AMF

WORLD TOBACCO GROUP
689 Hope Street, Stamford, Connecticut 06907 · 203/325-2211
AMF INCORPORATED

April 12, 1978

Dr. W. H. Johnson
NORTH CAROLINA STATE UNIVERSITY
Dept. of Biological and
Agricultural Engineering
P.O. Box 5906
Raleigh, N.C. 27607

Dear Bill:

Howard Halter has been invited to participate in the 32nd TCRC Symposium; Physical Parameters Which Affect The Composition of Cigarette Smoke. Mr. Halter and I will co-author a paper entitled "Effect of Tobacco Reconstitution and Expansion Processes on Smoke Composition."

Since you are a leader in the field of freeze dried expanded tobacco, I would like to request your help in identifying the key patents and significant publications which you would like to have included in our review.

I plan to be out for the next few days, but I do expect to be back late next week. I plan to call you then to discuss these matters with you personally.

It would also be helpful if you could suggest any other significant review papers or patents relating to the topic.

Sincerely,

AMF WORLD TOBACCO GROUP

Thomas I. Ito
Assistant Director of
Research and Development

TII/ed

AMF INCORPORATED · MOREHEAD PATTERSON CENTER
689 Hope Street, Stamford, Connecticut 06907 · 203/325-2211

February 14, 1975

Dr. William H. Johnson
Dept. of Biol. & Agr. Engineering
North Carolina State Univ.
Raleigh, N.C. 27607

Dear Bill:

I apologize for the long delay in acknowledging receipt of the freeze-dried tobacco you prepared for me. Many thanks for your prompt attention to my request.

Best personal regards.

Sincerely,

J. V. Fiore

JVF:cm

January 21, 1975

Dr. Thomas I. Ito
AMF, World Tobacco Group
6301 Midlothian Turnpike
Richmond, Virginia 23225

Dear Tom:

Enclosed herewith are various articles relating to bulk curing. I do not yet have reprints available on the modular curing system, however enclosed is a copy of the Montreux report for your use.

Best regards,

Sincerely yours,

William H. Johnson
Professor

WHJ/t

Enclosure

AMF

WORLD TOBACCO GROUP
6301 Midlothian Turnpike, Richmond, Virginia 23225 · 804/276-1900
AMF INCORPORATED

December 16, 1974

Dr. William Johnson
3731 Swift Drive
Raleigh, North Carolina 27606

Dear Bill;

Hope you and your family have a good holiday season.

I would appreciate it if you would send me any available reprints of your various papers concerning bulk curing.

Thank you.

Sincerely,

Thomas I. Ito

TII/fhf

File

December 7, 1973

Dr. Joseph V. Fiore
AMF Incorporated
689 Hope Street
Stamford, Conn. 06907

Dear Joe:

I checked with Dr. Ray Long of the Tobacco Chemistry Lab and unfortunately they have insufficient material from their tar collection from uncured leaves to supply some for your use. Their study permitted apparently only a few grams which they currently have under study.

The best approach may be to obtain the foam rubber rollers from a mechanical harvester after at least a season's use. I discussed this with Mr. Bob Harrington of Harrington Mf. Co., Lewiston, N.C., and he felt this should be possible. I would suggest that you correspond directly with him and indicate my prior discussion with him on subject.

With best regards,

Sincerely yours,

William H. Johnson
Professor

WHJ/t

AMF ELECTRICAL PRODUCTS DEVELOPMENT DIVISION
1025 North Royal Street, Alexandria, Virginia 22314 • 703/548-7221 • TWX 710/832-0602 • TELEX 89-9120
AMF INCORPORATED

January 11, 1974

Dr. William H. Johnson
North Carolina State University
P. O. Box 5906
College Station
Raleigh, North Carolina 27607

Dear Bill:

My heartiest congratulations on receiving the seventh annual Philip Morris Incorporated Award for Distinguished Achievement in Tobacco Science. It could not have gone to a more deserving person.

I trust this award will be a harbinger of even greater things in your future.

Warmest personal regards.

Yours very truly,

Don

Donald J. Blewitt

DJB/tb

December 10, 1973

Mr. Joe Heffernan, AMF Inc.
200 Sullivan Avenue
South Windsor, Conn. 06028

Dear Mr. Heffernan:

We have shipped by motor freight within the last few days a box of tobacco at the request of Mr. John Hester of your Richmond office. The material that you will receive represents the second clipping of plant bed tobacco, harvested and cured at the Oxford Tobacco Research Station during the 1973 season. I assume that you are familiar with the material from the previous clipping (Harvest) from the same plant bed.

I should mention that the tobacco was grown under dry weather conditions, without irrigation, and primarily for the purpose of establishing potential dry matter yield with two harvests from the same land. For this reason, results should be considered as preliminary data only, and with expectations for rather significant improvement as the research in production and processing continue.

Sincerely yours,

William H. Johnson
Professor

WHJ/pt

cc: Mr. John Hester
Mr. Bill Nellen

AMF INCORPORATED • MOREHEAD PATTERSON CENTER
689 Hope Street, Stamford, Connecticut 06907 • 203/325-2211

December 26, 1973

Mr. Robert Harrington
Harrington Manufacturing Co.
Lewiston, North Carolina

Dear Mr. Harrington:

Attached is a copy of a letter which I recently received from Dr. Bill Johnson and which will serve to introduce me and my subject.

As Bill told you, we are interested in the "tar" or gum which is found on freshly harvested tobacco leaves. I have seen a mechanical harvester in operation and I recall that quite a bit of the gum has a tendency to collect on the foam rubber rollers. I also understand that because of this, the rollers have to be replaced periodically.

Is there any arrangement we can make with you, whereby you can make available to us some of the "gummed" rubber rollers? By some sort of extraction, we may be able to remove the gums from the rollers. Please let us know, at your convenience, whether or not you can help us.

