

ACCELERATED SYNTHETIC CURING OF FLUE-CURED TOBACCO WITH CEPA, DIASTASE AND MICROWAVE ENERGY^{1, 4}

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INTRODUCTION

To determine the possibility of rapid processing by chemical ripening and field curing on flue cured tobacco a preliminary experiment was conducted at the Georgia Coastal Plain Experiment Station, Tifton, Georgia. Plants were sprayed with 2-chloroethylphosphonic acid (CEPA) (5), diastase, and a combination of CEPA and diastase. A microwave oven was used as a rapid method of drying.

MATERIALS AND METHODS

Flue-cured tobacco *Nicotiana tabacum* L. cv. 'Hicks Broadleaf' was grown on a Klej loamy fine sand soil. Ten plants per treatment were sprayed with 150 mg CEPA/plant, 2.0g diastase/100ml/plant, a combination of the above CEPA and diastase concentrations, and an untreated check. The diastase concentration was determined by preparing a starch solution corresponding to the amounts in uncured leaves (15 percent) and then adding various concentrations of diastase (a mixture of α and β amylase) until a negative iodine test resulted. A two percent diastase solution hydrolyzed all the starch in ten minutes.

Five days after spraying, four leaves were harvested from the middle third of each plant, yielding 40 leaves per treatment. The leaves were divided into three groups and dried in a microwave oven (Amana Radar Range Model IRR-2, 1600 watts) two leaves at a time for three one-minute intervals; in a drying oven for three hours at 100°C.; and by standard flue curing.

For chemical analysis of total nitrogen, nicotine alkaloids, reducing sugars, and starches, the lamina of each treatment was ground in a Wiley Mill with a 40 mesh screen. Total nitrogen was determined by the modified salicylic-thiosulfate semimicro Kjeldahl method (6) with a Kemmerer-Hallett Distillation Unit (4). Nicotine alkaloids and reducing sugars were determined simultaneously (3) and starch was determined by a Technicon Auto-Analyzer method (2). All analytical results were based on an oven dry weight: 99-100° dried for 3 hours.

DISCUSSION

The microwave oven was utilized in this study because it has the capacity to dry the leaves uniformly and rapidly. CEPA-treated leaves, which were well colored when removed from the stalks, held their color after being dried in the microwave oven. However, the leaf

texture seemed to be lighter, but chemical composition (total nitrogen, nicotine alkaloids and reducing sugars) was well within the limits set for conventional flue-cured leaf, except for starch. As shown in Table 1, starch in the "microwave check" was 20.2 percent, as compared to typical starch content of 2.3 percent in the "flue-cured check". It was possible to lower the starch content of these samples to 11.6% but this was still higher than the normal range of 3 to 6% for flue-cured tobacco (1). It was also evident from Table 1 that diastase decreased starch content by 21.3% and the CEPA diastase combination by 42.6% during field ripening. Reducing sugars increased only slightly possibly due to incomplete conversion and various physiological factors. Total nitrogen and nicotine alkaloid contents differed only slightly between microwave oven-dried tobacco and flue-cured tobacco. Reducing sugars in all treatments of

Table 1—Chemical effects of diastase-CEPA and drying method on flue-cured tobacco

Treatment	Total Nitrogen	Nicotine Alkaloids	Reducing Sugars	Starch
Flue-cured				
Check	1.71	1.45	14.0	2.3
CEPA	1.18	1.22	12.1	6.2
Diastase	1.72	1.64	15.7	2.3
CEPA-Diastase	1.36	1.49	13.4	5.1
Oven Dried				
Check	1.39	1.04	3.4	11.3
CEPA	1.30	1.01	3.5	5.9
Diastase	1.31	1.03	3.0	9.9
CEPA-Diastase	1.41	0.95	3.4	6.2
Microwave				
Check	1.25	1.26	7.5	20.2
CEPA	1.20	1.30	8.8	14.9
Diastase	1.36	1.54	7.7	15.9
CEPA-Diastase	1.56	1.76	9.1	11.6

flue-cured material tended to be much higher than oven dried or microwaved. (Table 1.) Obviously the flue-cured process gives a much better opportunity for enzymatic activity.

It is possible that the leaf epidermis acts as a barrier and thus reduced the effectiveness of the sprayed diastase solution. Also CEPA appears to interfere with the hydrolytic properties of diastase, Table 1. The conversion of starch to sugars could possibly be improved by using different concentrations of enzymes, by varying the application time and by using surfactants to improve the penetration of diastase.

SUMMARY

In a field experiment with flue-cured tobacco, mature leaves were treated with 2-chloroethylphosphonic acid (CEPA) which has been shown to yellow mature tobacco on the stalk, in combination with diastase to promote starch-sugar conversion and a microwave oven as a rapid method of drying. Total nitrogen, nicotine alkaloids and reducing sugars were within acceptable limits and starch was reduced to near acceptable limits with the CEPA-diastase combination.

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