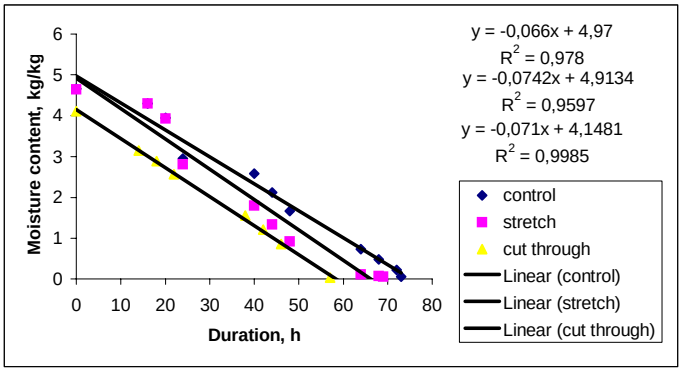

Fig. 1. Curing curves.

TABLE 1

II Variant – PR

Hour, h	Mass of separated moisture, kg	U, kg/kg
0	1.935	4.117
14	1.480	3.149
18	1.355	2.883
22	1.205	2.564
38	0.730	1.553
42	0.565	1.202
46	0.400	0.851
57	0.015	0.032

Data in **Table 1** show experimental determined values of moisture content in respective stages of its determine. The results for variant II are given.

These results are valid for curing conditions in experimental curing chambers as every curve refer to conditions in which it is taken down.

The total process precipitation in variant I is 5% and in variant II is 22% compared to control. The shortening duration of curing cycle is 18% in comparison to experimental variants.

It's known that the forms of moisture connection with dry matter determine character of its separation in curing. The mechanical connected moisture separates most quickly in initial stage and physical-chemical connected moisture in the following stages /adsorption and osmotic/ (6, 5). 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 ($du/d\tau$) for experimental samples. The velocity is maximum for variant with stem cross cut through – 2.1 $du/d\tau$ and minimum – 1.3 $du/d\tau$ for control. Therefore the material preparation made precipitates the process in the two stages – constant and

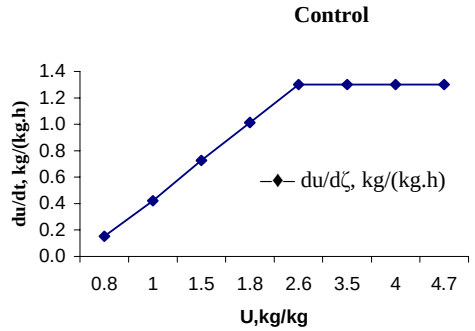

Fig. 2. Curing velocity curve.

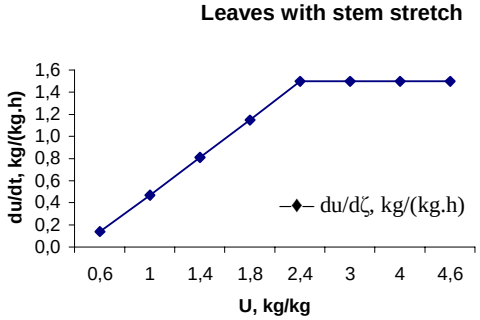

Fig. 3. Curing velocity curve.

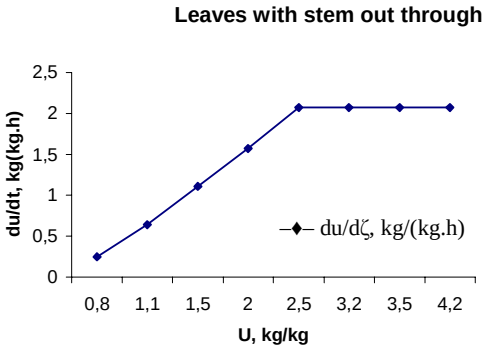

Fig. 4. Curing velocity curve.

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.

TABLE 2

Tobacco chemical indexes

Sample	Kontrola	SP	PR
Tobacco chemical composition			
Nicotine, %	0.65	0.65	0.41
Reduced sugars, %	24.8	25.9	27.4
Overall nitrogen, %	1.38	1.14	1.00
Ashes, %	9.6	9.4	8.4
Potasium, %	1.83	1.50	1.66
Hexane extract, %	4.98	4.99	4.42
Smoke chemical composition			
Nicotine in smoke, mg/cig	0.58	0.58	0.46
Tars, mg/cig	18.38	18.49	18.79

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/m^3) independently to tobacco type and method of it processing (9). Therefore the applied methods for ma-

TABLE 3

Tobacco physical indexes

Sample	Cut tobacco density, g/cm^3	Conventional cigarette output, num. cig/kg. tob.	Elasticity, m^2	Strength, N	Dry matter density, kg/m^3
Kontrola	0.229	1293	0.8	5.24	1642
SP	0.252	1175	0.6	4.29	1574
PR	0.291	1018	0.7	4.26	1555

terial preparation for curing have effect on definite influence on tobacco physical indexes as it indicated above.

The significant changes are determined in respect of curing tobacco chemical composition and physical indexes in result of applied different methods for Virginia tobacco preparation for curing. These changes are due to different velocity and depth of bio chemical and chemical processes conduction as in the first stage of curing – yellowing, as in the second in real curing in result of moisture separation dynamics.

Conclusions

In result of conducted investigations concerning different methods for tobacco curing preparation – leaves with stem stretch at about 50% decreasing vein thickness and leaves with stem cross cut through at about 10 mm in depth 0.5 mm it can make following main conclusions:

1.Shortening duration of curing process conduction.

It is maximum for variant with stem cut through – 22% and for variant with stretch – 5.5%.

2.The character of dependence between moisture content and time is the same – linear with different coefficients of variables in equations.

3.The process precipitation is maximum in stage of falling velocity in variant with cut through.

4.The investigated methods for tobacco curing preparation have effect on determinate changes of quality of cured tobacco:

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.

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