Sincerely yours,

Joseph V. Fiore

Dr. Joseph V. Fiore

JVF/jg
Encl.
cc: Dr. W. H. Johnson

AMF

WORLD TOBACCO GROUP
6301 Midlothian Turnpike, Richmond, Virginia 23225 • 703/276-1900
AMF INCORPORATED

HOWARD M. HALTER
Vice President
and
Director of Engineering

September 25, 1973

Dr. William H. Johnson
3731 Swift Drive
Raleigh, North Carolina 27606

Dear Bill:

Under separate cover, we are sending to you 8 boxes (32 cigarettes per box) of cigarettes containing Microflake Cigarette Filler made from your C-139 Top Layer tobacco. These are 85-mm unfiltered cigarettes, with the cigarette filler sheet shredded 32 cuts/inch and wrapped with Ecusta 351 cigarette paper.

We will be running tar and nicotine contents soon on four different weight groups from the range manufactured, and will report these results to you as soon as they are complete.

We are prepared to repeat this with the second crop of this tobacco which, I understand, will soon be ready. Since I may be driving to the TCRC meeting in Winston-Salem, it may be appropriate for me to pick up this tobacco on the way home.

See you at the meeting. Best regards.

Sincerely yours,

Howard

Howard M. Halter

HMH/fhf

April 17, 1972

Dr. Joseph V. Fiore
AMF Incorporated
689 Hope Street
Stamford, Conn. 06907

Dear Joe:

Enclosed herewith are copies of the papers as requested by telephone.

I enjoyed very much your visit here during March and do hope that you may be able to visit again during the harvest-curing season. You will be able to project ahead much better, I believe, if you can get a first-hand impression of the stage of mechanization and of those factors which must be overcome to permit "custom" processing.

With best regards.

Sincerely yours,

Bill
William H. Johnson
Professor

WHJ/pt

Enclosure

File

September 18, 1972

Mr. Donald J. Blewitt, Product Manager
World Tobacco Group, AMF
6301 Midlothian Turnpike
Richmond, Virginia 23225

Dear Don:

Many thanks for your letter of August 29 and for the kind invitation to attend this years Tobacco Festival in Richmond. Glenda and I accept with pleasure and look forward to the event.

Since we will be attending the CORESTA/TCRC Conference in Williamsburg during the same week, we will not be arriving in Richmond until Saturday morning, October 28. We will be driving our car and will plan to arrive by 10:00 a.m. Saturday morning and will go directly to the John Marshall Hotel.

Don, I am glad that you and the others from AMF were able to visit here on August 29 to see the status of tobacco mechanization and processing. I also hope that Chuck Kelley's later visit was helpful in sizing up the future potentials.

With kind regards.

Sincerely yours,

Bill

William H. Johnson
Professor

WHJ/bf

IN RICHMOND, VIRGINIA

☐ The John Marshall ☐ The Richmond West ☐ The Wm. Byrd Motor Hotel

IN FORT MONROE, VIRGINIA

☐ The Chamberlin

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NO. 748	NAME Dr. W. H. Johnson
RATE 26.50 / 1.59	STREET 3731 Swift Dr.
DEPART 10-29	CITY & STATE Raleigh, N. C.
	FIRM N. C. State Univ.

SURVEY	
ARRIVED VIA	
AIR	BUS
CAR	RAIL

RICHMOND HOTELS CREDIT CARD	
YES	NO

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AMF

WORLD TOBACCO GROUP
6301 Midlothian Turnpike, Richmond, Virginia 23225 · 703/276-1900
AMF INCORPORATED

November 21, 1972

Professor William H. Johnson
North Carolina State University
Department of Biological and
Agricultural Engineering ,Box 5906
Raleigh, North Carolina 27607

Dear Bill:

Many thanks for your kind letter of November 3. We certainly have not forgotten your project and continue to be vitally interested. I expect to be in North Carolina for the better part of the week of November 27 and December 4th and will contact you at that time for additional discussions regarding your modular handling and curing of sized tobacco strips.

It was a pleasure being with you and Glenda and I look forward to seeing you in the next couple of weeks.

Best regards.

Yours very truly,

Don

Donald J. Blewitt

DJB/tb

November 3, 1972

Mr. Donald J. Blewitt, Product Manager
World Tobacco Group, AMF
6301 Midlothian Turnpike
Richmond, Virginia 23225

Dear Don:

I wish to thank you again for having Glenda and I as guests of AMF for the Tobacco Festival. The festival was indeed a delightful event and we enjoyed it thoroughly. Further, it was good to have the opportunity of meeting your wife, associates and friends and to join you for the festivities.

This week has been somewhat hectic with numerous visitors here following the Coresta Conference. It has been enjoyable, nevertheless, in seeing friends again from other countries and in establishing new relationships.

Don, I've had many individuals express interest in the paper presented on "Modular Handling and Curing of Sized Tobacco Strips", with many indicating their belief that this approach appears highly promising for further advancing tobacco mechanization and processing. I'm glad that you and others with AMF have taken an interest in this approach at this stage of development and hope that your appraisal is favorable and receives company support. Perhaps we can get together during your next trip to Raleigh to further discuss the topic and projection for the industry.

With best regards,

Sincerely yours,

William H. Johnson
Professor

WHJ/pt

AMF
WORLD TOBACCO GROUP
6301 Midlothian Turnpike, Richmond, Virginia 23225 · 703/276-1900
AMF INCORPORATED

August 29, 1972

Dr. William H. Johnson
P. O. Box 5906
College Station
North Carolina State University
Raleigh, North Carolina 27607

Dear Dr. Johnson:

This letter will confirm the verbal invitation extended to you and your wife to attend this year's Tobacco Festival as AMF's guests.

