GR

ORIGINAL SUBMISSION

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WM. BOLTHOUSE FARMS, INC.
7200 EAST BRUNDAGE LANE • BAKERSFIELD, CA 93307-3099
661/ 366-7205 • FAX: 661/ 366-2834

RECEIVED
SEP 13 2002
OFFICE OF
FOOD ADDITIVE SAFETY

September 6, 2002

Paulette M. Gaynor, Ph.D.
Consumer Safety Officer
U.S. Food and Drug Administration
Center for Food Safety and Applied Nutrition Office of Food Additive Safety
HFS-255
5100 Paint Branch Parkway
College Park, MD 20740

Dear Ms. Gaynor:

Wm. Bolthouse Farms, Inc. (Bolthouse), 7200 East Brundage Lane, Bakersfield, CA 93307-3099, is submitting this Notification and supporting documentation that Hydrobind™ Carrot Fiber/ Carrot Isolate (formerly referred to as Carrot Fiber 602), when prepared according to Bolthouse food grade specifications, is Generally Recognized as Safe (GRAS) for use as a binder/extender and to reduce water purging and gelling in specific standardized and nonstandardized meat and poultry products, including reduced fat products, as a quality and yield improvement in a variety of bakery goods, when used according to Good Manufacturing Practice, at use levels ranging from 0.4% to 5.0% of from 0.4% up to 5.0% of flour weight (baking applications) or total formula weight (processed meat and poultry applications). The levels of use of Hydrobind™ are self-limiting, as unacceptable taste and texture characteristics result when recommended levels are exceeded. Due to the self-limiting levels of use, neither baked goods nor processed meat products can make fiber claims based on Hydrobind™ content.

Unlike most other fibers currently being used in foods, Hydrobind™ is made from the edible portion of the fresh commodity. Hydrobind™ has functional properties that confer important advantages as compared to conventional fiber ingredients.

This GRAS Notification has been developed in accordance with the FDA policy set forth in the Federal Register Notice dated April 17, 1997 (62 FR 18938). Bolthouse is simultaneously seeking a determination from the USDA Food Safety and Inspection Service (FSIS) that Hydrobind™ Carrot Fiber is suitable for the uses in meat products that are the subject of this Notification. As required in FDA's proposed policy for coordinated FSIS review (65 Fed Reg 51758, 8/25/2000), we are enclosing four copies of this Notification. We respectfully request that FDA forward a copy to FSIS for their review. To facilitate the coordinated determination of safety and suitability under the Memorandum of Understanding between FDA and FSIS, Section VI of this Notification contains data demonstrating the functional suitability of Hydrobind™ Carrot Fiber in processed meat and poultry products.

This GRAS determination has been made through scientific procedures as corroborated by common use in foods. The data and information in this notification establish that the carrot isolate/carrot fiber is substantially equivalent to the fiber in carrots. At the request of Bolthouse, qualified scientific experts critically evaluated and summarized information relevant to the GRAS status of Hydrobind™, including both generally available and company confidential information about production; published literature on the historical consumption of carrots; published literature on the compositions and physiology of carrots; information from the literature and from Bolthouse concerning the production of fresh carrots; information from Bolthouse about their processing methods for fresh carrots and Hydrobind™, including quality assurance procedures and typical results of safety testing. This Notification contains detailed information relating to the technical safety of Hydrobind™. Hydrobind™ is the fiber portion of fresh carrot. Carrots, and the fiber they contain, have been consumed for centuries. Estimated daily intakes of carrot fiber/carrot isolate associated with the proposed uses correspond to the adding the fiber portion of 1.23g -12g of fresh carrot per day to the US diet.

Pursuant to proposed 21 CFR 170.36(c)(1), Bolthouse provides the following required information:

Notifier:	Wm. Bolthouse Farms, Inc.
Mailing Address:	7200 East Brundage Lane Bakersfield, CA 93307-3099 Att'n.: Don Bailey Regional Sales Director

Common or Usual Name:	Carrot fiber (when used in FDA-regulated products) or Carrot isolate (when used in meat and poultry products)
Applicable Conditions of Use:	Increase yield and improve softness, texture and slice flexibility in various bakery products ranging from dinner rolls and breads to cakes, pastries and tortillas; as a binder/extender in various standardized and nonstandardized meat and poultry products such as sausages and pates, and to reduce water purging and gelling in canned meat and poultry products.
Basis for GRAS Determination:	Scientific Procedures as corroborated by common use in foods
Availability of Data:	The data and information that are the basis for this GRAS determination are available for FDA's review or copying during business hours at the offices of Exponent, Inc. (formerly Novigen Sciences, Inc.), 1730 Rhode Island Ave., NW, Suite 1100, Washington, DC 20036, telephone (202) 293-5374. Bolthouse agrees to provide copies of this information to FDA at FDA's request. GRAS Exemption
Claim:	The uses of Hydrobrind™ to increase yield and improve softness, texture and slice flexibility in various bakery products ranging from dinner rolls and breads to cakes, pastries and tortillas; as a binder/extender in various standardized and nonstandardized meat and poultry products such as sausages and pates; and to reduce water purging and gelling in canned meat and poultry products, are exempt from the premarket approval requirements of the Federal Food, Drug, and Cosmetic Act (the Act) because Wm. Bolthouse Farms, Inc. has determined that such uses are GRAS.

Please direct any questions or information requests concerning this Notification to Dr. Nancy Rachman at Exponent, (202) 293-5374, or nrachman@exponent.com.

Sincerely,

Don Bailey
Regional Sales Director
Wm. Bolthouse Farms, Inc.

Enclosures

NJR/sad

Wm. Bolthouse Farms, Inc.

Fax Message

Date:	9/27/02
To:	Linda Kahl and Bob Martin, U.S. Food and Drug Administration Fax: 202-418-3131
From:	Don Bailey, Wm. Bolthouse Farms Phone: 352-315-0940 Fax: 352-315-0963
Pages:	5
Subject:	Revised Cover Letter for GRAS Submission

Dear Linda and Bob:

Following is a signed revised copy of the cover letter for the GRAS submission of HYDROBIND™ from Wm. Bolthouse Farms. The original signed letter is being mailed to your attention and should arrive early next week.