The attached agenda outlines the schedule we have set up for your pleasure. In order for us to provide proper and timely transportation, we will need to know your mode of travel and estimated arrival time in Richmond on Friday, October 27. Should you be arriving by plane, we would appreciate airline and flight number.

For your guidance, you should plan to arrive prior to 4:00 PM to allow for transportation from the airport, check in and transportation to dinner.

We are looking forward to this year's festival and should be favored with a very interesting group of guests. However, to insure a good group, we need you. If, for any reason, you have changed your mind about attending, we would appreciate your earliest advice so we can attempt to secure at least a reasonable substitute.

Best regards.

Very truly yours,

Donald J. Blewitt
Product Manager

DJB/tb

TOBACCO FESTIVAL AGENDA

Friday, October 27

(Dress informal)	6:00 PM	Cocktails and dinner The Abbey - Holiday Inn
	8:00 PM	Parade at Parker Field (reserved seats)
	10:00 PM	Hospitality suite at John Marshall Hotel

Saturday, October 28

(Dress informal)	11:00 AM	Bull & Bear Club - Brunch
	12:30 PM	Depart for football game at City Stadium (William & Mary Vs. V.P.I.)
	6:00 PM	Cocktails & Dinner at Bull & Bear Club
	9:00 PM	Assemble at hospitality suite (John Marshall) prior to ball
(Dress - Black Tie)	9:30 PM	Tobacco Festival Ball

Sunday, October 29

	11:00 AM	Hospitality suite open Breakfast at individual's leisure and departure

NOTE: ROOMS RESERVED FOR OUT-OF-TOWN GUESTS AT JOHN MARSHALL HOTEL.

AMF INCORPORATED · MOREHEAD PATTERSON CENTER
689 Hope Street, Stamford, Connecticut 06907 · 203/325-2211

April 20, 1972

Dr. William H. Johnson
North Carolina State University
Dept. of Biological & Agricultural Engineering
Box 5906
Raleigh, North Carolina 27607

Dear Bill:

I have received copies of the papers which I requested by phone and I want to thank you sincerely for making them available to us.

We most sincerely would like to visit with you during the harvest and curing season. However, since we are not familiar with time schedules, I would like to ask you to suggest a date for this visit.

Best personal regards.

Sincerely yours,

AMF INCORPORATED

Joseph V. Fiore

JVF:cn

COMPANY CONFIDENTIAL

NCP ALTERNATES

by

THE STAFF

The Staff:

Joseph V. Fiore
T. Kenneth Kelly
John M. Slanski

Date: March 1, 1972

Presented to:
Dr. William H. Johnson on
March 15, 1972 at the
North Carolina State University
Raleigh, North Carolina

AMF-ENGINEERING & RESEARCH DIVISION
689 HOPE STREET
STAMFORD, CONN. 06907

INDEX

I. SUMMARY

This project has focused on an evaluation of freeze-dried tobacco, puffed tobacco and a tobacco substitute (oxycellulose) in comparison to the Microflake NCP process in terms of product filling power and smoke chemistry. The freeze-dried, puffed and Microflake NCP samples were all prepared from the same lot of flue-cured tobacco (C319) obtained through the courtesy of Dr. W. H. Johnson of North Carolina State University. The oxycellulose was a commercial product purchased from Eastman-Kodak.

At the request of Dr. Johnson, two additional samples have been included in these studies - i.e., a heat-treated flue-cured tobacco and its freeze-dried counterpart. These samples were also prepared from the same lot of tobacco noted above.

The findings accumulated during these studies can be summarized as follows:

1.) Freeze-drying and puffing do in fact improve the filling power of the original tobacco but the improvements are no more dramatic than those obtained by converting the same tobacco to a low density (foamed) sheet by the NCP process.

2.) Oxycellulose converted to a sheet by the Microflake process (either flat or foam) displays greater improvement in filling power than freeze-dried, puffed or NCP converted tobacco.

3.) Freeze-dried tobacco cigarettes (at the 100% level) seem to be an unsatisfactory commercial product because of softening during smoking. Puffed tobacco cigarettes (at the 100% level), on the other hand, display only a slight degree of softening.

4.) Oxycellulose cigarettes prepared via the Microflake process (at the 100% level) yield an unsatisfactory product from the point of view of taste and aroma.

5.) Freeze-dried tobacco (both conventional and heat-treated) and puffed tobacco show no significant smoke chemistry alterations from the controls under the conditions studied. Because of this finding, the data on the freeze-dried samples are at variance with those presented by Enzell et al., who reported a "significant difference" in smoke phenols between control and freeze-dried tobacco. However, our data is more consistent with their additional finding that there was no difference in ciliatoxic activity between the two samples. This would be expected if smoke phenols (which is the only variation reported by them in over 100 smoke compounds studied) were the same.

6.) The NCP process (low density materials) substantially reduces the tar yields not only with tobacco as the main sheet constituent but also with oxycellulose. This relationship is just as dramatic in the case of smoke phenols.

7.) The NCP process results in a substantial nicotine reduction over its unfoamed (flat) counterpart as compared to freeze-dried or puffed tobacco.

8.) Because of the high tar yields obtained with the oxycellulose type cigarettes, the reported safety of its combustion products becomes questionable.

II. INTRODUCTION

In February 1970, the World Tobacco Group began commercialization of NCP (low density sheet made by the Microflake process) with the assistance of the Engineering & Research Division personnel. It has therefore called for an awareness of possible competitive processes and products. Three areas which could possibly be competitive to NCP are freeze-dried tobacco, puffed tobacco, and tobacco substitutes because potentially, they are either low density products or they could result in "safer" cigarettes or both. For this reason, the NCP Alternate program has focused on these three competitive materials in comparison with regular Microflake NCP in terms of filling power studies and smoke chemistries.

III. EXPERIMENTAL

Early in 1971, Dr. William H. Johnson of North Carolina State University was contacted in order to ascertain the availability of freeze-dried tobacco samples which were needed to perform the evaluations intended for this study. The four samples we eventually received from Dr. Johnson are presented in Table 1. Variation in our experimental approach, as suggested by Dr. Johnson, was the introduction into the series of a heat-treated tobacco. It is very important to note that this particular sample is a conventionally flue-cured tobacco with a short-term heat-treatment which, according to Johnson, lowers polyphenols (up to 60%) and nicotine (up to 25%). The lowering of the polyphenols and nicotine in the tobacco is claimed to result in lower smoke nicotine and phenols. This claim is a very important one to keep in mind in later discussions with respect to smoke chemistries.

It was during the course of processing the above samples that the decision was made to take the same lot of virgin tobacco (Check C-319) and convert it to an NCP foam and flat sheet in order to see what the effects of Microflake processing would be on this particular type of tobacco as compared to freeze-drying, heat-treating and freeze-drying, and puffing. For this experiment, there was need for additional tobacco and therefore we contacted Dr. Johnson again. For this reason, control samples noted in the data are sometimes referred to as Check-1 and Check-2. What this simply means is that two shipments of the same identical starting material were received. In order to determine whether these two samples of tobacco were related and identical, analyses were carried out to determine the extractables and slurry pH's of the two samples. These data are contained in Table 2 and indicate that the two Check samples are identical and they vary in no way from the freeze-dried material where one might expect a loss in solubles because of the Turgor processing. However, there is a noticable difference in the percent water extractables and the slurry pH's in the heat-treated counterpart of this Check material.

In order to have a completely controlled series of experiments, it was decided also to see if we could prepare puffed tobacco from the same Check starting tobacco. Unfortunately, the amount of materials availabe from Dr. Johnson

were rather limited so that only selected experimentations could be carried out. It was hoped that the puffing of this particular tobacco sample could be carried out by Reynolds to compare their method of processing but after negotiations, Reynolds declined to participate in the study. For this reason, arrangements were made to puff the tobacco at Proctor & Schwartz under their experimental conditions using Freon.

The only additional sample left to add to this series would be a typical tobacco substitute. For these studies, because of the unavailability of Celanese or IDL (Imperial Development Ltd.) materials, it was decided to purchase Oxycel from Eastman-Kodak and use this material as the typical cellulosic tobacco substitute product. For the studies involving Oxycel, in order to convert this material into a cigarette, we decided to make a flat Oxycel and a foam Oxycel via the Microflake process. The formulations used for the preparation of the Microflake sheets are depicted in brief in Table 3.

In essence then, the studies described in this report have covered nine different samples as follows:

1.) Check control
2.) Check freeze-dried
3.) Heat-treated Check control
4.) Heat-treated Check freeze-dried
5.) Check flat by the Microflake process
6.) Check foam by the Microflake process
7.) Oxycel flat by the Microflake process
8.) Oxycel foam by the Microflake process
9.) Puffed Check tobacco made at Proctor & Schwartz.

The filling power determinations and smoke chemistry methodology employed throughout these studies were essentially those described in a Confidential Report prepared by the AMF Tobacco Machinery Division (now the World Tobacco Group) entitled "New Cigarette Process" dated July, 1970. Cigarettes were rolled on a Chico-AMF Standard Model CCM machine to a length of 85 mm. The only variation in methodology was the

use of a commercially available Borgwaldt Densimeter for the measurement of cigarette compressions (instead of the AMF designed unit) and for specific volume measurements.

IV. FILLING POWER DATA

Filling power data covering these samples is summarized in Table 4. Both NCP sheets (Check flat and Check foam) gave expected filling power values. The foamed oxidized cellulose cigarettes on the other hand, measured very high in filling power improvement - about 61% by weight. Freeze-drying gave about the same filling power as low density NCP (foamed NCP) cigarette filler. The puffed tobacco sample, on the other hand, gave only a 27% improvement in filling power by weight. It is by no means claimed that this material would be typical of the Reynold's process - it is, however, related. Because of the limited quantity of available tobacco, the processing conditions used by Proctor & Schwartz were in reality a "one-shot" deal.

Some observations made after these cigarettes were made and tested are very critical. It was noted, for example, that Check freeze-dried tobacco at the 100% level in a cigarette is a very unsatisfactory product from the point of view of softening. Immediately upon lighting the cigarette, it loses firmness and becomes extremely soft between the fingers. The observation is not the same when puffed tobacco is smoked. Puffed tobacco seems to have more resistance to softening during smoking. Additionally, the freeze-dried materials are extremely mild upon smoking. On the other hand, the oxycellulose material, both flat and foam, are extremely objectionable from the point of view of taste. Check flat and foam cigarettes were found to be no different than the typical NCP cigarettes at the 100% level as far as taste, aroma and smoking characteristics are concerned.

In conclusion then, one can say that freeze-drying and puffing do in fact improve the filling power of the original tobacco but the improvements are no more dramatic than those obtained by converting the same tobacco to a foamed material by the NCP process. The oxycellulose flat or foamed material, on the other hand, do display a higher percent improved filling power than freeze-dried, puffed or NCP converted tobacco.

V. SMOKE CHEMISTRY DATA

The data obtained on the smoke chemistries with these samples is summarized in Table 5. There are some interesting data comparisons that may be drawn from the study as seen in Table 5. The first being that the NCP process certainly reduces the TPM yield more than any other process, not only with tobacco but with the oxycellulose samples. This comparison does not hold true for freeze-drying or for puffing. Secondly, the NCP foam sheets and the two oxycellulose samples showed by far the highest amount of acrolein in the gas phase. On a TPM basis, we do not see a favorable reduction of TPM for freeze-drying or heat-treating or puffing or any combination of these processes, nor is there a TPM reduction when an oxidized cellulose is used in the form of a flat sheet. It is interesting to note that the oxycellulose flat sheet delivers more tar than the Check flat sheet which presumably has tobacco instead of the tobacco substitute in the same formulation. This certainly is an indication of the questionable toxicity of the components which arise from the oxidation of oxycellulose.