Please contact Nancy Rachman, Exponent Inc., at telephone 202-293-5374, for any questions.

Best regards,
Wm. Bolthouse Farms

Don Bailey

WM. BOLTHOUSE FARMS, INC.
7200 EAST BRUNDAGE LANE • BAKERSFIELD, CA 93307-3099
661/366-7205 • FAX 661/366-2834

September 6, 2002

Paulette M. Gaynor, Ph.D.
Consumer Safety Officer
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HFS-255
5100 Paint Branch Parkway
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Unlike most other fibers currently being used in foods, Hydrobind™ is made from the edible portion of the fresh commodity. Hydrobind™ has functional properties that confer important advantages as compared to conventional fiber ingredients.

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This GRAS determination has been made through scientific procedures. The data and information in this notification establish that the carrot isolate/carrot fiber is substantially equivalent to the fiber in carrots. At the request of Bolthouse, qualified scientific experts critically evaluated and summarized information relevant to the GRAS status of Hydrobind™, including both generally available and company confidential information about production; published literature on the historical consumption of carrots; published literature on the compositions and physiology of carrots; information from the literature and from Bolthouse concerning the production of fresh carrots; information from Bolthouse about their processing methods for fresh carrots and Hydrobind™, including quality assurance procedures and typical results of safety testing. This Notification contains detailed information relating to the technical safety of Hydrobind™. Hydrobind™ is the fiber portion of fresh carrot. Carrots, and the fiber they contain, have been consumed for centuries. Estimated daily intakes of carrot fiber/carrot isolate associated with the proposed uses correspond to the adding the fiber portion of 1.23g -12g of fresh carrot per day to the US diet.

Pursuant to proposed 21 CFR 170.36(c)(1), Bolthouse provides the following required information:

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Mailing Address:	7200 East Brundage Lane Bakersfield, CA 93307-3099 Att'n.: Don Bailey Regional Sales Director

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Basis for GRAS Determination:	Scientific Procedures
Availability of Data:	The data and information that are the basis for this GRAS determination are available for FDA's review or copying during business hours at the offices of Exponent, Inc. (formerly Novigen Sciences, Inc.), 1730 Rhode Island Ave., NW, Suite 1100, Washington, DC 20036, telephone (202) 293-5374. Bolthouse agrees to provide copies of this information to FDA at FDA's request. GRAS Exemption
Claim:	The uses of Hydrobrind™ to increase yield and improve softness, texture and slice flexibility in various bakery products ranging from dinner rolls and breads to cakes, pastries and tortillas; as a binder/extender in various standardized and nonstandardized meat and poultry products such as sausages and pates; and to reduce water purging and gelling in canned meat and poultry products, are exempt from the premarket approval requirements of the Federal Food, Drug, and Cosmetic Act (the Act) because Wm. Bolthouse Farms, Inc. has determined that such uses are GRAS.

Please direct any questions or information requests concerning this Notification to Dr. Nancy Rachman at Exponent, (202) 293-5374, or nrachman@exponent.com.

Sincerely,

Don Bailey
Regional Sales Director
Wm. Bolthouse Farms, Inc.

Enclosures

NJR/sad

WM. BOLTHOUSE FARMS, INC.
7200 EAST BRUNDAGE LANE • BAKERSFIELD, CA 93307-5099
661/ 366-7205 • FAX: 661/ 366-2834

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OCT 3 2002
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September 6, 2002

Paulette M. Gaynor, Ph.D.
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Sincerely,

Don Bailey
Regional Sales Director
Wm. Bolthouse Farms, Inc.

Enclosures

NJR/sad

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(formerly Novigen Sciences, Inc.)

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United States

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GRAS NOTIFICATION FOR HYDROBIND™

SUBMITTED BY:
Wm. Bolthouse Farms, Inc.
7200 East Brundage Lane
Bakersfield, CA 93307-3099

SUBMITTED TO:
Paulette M. Gaynor, Ph.D.
U.S. Food and Drug Administration
Center for Food Safety and Applied Nutrition
Office of Food Additive Safety
HFS-255
5100 Paint Branch Parkway
College Park, MD 20740

CONTACT FOR TECHNICAL OR OTHER INFORMATION:
Nancy J. Rachman, Ph.D.
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September 9, 2002

WD00595.000-F0T0-0902-0002

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I. SUMMARY AND INTRODUCTION

Wm. Bolthouse Farms, Inc. (Bolthouse) is submitting this notification that Hydrobind™ Carrot Fiber (when used in baked goods) and Hydrobind™ Carrot Isolate (when used in standardized and nonstandardized processed meat and poultry products), prepared according to food grade specifications, is Generally Recognized as Safe (GRAS) for use as a binder/extender and to reduce water purging and gelling in specific processed meat and poultry products, and to improve texture and yield and reduce caloric content in a variety of bakery goods, when used according to Good Manufacturing Practice. Hydrobind™ was formerly referred to as "Carrot Fiber 602". This GRAS Notification has been developed in accordance with the FDA policy set forth in the Federal Register Notice dated April 17, 1997 (62 FR 18938). The use levels for Hydrobind™ in the proposed products range from 0.4% up to 5.0% of flour weight (baking applications) or total formula (product) weight (processed meat and poultry applications). The levels of use of Hydrobind™ are self-limiting, as unacceptable taste and texture characteristics result when recommended levels are exceeded. Due to the self-limiting levels of use, neither baked goods nor processed meat and poultry products can make fiber claims based on Hydrobind™ content.

Bolthouse is simultaneously seeking a determination from the USDA Food Safety and Inspection Service (FSIS) that Hydrobind™ Carrot Isolate is safe and suitable for use in standardized and nonstandardized processed meat and poultry products that are the subject of this Notification. Data demonstrating the functionality of Hydrobind™ Carrot Isolate in processed meat and poultry products can be found in Section VI of this Notification. As certain standardized and nonstandardized processed meat or poultry products may contain mixtures of available animal proteins, Hydrobind™ has been evaluated in formulations containing single meats and combinations of animal proteins (beef, pork, and poultry). Additional research on specific standardized and nonstandardized processed meat and poultry products is underway, and data will be provided to the USDA as they become available.

Hydrobind™ is the dried fiber portion of fresh carrots ("carrot fiber"). Unlike most other fibers currently being used in foods, Hydrobind™ is made from the <u>edible</u> portion of the fresh commodity. Hydrobind™ has functional properties that confer important advantages as compared to conventional fiber ingredients. These properties include:

- The ability to absorb, at low soluble fiber levels, at least 10 times its weight in water but only 4 times its weight in oil, while imparting an excellent, smooth texture.
- Higher water absorption and less oil binding capacity than other fibers used as food additives.
- High dietary fiber content, typically more than 90% of total solids.
- Caloric content of only 1.6 calories per gram, making Hydrobind™ ideal for reducing the caloric (i.e., fat) content of many foods.

Hydrobind™ is a free flowing, bland tasting, off-white powder, composed of natural soluble and insoluble fiber from fresh carrots. This natural food ingredient is made through a patent-pending process that was developed solely by Wm. Bolthouse Farms, Inc. The process of making Hydrobind™ is a series of physical processes that renders a free-flowing powder from fresh carrots. There are no chemical extractions or treatments involved. This Notification pertains to unbleached Hydrobind™.

The fresh carrot from which Hydrobind™ is removed has been consumed for centuries. For example, carrots were among the vegetables eaten by early Mediterranean civilizations in Sumer and Egypt (around 3000 B.C.) (McGee 1984). There are no known detrimental effects associated with its typical consumption.

Hydrobind™ is generally consumed at levels lower than or similar to the fiber portion in a typical serving of fresh carrots. According to USDA's Nutrient Database for Standard Reference, 100 grams of fresh carrots contains 3 grams of fiber. According to 21 CFR 101, Exhibit C, Nutrition Facts for Raw Fruits and Vegetables, a typical fresh carrot (7" length, 1 ¼" diameter, weight 78 g) contains 2 g (8%) dietary fiber. The recommended daily intake of fiber is 25 g (for a 2000 calorie diet) (21 CFR 109.9 (9)). The properties of Hydrobind™ are such that the usage level is self-limiting and generally does not exceed 3%, of flour weight in the case of bakery goods, and of total formula (product) weight in processed meat and poultry products. The maximum recommended use level is 5% of flour weight in dense breads, which corresponds to a concentration of 3% by weight in the bread dough. The consumption level of Hydrobind™ in a typical product serving (baked good or processed meat/poultry product) would be less than or similar to the fiber content in a fresh carrot.

At the request of Bolthouse, Exponent, Inc. (Exponent) (formerly Novigen Sciences, Inc.), critically evaluated and summarized information relevant to the GRAS status of Hydrobind™, including both generally available and company confidential information about production; published literature on the historical consumption of carrots; published literature on the composition and physiology of carrots; information from the literature and from Bolthouse concerning the production of fresh carrots; information from Bolthouse about their processing methods for fresh carrots and Hydrobind™, including quality assurance procedures and typical results of safety testing; and information and data from Bolthouse about proposed uses of Hydrobind™ in baked goods and standardized and nonstandardized processed meat and poultry products.

Exponent also estimated the consumer exposure associated with the proposed uses. Based on current USDA information, mean U.S. *per capita* consumption of fiber from carrots in the diet is about 0.3 g/day. Assuming that 133% of Hydrobind™ production capacity (8 million lb) is consumed in the US, mean *per capita* consumption of the fiber portion of fresh carrot would increase by 0.03 g/day, which corresponds to adding the fiber portion of 0.01 medium whole carrot/day to the US diet. Exponent concluded that Hydrobind™, meeting appropriate specifications and used according to Good Manufacturing Practice, is GRAS by scientific procedures, for use in the bakery and meat and poultry products at the proposed levels. A summary of Exponent's findings is included as Exhibit 1 of this document.

II. IDENTITY OF SUBSTANCE AND PRODUCTION

Hydrobind™ is a free flowing, bland tasting, off-white powder, composed entirely of natural soluble and insoluble fiber from fresh carrots. This natural food ingredient is made through a patent-pending process that was developed solely by Wm. Bolthouse Farms, Inc. The process of making Hydrobind™ is a series of physical processes that renders a free-flowing powder from fresh carrots. There are no chemical extractions or treatments involved. The physical processes comprise washing, peeling, dehydration, and milling.

The physical chemical characteristics of Hydrobind™ have been identified, and a method of analysis has been developed for the product. Once Hydrobind™ powder has been produced, it is tested to ensure that it is within food grade specifications. These processes are detailed below.

A. Chemical Identity and Specifications

Based on the labeling requirements as outlined in 21 CFR, Part 100, the accurate label identification(s) for Hydrobind™ are "carrot fiber" (FDA uses) and "carrot isolate" (USDA uses). Hydrobind™ can be detected in processed foods, not normally containing fiber, by the AOAC Official Method of Analysis ((11) 985.29) for Determination of Dietary Fiber. A nutritional analysis of Hydrobind™ and a copy of USDA's Nutrient Data for fresh carrots are attached as Exhibits 2 and 3, respectively.

Hydrobind™ has a pH of 5.0 at 1% solution. It is slightly soluble in water and is composed of more than 92% solids. The bulk density is 306 g/L. In appearance, Hydrobind™ has a creamy white color, and is a free-flowing powder. The product has a bland flavor and neutral odor. The specifications require that the granulation of the product must be a minimum of 98% using a #100 testing sieve. Hydrobind™ absorbs more than ten times its weight in water via centrifuge, AACC Method 56–20.