The most fascinating chemical studies are those involving phenol determinations. The lowest amounts of phenols recorded, as seen in Table 5, are those which involve the NCP (foamed Microflake) process as in the case of the Check foam and the Oxycel foam samples. The reduction is from five to tenfold.

In the beginning of this report, it was noted that heat-treated tobacco (HT), which is conventional flue-cured tobacco with a short-term heat-treatment, according to Johnson, lowers polyphenols up to 60% which in turn is claimed to reduce smoke phenols. If one looks at the data in Table 5, there is no evidence of a substantial reduction in phenols by freeze-drying (with either the Check or Heat-treated samples). This finding is in complete opposition to the data reported by Enzell, Bergstedt, Balhamn & Johnson, Beitrage Zur Tabakforschung Vol. 6, pg. 41, 1971 entitled "Chemical & Ciliatoxic Studies of Smoke from Freeze-Dried Tobacco". These authors noted "an interesting and unexpected difference in the amount of phenol", irrespective

of the basis on which the comparison was made, with regard to the freeze-dried and non-freeze-dried samples. It should also be pointed out that the same article goes on to say that despite this striking quantitative difference in phenol, there was no difference found in the ciliatoxic properties of the two samples. Wynder et al. of the American Health Foundation have previously reported that a relationship between phenol content of smoke and ciliatoxic activity does exist and that high phenol levels do depress this activity. Based upon the data reported by Enzell et al., and those found in our laboratory, and assuming that the ciliatoxic effects of phenol are as reported by Wynder et al., it is obvious that the phenol data by Enzell et al. are somewhat questionable. In all other respects our data seem to be consistent with those reported by Enzell et al.

One other piece of data is worth noting. The NCP process results in a substantial nicotine reduction over its unfoamed (flat) counterpart as compared to the freeze-dried or puffed tobacco samples made with the same tobacco.

In conclusion then, one can state that these studies definitely indicate that the NCP Microflake foam process does indeed alter the smoke chemistry significantly over any other process studied within this series, namely freeze-drying and puffing. Additionally, even in the case of tobacco substitutes, which we have found to result in high tar yields, the NCP foam process does indeed change the smoke chemistry significantly at least with respect to tar yield and smoke phenols.

TABLE 1

FREEZE-DRIED SAMPLES*

SAMPLE DESIGNATION	SAMPLE DESCRIPTION	REMARKS
CK	CHECK (CONTROL)	Conventionally flue-cured tobacco (C-319).
CKFD	CHECK-FREEZE-DRIED	Same as above (CK) but additionally freeze-dried.
HT	HEAT-TREATED DURING CURING	Conventionally flue-cured tobacco with a short-term heat treatment which according to Johnson lowers polyphenols (up to 60%) and nicotine (up to 25%) and therefore smoke phenols and nicotine.
HTFD	HEAT-TREATED AND FREEZE-DRIED	Same as HT but additionally freeze-dried.

* ALL SAMPLES WERE PREPARED FROM THE SAME LOT OF TOBACCO.

TABLE 2

EXTRACTABLES

SAMPLE	% H_2O SOLUBLES (DRY BASIS)	pH OF APPROX. 3½% SLURRY
CK-1 (CONTROL)	48.7	5.15
CK-2 (CONTROL)	48.2	5.15
CKFD	48.0	5.10
HT	46.0	4.75
HTFD	50.1	4.80

TABLE 3

SHEET FORMULAS

SO. WINDSOR TRIALS (3/30/71)

SAMPLE	RUN NO.	DESCRIPTION	TOBACCO OR OXYCEL LEVEL % (d.b.)
CK-2 FOAM	75-7	NCP FOAM SHEET WITH C-319 TOBACCO	77
CK-2 FLAT	75-3	NCP FLAT SHEET WITH C-319 TOBACCO	77
OXYCEL*-FOAM	75-8	OXIDIZED CELLULOSE FOAM	77
OXYCEL*-FLAT	75-4	OXIDIZED CELLULOSE FLAT	77

* EASTMAN-KODAK OXYCELLULOSE

COMMON BASE WEB

23% (d.b.) CONSISTING OF GUMS, HUMECTANTS, ETC.

C-319 TOBACCO - NATURAL FLUE-CURED BRIGHT LEAF.

TABLE 4

FILLING POWER DATA

SAMPLE	% IMPROVEMENT IN FILLING POWER BY WEIGHT[1].	BY VOLUME[2].
CK (CONTROL)	0	0
CKFD	40	62
HT	- 5	- 6
HTFD	42	56
CK-FLAT	27	34
CK-FOAM	45	59
OXYCEL-FLAT	51	10 ?
OXYCEL-FOAM	61	103
P & S #4[3].	27	35

1. As cigarettes

2. As Shreds

3. Puffed tobacco prepared at Proctor & Schwartz from Check Control tobacco.

TABLE 5

SMOKE CHEMISTRIES[1].

SAMPLE	WATER	NICOTINE	T.P.M.[2]	TAR	TAR/ NICOTINE RATIO	CO	ACETAL-DEHYDE	ACRO-LEIN	PHENOL[4]	O-CRESOL[4]	M&P CRESOL
CK	7.95	5.44	75.01	61.77	11.4	26.61	0.95	0.31	276	63	108
CKFD	13.73	4.45	86.72	68.54	15.4	31.62	1.20	0.33	255	56	100
HT	6.85	3.51	71.26	55.27	15.7	24.16	0.62	0.24	268	69	99
HTFD	12.46	4.32	73.31	56.54	13.1	29.08	0.80	0.21	205	46	71
CK-FLAT	8.37	3.37	72.55	60.82	18.0	33.29	1.20	0.41	122	29	46
CK-FOAM	1.60	0.98	23.86	21.90	22.2	27.84	0.94	1.05	11	5	4
OXYCEL-FLAT	27.05	0.27	112.58	82.35	303	35.07	1.12	1.36	49	<2	<2
OXYCEL-FOAM	5.41	0.30	37.21	32.58	108	21.80	0.82	1.91	10	<2	<2
P&S #4[3]	5.98	4.63	76.1	65.50	14.1	23.92	1.57	0.76	-	-	-

1. All data expressed as mg/gm. tobacco (or other) consumed except phenols.

2. T.P.M. = Total particulate matter.

3. Puffed tobacco prepared from Check tobacco at Proctor & Schwartz.

4. Phenol data expressed as micrograms/gm tobacco (or other) consumed

FILM POS 85% ORIG SIZE

AMF INCORPORATED • MOREHEAD PATTERSON CENTER
689 Hope Street, Stamford, Connecticut 06907 • 203/325-2211

March 20, 1972

Dr. W. H. Johnson
North Carolina State University
Dept. of Biological & Agricultural Engineering
Raleigh, No. Carolina

Dear Bill:

On behalf of myself and my colleagues, Messrs. Halter and Bott, I would like to express our thanks for the courtesy extended to us during our visit with you in North Carolina.

It was indeed a very rewarding and pleasurable visit and we look forward to the possibility of visiting with you again late in the summer during the harvesting of flue-cured tobacco.

Just as soon as we are able to collect our thoughts and determine a course of action, I will be back in touch with you. In the meantime, best personal regards to you and Mrs. "Cold Duck".

Sincerely yours,

AMF INCORPORATED

Joseph V. Fiore

JVF:cn

cc: H.M. Halter
G. Bott

NORTH CAROLINA STATE UNIVERSITY AT RALEIGH

SCHOOL OF AGRICULTURE AND LIFE SCIENCES

DEPARTMENT OF BIOLOGICAL AND AGRICULTURAL ENGINEERING
Box 5906 ZIP 27607

January 11, 1972

Dr. Joseph V. Fiore
Laboratory Manager
AMF Incorporated
689 Hope Street
Stamford, Conn. 06907

Dear Joe:

I appreciate receiving your call yesterday and look forward to your coming down to Raleigh sometime in the near future for discussions on the results of your tests and on curing - fermentation processes.

Enclosed are a number of reprints which may be of interest, particularly as regards curing and certain oxidative browning reactions.

Sincerely yours,

Bill
William H. Johnson
Professor

WHJ/pt

Encl.

AMF INCORPORATED · MOREHEAD PATTERSON CENTER
689 Hope Street, Stamford, Connecticut 06907 · 203/325-2211

May 10, 1971

Dr. William H. Johnson
Biological & Agricultural Engrg. Dept.
North Carolina State University
Raleigh, North Carolina

Dear Bill:

I have just received your new shipment of the control tobacco which was used in our freeze drying experiments. Again, I am most grateful for your full cooperation and assistance in this work.

Thus far our studies indicate that the Check Freeze-Dried shreds seem to display a filling power improvement of 44% over the Check control. These are preliminary data which will give you some idea of where the freeze-dried samples sit with respect to filling power.

As I promised you, as soon as we have all our data we expect to visit with you and discuss them in person.

Again many, many thanks.

Sincerely yours,

AMF INCORPORATED

Joe Fiore

JVF:cn

Dr. Joseph V. Fiore,
Laboratory Manager

cc: W.J. Nellen
T.K. Kelly

AMERICAN MACHINE & FOUNDRY COMPANY
MOREHEAD PATTERSON CENTER
689 Hope Street, Stamford, Connecticut 06907 • Area Code 203/325-2211

March 5, 1971

Dr. William H. Johnson
North Carolina State University
Dept. of Biological &
Agricultural Engineering
Raleigh, North Carolina

Dear Bill:

I would like to commend you and your associates not only for the cooperation which you have extended us in the preparation of the freeze-dried samples, but also for the expedient fashion in which you have executed our request. The freeze-dried samples described in your letter to me dated January 28, 1971 have been received and will be analyzed as rapidly as possible.

As soon as I receive more of the Check (CK) sample, we will convert this to a low density material by our own AMF Process and will start working on it.

Again, many, many thanks for your cooperation. I will look forward to meeting you personally when these studies are completed.

Sincerely yours,

AMF INCORPORATED

Joseph V. Fiore

JVF:cn

Dr. Joseph V. Fiore,
Laboratory Manager

January 28, 1971

Dr. Joseph V. Fiore, Laboratory Manager
Research Division, AMF Inc.
689 Hope Street
Stamford, Connecticut 06907

Dear Dr. Fiore:

I appreciate receiving your call recently and learning of your continued interests in performing certain evaluations on freeze-dried tobacco. Also, I am pleased to learn of Howard Hafter's advance to Vice President within the company.

As discussed earlier with Howard, I will be pleased to process selected tobacco samples from our ongoing research program for evaluation by your laboratory. Two samples from a study on thermal modification of leaf constituents in combination with freeze drying would be of particular interest. In 1969 we began a study in which Coker 319 tobacco was produced at the Oxford Research Station for test material. Tobacco was harvested weekly for six primings. Following the yellowing phase of curing, a portion of the tobacco was submitted to a short-term heat treatment which previous studies had shown will significantly reduce polyphenol content (up to 60%) and nicotine (up to 25%). The remainder of curing throughout the drying phase was identical for both lots of tobacco, which are identified as check (CK) and heat treated (HT). For each lot, composite samples were made over primings and these were stemmed, redryed and shredded.