To protect the product and increase its shelf life, the ideal storage and handling procedures include protection from moisture and storage at 70°F or less. The current MSDS and product specifications for Hydrobind™ are attached as Exhibits 4 and 5, respectively.

Hydrobind™ is composed of approximately 92% total dietary fiber, 4.5% ash, 2.5% protein, and 0.5% fat on a dry solids basis. The total dietary fiber (TDF) comprises approximately 27% soluble fiber and 65% insoluble fiber. Exhibits 6 through 8 contain the results of typical product composition analyses and a typical ash composition analysis. Table 1 below presents the composition of Hydrobind™.

TABLE 1

FOOD GRADE HYDROBIND™ COMPOSITION

Component	Typical Percent
Total Dietary Fiber	92.0% of dry solids
Soluble	27.0% of dry solids
Insoluble	65.0% of dry solids
Ash	4.5% of dry solids
Protein	2.5% of dry solids
Fat	0.5% of dry solids
Moisture	8.0% overall

Except for β-carotene (present at approximately 7 mg/100 mg), carrots are low in other nutrients except for sugars (7%) (Vaugh and Geissler, 1999). Because large volumes of water are used to move fresh carrots through the normal packing process (washing, sorting and cutting operations), some loss of these nutrients occurs. The production of Hydrobind™ from fresh carrot involves only physical processes: cutting, washing, drying and milling. The additional water employed removes residual β-carotene and soluble sugars from the material.

In order to ensure the quality and consistency of Hydrobind™, Bolthouse developed a profile of Hydrobind™ composition. Although Hydrobind™ is derived from a fresh vegetable and therefore the percentage of each component may vary slightly, this profile assures that the Hydrobind™ used in foods is as consistent as possible and maintains a high standard of quality. In addition, the moisture content of Hydrobind™ is tightly controlled at not more than 8%. The moisture content specification not only assures consistent product quality, but also serves to maintain other components, and any inadvertent residues, well within acceptable range.

The fiber portion of fresh carrot consists of cellulose, hemicellulose and lignin. (A typical analysis of the fiber composition of Hydrobind™ is included in the report in Exhibit 9).

B. Production Methods

Bolthouse uses a vertically integrated farming and processing operation solely dedicated to the development and production of fresh carrots and carrot-based ingredients. More than 70% of the carrots processed by Bolthouse are grown on land that the company owns and manages; about 30% are grown under contract to Bolthouse on land that is under long-term lease to the Company. Bolthouse blends the fertilizers, plants the seeds, and harvests and processes the carrots 360 days a year. Each month Bolthouse packs about 22,000,000 bags of carrots for retail, food service, and ingredient use.

The production steps for making Hydrobind™ begin with the processing of the fresh carrots of the Caropak™ variety. The fresh carrots are processed through an initial washing and sorting. The carrots are then cut and moved through an abrasive peeling process and finally are sorted optically. In the process of packaging, fresh carrots come in contact with large volumes of water. In addition to washing, streams of water are used to move the whole carrots and carrot pieces through the sorting, cutting, and packing equipment.

The production of Hydrobind™ involves only physical processes that remove water from fresh carrots and mill the fiber to desired size; no chemical extraction or modification is performed. The starting material for Hydrobind™ is the by-products of the fresh baby-cut carrot packing operations, washed fine carrot pieces. The process begins by reducing the size of the carrot pieces to fine particles and washing the particles with additional volumes of water, which removes soluble residual sugars and color. Following the washing, a de-watering press is used and the particles are dehydrated. Through a milling process the particles are reduced in size a final time and the end product is then packaged. The final moisture content of the powder (Hydrobind™) is less than 8.0%, by specification.

Bolthouse assures the safety and quality of Hydrobind™ through a number of certifications, and rigorous analyses. The fresh carrots are routinely tested for agricultural chemical residues; residues do not exceed legal residue tolerance levels. Typical residue analysis reports for the fresh carrots are included in Exhibit 10. Growers under contract to Bolthouse must agree, and guarantee, that the carrots meet all applicable federal, state and local laws and regulations including those governing pesticides and fertilizers (See Exhibit 10 for more detail). As part of the production process, Bolthouse certifies that Hydrobind™ neither contains, nor has been exposed to, potential sources of contamination from a variety of common allergens. A copy of the Allergens Statement, listing the allergens that are certified as not present in the product, is attached as Exhibit 11.

III. INTENDED USE IN FOOD

A. Bakery Products

Hydrobind's ™ high water absorption characteristics enable the improvement of yields and slice flexibility in bakery products ranging from dinner rolls and breads to cakes, pastries and tortillas. Improved flexibility is especially desirable in tortillas, wraps, and pita breads to resist breaking and shattering. Hydrobind™ also improves the quality of frozen dough and par-baked products due to its ability to retard ice crystallization.

Based on Farinograph test results, the addition of 1% Hydrobind™ to most bread and other yeast dough formulas required 5 to 8% more total water. The ideal amount of Hydrobind™ used to achieve the desired water absorption in any application depends on many factors, including the bakery formula, the desired consistency of the end-product, shop conditions, and the type of flour and other ingredients used. To achieve its intended effect, Hydrobind™ is typically used in bakery formulations at levels of 0.25 – 3.00 % of total flour weight. For hamburger and hot dog buns, dinner rolls, sour dough bread and rolls, addition of Hydrobind™ at 0.5% of flour weight and 3% additional water in the product formula is recommended. Addition of Hydrobind™ at 1% of flour weight is recommended for bread, sweet breads, French bread, donuts, pound cakes, white and chocolate cakes, muffins, croissants, Danish-type pastries, puff pastries, bagels, cinnamon rolls, flour tortillas, crackers and cookies. Addition of Hydrobind™ at 2% of flour weight with 12% additional water is recommended for ciabatta bread, special cakes, pizza, cup cakes, and sponge cakes. For corn tortillas, addition at 4% of flour weight with 24% additional water has been found to be a good combination. Other formulas that can benefit from this higher percentage level of Hydrobind™ are carrot cakes, carrot muffins, and cookies.