Howard and I discussed earlier that it may be possible to obtain evaluations on 5-lb samples. I would propose four samples as follows:

1. Check (CK). Conventionally flue-cured tobacco as described above, C 319, composite over primings.
2. Check-freeze dried (CKFD). This sample would represent the check further processed by turgor conditioning, freezing, freeze-drying, and reconditioning.
3. Heat-treated during curing (HT). Conventionally flue-cured but including the short-term heat treatment.
4. Heat treated and freeze dried (HTFD). Same as sample 3 but further processed by freeze drying.

For the freeze-drying conditions, I would propose that suitable process parameters be used which will provide a substantial expansion but with minimal solute losses. This would involve turgor conditioning with a water/solids ratio of about 4.0/1 to 4.25/1, rapid freezing, freeze-drying and reconditioning.

I look forward to hearing from you in regards to whether the samples suggested will be suitable.

Sincerely yours,

William H. Johnson

William H. Johnson
Professor

WHJ/cbe

AMERICAN MACHINE & FOUNDRY COMPANY
MOREHEAD PATTERSON CENTER
689 Hope Street, Stamford, Connecticut 06907 • Area Code 203/325-2211

February 2, 1971

Dr. William H. Johnson
North Carolina State University
School of Agriculture and Life Sciences
Dept. of Biological & Agricultural Engineering
Box 5906
Raleigh, N. C. 27607

Dear Dr. Johnson:

I have just received your letter of January 28th and am extremely excited about your proposed plan of attack. I have no objections whatsoever to your proposal regarding the types of samples which should be prepared. I would, however, like to make one request and that is that if at all possible, the sample size should be 10 pounds instead of 5 pounds.

I would like to know when you plan to start preparation of these samples and approximately how long from that date will it take before I receive the samples. Is it possible to have one of our people witness some of the freeze-drying techniques during the preparation of these samples?

I am sincerely grateful for your cooperation and interest in our tobacco investigations.

Sincerely yours,

AMF INCORPORATED

Joseph V. Fiore

Dr. Joseph V. Fiore,
Laboratory Manager

JVF:cn

cc: H.M. Halter

AMF

TOBACCO MACHINERY DIVISION
6301 Midlothian Turnpike, Richmond, Virginia 23225 · 703/276-1900
AMF INCORPORATED

HOWARD M. HALTER
Vice President
and
Director of Engineering

February 15, 1971

Dr. William H. Johnson
Department of Biological
and Agricultural Engineering
North Carolina State University
Box 5906
Raleigh, North Carolina 27607

Dear Bill:

Thanks for the kind wishes on my new position.

Attached is a copy of the AMF paper on "Tobacco Density Effects on Combustion and Smoke Composition" as you requested. We will certainly be anxious to make similar analyses on the samples of freeze-dried natural tobacco which you will supply. The data, of course, will be made available to you upon completion.

We look forward to a most interesting cooperative study.

Best Regards.

Sincerely yours,

Howard M. Halter

Howard M. Halter
Vice-President and
Director of Engineering

HMH/fah

February 2, 1971

Dr. Howard M. Halter
AMF Incorporated
6301 Midlothian Turnpike
Richmond, Virginia 23225

Dear Howard:

Congratulations on your new position! I have corresponded recently with Dr. J. V. Fiore and learned of your promotion.

We are looking forward to obtaining certain evaluations on the freeze-dried tobaccos from the BAE 126 Study involving thermal modification of leaf constituents and freeze drying after curing.

I wonder if it would be possible to obtain from you a copy of the paper you presented in Hamburg: "Tobacco Density Effects on Combustion and Smoke Composition". The changes you have observed related to changes in physical structure are very interesting and may be similar to those obtained by freeze drying.

I look forward to hearing from you and extend my best wishes for success in your new "post".

Sincerely yours,

William H. Johnson

William H. Johnson
Professor

WHJ/kp

June 19, 1970

Mr. James E. Morris
AMF INCORPORATED
6301 Midlothian Turnpike
Richmond, Virginia 23225

Dear Jim:

Thank you for your letter of June 17. It was a pleasure having you visit with us recently for discussions on tobacco processing, freeze drying, etc.

I have made reservations for you and the three others from AMF at the College Inn Motel for the night of June 30. The schedule as suggested is fine and I look forward to further discussions on topics of mutual interest.

With best regards.

Sincerely yours,

Bill

William H. Johnson
Professor

WHJ/pf

"The name of American Machine & Foundry Company has been changed to AMF INCORPORATED."

AMF

U. S. OPERATIONS · 6301 Midlothian Turnpike, Richmond, Virginia 23225 · 703/276-1900
Telex: 827496 · Cable: AMMAFOCO, Richmond
Tobacco Machinery Division · AMERICAN MACHINE & FOUNDRY COMPANY

June 17, 1970

William Johnson, PhD
North Carolina State University
Department of Agriculture Engineering
Raleigh, North Carolina

Dear Bill:

Again I want to thank you most sincerely for the time and generous attention you afforded me during my visit to your laboratory Monday, June 15. It was a most pleasant experience and I hope that we will derive some mutual benefits from the occasion.

Confirming arrangements discussed over the telephone June 16, we would like to visit your laboratory June 30, stay overnight and leave July 1. The names of the visitors are Messrs Howard Halter, Bob Ruggles, John Slansky and myself. Unfortunately, the aircraft schedules to Raleigh in the mornings are not good; consequently, we will be arriving on Eastern flight 863 at 1:01 p.m. as a party and coming direct to your laboratory with the intention of starting work as soon as we get to you.