Recommended use levels for baked goods are summarized in Table 2. Note that these usage levels are not sufficient to allow the baked goods to make any dietary fiber claim. The self-limiting level of use of Hydrobind™, 5% of flour weight, would correspond to a concentration in raw dough of 15,000 ppm (sponge cakes and pizza dough, containing 30% flour) to 25,000 ppm (soft breads and rolls, containing 60% flour).

TABLE 2

RECOMMENDED USE LEVELS – BAKERY PRODUCTS

Product	Hydrobind™ (as % of flour wt.)	Additional Water (% of bakery formula)	Intended Effect
Soft breads and rolls	0.5	3.0	Increase yield; improve softness, texture, slice flexibility
More dense breads, cakes, crackers, cookies	1.0	5.0-8.0	
Sponge type cakes, pizza dough	2.0	12.0	
Corn tortillas	4.0	24.0	

B. Processed Meat and Poultry Products

For processed meat and poultry products, Hydrobind™'s water binding ability results in increased product yield, shelf life, and texture improvement. Hydrobind™ is used as a binder/extender and to reduce water purging and gelling. The maximum recommended level of Hydrobind™ in processed meat and poultry products is 5% of the formulation (total product weight); typical recommended levels range from 0.25 – 3.0%. Table 3 presents usage levels that have been tested and are recommended for the commercial production of the noted products.

TABLE 3

RECOMMENDED USE LEVELS – MEAT AND POULTRY PRODUCTS

Product	Hydrobind™ (% total product wt.)	Effect
Meat patties (e.g., beef, pork, sausage)	2.00	reduced water loss, improved texture
Frankfurters, hot dogs, other "scalding-type" sausages	2.00	higher yield, better emulsion stability; improved texture
Salami	1.00	improved texture, yield improvement
Poultry sausages	2.00	improved texture, improved yield
Canned meats	2.00	reduced jelling, better water binding
Reduced fat paté	3.00	improved consistency, higher yield
Bologna and "mettwurst" – type sausage	2.00	improved consistency, higher yield

Data supporting these use recommendations can be found in Section VI. Note that these usage levels are not sufficient to allow the meat products to make any dietary fiber claim.

As certain standardized and nonstandardized processed meat or poultry products may contain mixtures of available animal proteins, Hydrobind™ has been evaluated in formulations containing single meats and combinations of animal proteins (beef, pork, and poultry). Additional research on specific standardized and nonstandardized processed meat and poultry products is underway, and data will be provided to the USDA as they become available.

C. Self-Limiting Levels Of Use

Above 5% (of total product weight) in meat products and 5% (of flour weight) in baked goods, Hydrobind™ has negative effects, including poor texture and flavor, that render the products undesirable to consumers. For example, when baked goods with higher levels were tested using a panel of trained subjects, they were reported to exhibit an overall lower flavor level than the standard product. The lower flavor level was found to be less desirable (Study 2, page 55).

Increased amounts of Hydrobind™ have a negative effect on texture and flavor because Hydrobind™ is highly absorptive, and requires increasing the amounts of water in the food product formulations to achieve the desired consistency. When too much water is added, either flavor is diluted to unacceptable levels, or product consistency and texture is not smooth and does not meet consumer standards for mouthfeel. Therefore, because of its highly absorptive properties, Hydrobind™ is self-limiting in bakery and standardized and nonstandardized processed meat and poultry products.

D. Probable Consumption Levels

Hydrobind™ will generally be consumed at levels similar to the fiber consumed when eating fresh carrots. According to the USDA Nutrient Database, fresh carrots contain 3% of fiber. A typical carrot weighs approximately 80 g. The highest concentration of Hydrobind™ is anticipated to be in meat products, where the self-limiting level of use is 5% of total product weight. According to the USDA Nutrient Database for Standard Reference, the reference serving sizes for frankfurters or sausages is 55g, and for meat patties or canned meats is 85g. Therefore, a serving of these foods containing the maximum level of Hydrobind™ would contain about 2.5g and 4.2g of carrot isolate, respectively. This is about the same as the fiber content in a typical fresh carrot.

IV. BASIS FOR THE GRAS DETERMINATION

A. Summary of Technical Evidence of Safety

The basis of this GRAS notification is scientific procedures. Carrots, including their fiber portion, have been consumed for centuries; they were among the vegetables eaten by early Mediterranean civilizations. Brought to the Americas by early explorers, this root crop was adopted by Native Americans.

Hydrobind™ is substantially similar, and is in fact identical, to the fiber portion of fresh carrot. More than 70% of the carrots from which Hydrobind™ is derived are grown by Bolthouse; the remainder are sourced from growers under contract to Bolthouse. Growers must agree to, and guarantee, that the carrots meet all applicable federal, state and local laws and regulations including those governing pesticides and fertilizers (See Exhibit 10 for more detail).

Based on generally available data and information, a conservative estimate of the mean estimated *per capita* daily intake of the fiber portion of fresh carrot associated with the proposed uses of Hydrobind™ is 0.03 g/day; intake by a heavy consumer of Hydrobind™-containing foods is conservatively estimated as 0.35 g/day. One average whole fresh carrot weighs about 80g; therefore these intakes correspond to the addition of the fiber portion of 1g -12g of fresh carrot per day to the US diet.

B. History of Consumption

There is common knowledge of a long history of human consumption of carrot, both fresh and cooked, including the fiber portion.

Traces of carrot have been discovered at archeological sites (pre-historic lake dwellings in Switzerland), and carrot was included in the listing of vegetables in the Babylonian royal gardens (8th century B.C.) (Davidson 1999). McGee (1984) states that carrots were among the vegetables eaten by early Mediterranean civilizations in Sumer and Egypt (around 3000 B.C.); however, the early references likely refer to carrot's use as an aromatic herb rather than root vegetable (Davidson 1999).

An Arab writer, Ibn Al-Awam, produced the first description of the modern carrot in the early 12th century in Andalusia. Carrots reached Western Europe in the 14th century and Britain in the 15th. The violet/purple carrot was grown in Italy by the early 1300s (Schneider 2001).

The Dutch were leaders in the improvement of carrot varieties. The early descriptions were all of two types, purple/red and pale yellow/white. The orange carrot first appeared in Dutch paintings in the 17th century and soon dominated carrot production. Cultivated carrots were brought to the New World before 1565, likely by the Spanish and the sweet roots were adopted by native Americans (Davidson 1999). Carrots, as well as parsnips and turnips, were introduced to the ill-fated Jamestown Colony (1607-9) (Trager 1995).

There is common knowledge of the health benefits associated with the consumption of the fiber in carrots and other vegetables. Carrots are listed among the foods containing dietary fiber in the USDA Nutrient Database. The daily reference value for dietary fiber is 25 g (for a 2000 calorie diet) (21 CFR 101.9(d)). USDA estimates mean *per capita* carrot fiber consumption is about 0.6 g /day.

C. Consumer Exposure and Cumulative Effect in the Diet

There is extensive common knowledge about the quantitative intake of the fiber portion of carrot in the US diet. Using generally available data and information, Exponent estimated current consumer intake of carrot fiber and the estimated daily intake (EDI) anticipated in association with the proposed uses. Details of these calculations can be found in Exhibit 1.

USDA has published various estimates of mean *per capita* carrot consumption during the 1990s; 15 lb/person/year is the most recent available (1996, see below). This value indicates that mean *per capita* consumption of carrot may be as much as 19 g/day, or 0.57 g carrot fiber.

Based on USDA food consumption survey data for 1994-96, 98, Exponent estimated that the *per capita* consumption of carrot (all forms) is 9 g/day at the mean and 30 g/day at the 90th percentile. Results are presented in Table 4. The fiber content of carrot is about 3% (USDA Nutrient Database for Standard Reference, www.nal.usda.gov/fnic/), so *per capita* consumption of carrot fiber is 0.03 g/day (mean), and 0.9 g/day (90th percentile).

TABLE 4

ESTIMATED DAILY *PER CAPITA* INTAKES OF CARROT AND CARROT FIBER

	Carrot Intake (g)	Carrot Fiber Intake (g)	Whole Carrot Intake[1] (# of carrots)
Current Intake			
***Exponent* FARE™ Analysis**			
Mean	9	0.27	0.11
90th Percentile	30	0.90	0.38
USDA Estimates			
Mean	19	0.57	0.24
EDI[2], Hydrobind™ Uses			
Mean	1	0.03	0.01
90th Percentile	12	0.35	0.15
Total Intake (Approximation)			
Mean	10	0.30	0.12

According to Bolthouse, production capacity for Hydrobind™ is 6 million lb/yr. Some of this product is exported for use in other countries. If, to be conservative, it is assumed that 133% of the annual production, or 8 million lb, were to be added to the US diet, the mean *per capita* intake of the fiber portion of carrot would be increased by 0.03 g/day. This corresponds to the amount of carrot fiber that would be consumed if about 1 g of whole carrot were added to the daily diet.

A very conservative approximation of estimated daily intake (EDI) of Hydrobind™ by heavy consumers of baked goods and meat products at the 90th percentile (using the "*per capita* intake x 10 method" of estimation, an approach generally accepted for flavorings or other additives present in a broad range of foods in the food supply) yields an EDI of 0.35 g carrot fiber per day. This corresponds to the amount of fiber in 12 g of whole carrot.

D. Discussion of Information Inconsistent with GRAS Determination

A search of the scientific literature revealed no indication of adverse effects associated with the consumption of carrot, carrot fiber, or the components of carrot fiber, at levels associated with the proposed uses of Hydrobind™.

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[1] Weight of average standard carrot is approximately 80g
[2] Estimated Daily Intake

V. DETERMINATION OF GRAS STATUS

Based on a review of generally available and company confidential information relating to the potential GRAS status of Hydrobind™ Carrot Fiber (for FDA uses)/Carrot Isolate (for USDA uses), qualified scientific experts at Exponent, Inc., have concluded that Hydrobind™, produced according to Bolthouse specifications and used in bakery and standardized and nonstandardized processed meat and poultry products at the recommended levels, is GRAS. This determination is based on the substantial similarity (identicalness) of Hydrobind™ to the fiber portion of fresh carrot; common knowledge of the historical consumption of fresh carrot, including its fiber portion; and the estimated daily intake of carrot and carrot fiber associated with the proposed uses, which is negligible. The detailed findings of Exponent's analysis are the basis for the foregoing sections of this Notification, and are summarized in Exhibit 1.

VI. DATA DEMONSTRATING THE FUNCTIONAL SUITABILITY OF USE OF HYDROBIND™ IN PROCESSED MEAT AND POULTRY PRODUCTS

A. List of Studies

1. Arotop Food Creation, Manufacturing of meat products with carrot fibres. Comparison of standard meat products and alternative binding systems

Introduction	*Page 25*
Scalded sausage	*Page 27*
Manufacturing of meatless sausages	*Page 35*
Production of fat-reduced paté	*Page 39*
Manufacture of burgers with carrot fiber	*Page 44*
Conclusion of all results	*Page 47*

2. Federal Center for Meat Research (BAFF) (Translated by Dr. Werner Uber), November 16, 2001: Carrot Fiber as binding agent in the production of canned products.....Page 49

3. Federal Center for Meat Research (BAFF) (Translated by Dr. Werner Uber), August 8, 2001: Bolthouse Carrot Fiber – applications in meat products.....Page 57

4. ABC Research Corporation, August 30, 2002: Evaluation of Carrot Fiber 602 in Beef Patties.....Page 66

5. ABC Research Corporation, August 30, 2002: Evaluation of Carrot Fiber 602 in Sausage Patties.....Page 74

6. ABC Research Corporation, August 29, 2002: Evaluation of Carrot Fiber 602 in Sausage Links.....Page 82

7. ABC Research Corporation, August 30, 2002: Evaluation of Carrot Fiber 602 in Bologna.....Page 90

8. ABC Research Corporation, August 30, 2002: Evaluation of Carrot Fiber 602 in Frankfurters.....Page 100

9. Rovita: Water and Fat Binding Capacity Using Plant Fibers in Scalding Sausages (Poultry) .....Page 110

B. Summary of Studies

Functional applications of the water binding properties of Hydrobind™ Carrot Isolate have been evaluated in a variety of meat products including scalded sausages, liver sausages (paté), meatless sausages, pork patties (burgers), and canned minced pork meat. Studies were conducted to determine the most appropriate levels of Hydrobind™ for these meat products, and to compare the taste and texture profiles of products prepared with Hydrobind™ and other binders. An overview of these studies is presented below. The final reports and their conclusions follow.