We understand that you will be good enough to make arrangements for overnight accommodations for us at The College Inn; and we would spend the next day with you, leaving in time to take aircraft out of Raleigh airport at 5:20 p.m. for two of the party, and 6:00 p.m. for the other two which enables us to get a full day with you.

The objects of the visit would be to have a similar discussion concerning freeze dry tobacco along the lines you presented to me and also to discuss other research work you have done in connection with processing tobacco from the farmer to manufacturing cigarettes.

Continued

Once again, many thanks for your kindnesses and we look forward to meeting with you. My kindest regards.

Yours sincerely,

James E. Morris
Consultant

JEM:lyc

NORTH CAROLINA STATE UNIVERSITY AT RALEIGH

SCHOOL OF AGRICULTURE AND LIFE SCIENCES

DEPARTMENT OF BIOLOGICAL AND AGRICULTURAL ENGINEERING
Box 5906 ZIP 27607

March 5, 1971

Dr. Joseph V. Fiore, Laboratory Manager
Research Division, AMF Inc.
689 Hope Street
Stamford, Connecticut 06907

Dear Dr. Fiore:

We are pleased to say that we have available some additional shredded tobacco from the study BAE 126 which can be used for manufacturer into low density sheet. I feel that your plan for carrying this through the separate route is excellent and will provide a direct comparison between the two methods, utilizing the same material. We are preparing around 25 pounds of the check material which will be mailed to you separately.

I am glad that you are thinking of a possible visit to North Carolina State University to discuss further this research and to see the freeze drying operation. We have made considerable progress during the past two years with the respect to developments on the process for improved operation and economy.

I look forward to further correspondence with you and to your visiting with us, hopefully in the near future.

With best regards,

Sincerely yours

William H. Johnson

William H. Johnson
Professor

WHJ/pbt

February 25, 1971

Dr. Joseph V. Fiore, Laboratory Manager
Research Division, AMF Inc.
689 Hope Street
Stamford, Connecticut 06907

Dear Dr. Fiore:

We have completed the processing of tobacco samples as discussed in my letter to you of January 28, 1971 and the samples were forwarded to you earlier this week. As discussed, the four samples consisted of the Check, the Check-freeze dried, Heat-treated during curing, and Heat treated freeze-dried.

The tobacco samples were processed generally as discussed in my letter including: turgor conditioning with a water to solid ratio of 4.25/1, rapid freezing by vacuum freezing, freeze-drying and reconditioning. I would suggest that the tobacco be examined upon receipt and consideration be given to possible further conditioning prior to shred separation. We have noticed that shred separationooccurs somewhat better if the tobacco is at a moisture level of at least 15%.

We sincerely appreciate your interest and cooperation in performing certain evaluations on these tobacco samples. Again I would extend an invitation to you to visit with us at any time in regards to the freeze drying project.

Sincerely yours,

William H. Johnson

William H. Johnson
Professor

WHJ/PF

Driscoll Nu-Way Tobacco
Rockville, Conn.

Mr. Don Driscoll —

At this plant we observed the process of reconstituting tobacco for cigar binder. Discussion of processes were concerned with problems related to to the following:

1. gaining uniform particle size of tobacco — this has been fairly successfully solved by remoistening large particles into pulverizing heads however, an occasional large particle at the point of spreading the tobacco - adhesive mixture onto the stainless steel belt will cause slits to appear in the end sheet.

2. They are able to use stems, shredy etc. and utilize the majority of tobacco material. Slight cracks on the adhesive are closely controlled.

Dr. Cardogan — American Machine & Foundry Company

Springdale Connecticut.

1. In the microflake process for cigarette tobacco. the tobacco is ground to 90% — 100 mesh.
2. Approx. 50% of research with tobacco.
3. They have 1 commercial plant for cigarette tobacco. Rockville Tuxbay Tobacco (?)
4. & 2 plants for cigar tobacco.
5. Process of reconstituting diffrent for cigar & cigarette tobacco.
   - ⓐ powder form for cigarette — laminating sheets — binder or adhesive applied between powder tobacco.
6. Use aged tobacco in research tests.

2. Maintaining quality control through use of electronic control of fuel supply, ~~co~~ speed of drying, and mixture ratio percentage.

In general, this process demonstrates the importance of industrial development in a process highly important to the economy of the Connecticut farmers. Offering many advantages to the cigar industry, it also challenges the imagination of research engineers to develop new and perhaps revolutionary methods of harvesting in preparation for processing.

The Zuber process for quick drying of tobacco tissue followed by chemical conversion of the biochemical phase normally completed during curing offers one possible revolutionary solution. It is felt that either something along this line, or mechanized harvesting will be necessary if the Connecticut leaf grower is to survive.

In relation to our curing research, the possible application of the reconstituting process was discussed. It was pointed out to them that in view of possible improvements in mechanization, there might be possibilities of the reconstituting process fitting into the scheme of affairs at an even different level than it presently does. For example tobacco shredded after yellowing might be then reconstituted, assuming that the aging ~~yellowing~~ process could be ~~to~~ successfully completed after this treatment. Contacts made with the companies were:

Dr. Kadigan at Springdale & Don Driscoll at Rockville.

Dr. Zuber at the New Haven Agr. Exp. Station has submitted samples to Rockville for reconstituting. ~~The was~~ The possibility of our submitting

samples for reconstituting were also discussed & Driscoll gave us the impression that they would be glad to cooperate with us.

The plant at Rockville, requiring only 10-15 men will turn out 1,000,000 #s tobacco/year. It is produced in 4 ft sheets and packaged at the plant for shipping. Approx. 20% of the ~~[illegible]~~ final sheets consists of adhesive.

Quality control & uniformity of product is maintained by tests of:

tensile strength, wet & dry

burning properties

porosity