As certain standardized and nonstandardized processed meat or poultry products may contain mixtures of available animal proteins, Hydrobind™ has been evaluated in formulations containing single meats and combinations of animal proteins (beef, pork, and poultry). Additional research on specific standardized and nonstandardized processed meat and poultry products is underway, and data will be provided to the USDA as they become available.

Due to its excellent water binding capabilities, carrot isolate is used in meat products for a variety of different purposes, including as a binding agent in sausages, a filler in reduced fat products, and to reduce gelling/purging in canned meats.

The purpose of binding agents in sausages is to ensure that water binds to the sausage matrix. If the water does not bind sufficiently the product loses mass and texture quality during the scalding process.

In reduced fat meat products, carrot isolate is used to create a texture similar to a standard full-fat product.

1. Arotop Food Creation: Sausages, Meatless Sausages, Reduced Fat Pate and Pork Patties

Arotop Food Creation (Arotop) compared attributes such as the texture and taste of standard meat products with meat products using carrot isolate (fiber). Arotop determined that 2-3% carrot isolate was the optimal amount for use in the variety of meats examined.

In the case of scalded (frankfurter-type) sausages, the addition of carrot isolate as a binding agent produced a product that compared favorably with the standard scalded sausage recipe in terms of both flavor and mouth feel.

Arotop also conducted trials using carrot isolate in meatless sausage products. Typical meatless sausages have had difficulty successfully imitating the taste and texture of standard meat sausages. However, using carrot isolate, Arotop was able to produce a meatless sausage that matched the taste of standard meat sausages.

Arotop developed a reduced fat pork liver paté using carrot isolate to absorb the extra water used in such recipes and to provide the desired texture. In taste trials comparing the reduced fat paté made with carrot isolate to standard paté, the reduced fat product was judged to have excellent taste, similar to the original.

Finally, pork meat patties (burgers) were developed using carrot isolate because its water binding capabilities prevented the loss of water that often occurs during the frying process. The experienced panel of testers determined that the burgers made with carrot isolate were better tasting than the standard. The full report conducted by Arotop is attached as Study 1.

2. Federal Center for Meat Research: Minced Pork and Scalding Sausages (Frankfurter-type Sausages)

Dr. Werner Uber, Federal Center for Meat Research (BAFF), Germany, conducted trials comparing jelly deposits and organoleptic properties in meat products with and without carrot isolate. Carrot isolate was added to canned minced pork meat and scalding sausages in the following amounts: 0.5%, 1%, 2% and 5%. The meat products were then heated in tins and cooled. The products were examined for jelly deposits and their organoleptic properties after 5 days. Photographs in the studies visually demonstrate the effect of carrot isolate on both jelly separation and texture in canned minced pork meat.

At levels of carrot isolate up to 3% of total product weight, product taste and mouth feel were maintained. At the 5% level, the taste and organoleptic properties were not acceptable.

The best application of carrot isolate in these products would be the ready-to-eat market. Dr. Uber has also developed a series of recipes using carrot isolate and presented the advantages of using carrot isolate in these products. The full reports conducted by BAFF are attached as Studies 2 and 3.

3. ABC Research Corporation: Beef and Sausage Patties, Sausage Links, Bologna, and Frankfurters

ABC Research Corporation (ABC) examined the use of carrot isolate in sausage and beef patties using a two-phase experiment process to determine the optimal use level and compare products with that level of carrot isolate to control samples. Based on the evaluation, ABC determined that 2% carrot isolate was the optimal usage level for sausage and beef patties and that products using carrot isolate compared favorably to control products.

During the first phase of the process trained panelists evaluated sausage and beef patties produced using 0%, 0.5%, 1% and 2% carrot isolate to determine the optimal use level. The panelists conducted a sensory evaluation of the sausage and beef patties and determined that there was very little difference between patties without carrot isolate and those with 2% carrot isolate. Based on those results, ABC conducted microbiological analyses and organoleptic evaluations between the control and treated (2%) patties. The control and treated patties both had increases in fat and protein and decreases in moisture and carbohydrates after cooking. However, the treated product had higher moisture and carbohydrate retention after cooking than the control. The control maintained a higher protein content than the treated product. The treated beef patties had a cook yield of 83.1% in comparison to the cook yield of 71.9% for the control beef patties. The treated sausage patties had a cook yield of 87.1% in comparison to the control sausage patties, which had a cook yield of 81.6%.

The sensory panel judged the control and treated beef and sausage patties on appearance, color, texture, and flavor as well as overall acceptability. Statistical analysis of the results indicated that there was no significant difference between the treated and control products for all of the attributes tested. However, the treated beef product did receive higher scores for the sensory attributes than the control beef products. Treated sausage products received a higher score for appearance than the control sausage patties. The full reports conducted by ABC are attached as Studies 4 and 5.

ABC also evaluated the use of carrot isolate in sausage links by comparing a batch of sausages formulated with 2% carrot isolate and a control batch formulated without carrot isolate. The cooked products were evaluated on composition and microbiological profile, average percent yield, average shear force, and sensory appeal. The sensory appeal was judged on appearance, color, texture, flavor, and overall acceptability by a trained 10-person panel.

Cooking resulted in a decrease in percent fat, a small decrease in carbohydrates, and an increase in percent protein for both the treated and control products. However, the treated product retained more moisture than the control after cooking. There was no significant difference between the microbiological profile of the treated and control sausages. The results of the cooking yield evaluation, the organoleptic evaluation and the shear force value test were evaluated for statistical significance. The average percent yield of the cooked treated sausage (82.9%) was significantly higher than the yield of the cooked control sausage (71.2%). The control sausages required statistically significant less force to shear than the treated sausages when tested on a Universal Testing Machine. Finally, the sensory panel determined that there was no significant difference between the treated and control sausage links in color, texture, flavor and overall acceptability. However, the treated sausages were rated significantly higher than the controls in appearance. The full report conducted by ABC is attached as Study 6.

Using the same procedures as the examination of carrot isolate in sausage links, ABC evaluated the use of 2% carrot isolate in bologna. The treated and control products both showed increases in fat and protein and decreases in moisture after cooking. However, carbohydrates increased in the treated bologna after cooking compared to a decrease in the control product. There was no significant difference in the cook yield, the shear force value or the organoleptic properties between the treated and control bologna. The full report conducted by ABC is attached as Study 7.

Lastly, ABC conducted an evaluation of carrot isolate in frankfurters. This study was conducted in two phases. The initial phase determined the optimal usage level for carrot isolate. Phase two compared frankfurters formulated with 2% carrot isolate to untreated control frankfurters. The frankfurters were evaluated on the same characteristics as the other meat products.

The composition of the treated and control frankfurters both showed a decrease in moisture and increase in protein after cooking. However, the control product had a decrease in fat and increase in carbohydrates after cooking, while the treated product had an increase in fat and a slight decrease in carbohydrates. The treated frankfurters had a significantly higher cook yield of 88.1% compared to the control's cook yield of 82.1%. There was no significant difference in the average shear force value between the control and treated products. The sensory panel determined that there was no significant difference in color, texture, flavor or overall acceptability between the treated and control products. However, the frankfurters treated with carrot isolate rated higher than the control for appearance. The full report conducted by ABC is attached as Study 8.

4. Rovita: Water and Fat Binding Capacity Using Plant Fibers in Scalding Sausages (Poultry)

Rovita evaluated the use of carrot isolate in poultry scalding sausages in comparison with control sausages and sausages formulated with other plant fibers. Sausages made with carrot isolate demonstrated a higher capacity for water binding than the products formulated with other plant fibers. Additionally, sausages made with carrot isolate had a better texture than the control. The sausages formulated with carrot isolate were equivalent in taste to sausages made with the other plant fibers.

STUDY 1

AROTOP FOOD CREATION

MANUFACTURING OF MEAT PRODUCTS WITH CARROT FIBRES. COMPARISON OF STANDARD MEAT PRODUCTS AND ALTERNATIVE BINDING SYSTEMS

arotop food creation

Report

Manufacturing of meat products with carrot fibres. Comparison of standard meat products and alternative binding systems

Description of the task:

As a by-product of carrot processing the Bolthouse Farms Company has recovered a carrot fibre, which, as a natural food component can be used, e.g. as dietary fibre in processed food.
These new carrot fibres show high water-binding functionality and emulsion producing capacity.

The task is, to evaluate the use of carrot fibres in four of typical traditional European meat products:

1. Scalded sausage type emulsions (wiener, frankfurter, hot dog)
2. Fat reduced liver sausage (pate')
3. Meatless sausages based on plant protein
4. Burgers

arotop food creation

Trial proceedings:

1. Scalded sausage

Standard manufacturing of scalded sausages is done in so called cutters. The used meat is minced very fine so that meat protein can produce an optimal spread mix with added ingredients. Usually, the meat is no more warm from slaughtering - water-binding capacity has gone. The pH, directly after slaughtering ranging from 7,0 to 7,2, within 24 hours goes down to ca. 6,0.

To build up structure for a characteristic bite after brewing, water has to be bound in a typical way within the scalded sausage´s matrix.

Mainly, common chopping agents should be used to improve water binding capacity. This way, meat protein gets unfolded and water is enriched close to it in form of hydratation clouds during cuttering process. Very often, the desirable amounts of water are not bound tightly, especially in case of few lean meat disposable. The results are losses of mass and quality during scalding process.
For this reason the use of additional water binding matters is necessary.

Functional materials such as fibres from plants with high water-binding capacity may be used in addition to solve the problem. The carrot fibre material, appearing in the market place recently, shows a theoretical analytically determined water-binding capacity of 1:12 (meaning one part of carrot fibre binds 12 parts of water). It has neutral taste and smell. An additional physiological benefit is the enrichment of fibre in the food pattern by consumption of sausage.

Trials in the pilot plant were planned as follows:

Production:

A. Standard

B. Extremely stressed meat recipe with high contents of water and fat without further binding components

C. Same as B. but with addition of 2% carrot fibre

D. Same as B. but with caseinate, soy isolate and wheat fibre, 2 % each, in addition

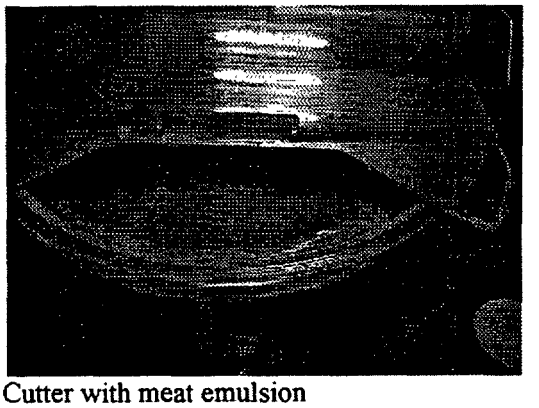
Recipe type wiener scalded sausage:

Sausage meat composition:	Poor recipe	Standard
	30 % pork meat	40 % pork meat
	10 % beef meat	20 % beef meat
	30 % water	20 % beef meat
	30 % fat	20 % fat

Additives:	6 g/kg	seasoning mix
	5 g/kg	chopping agents (phosphates)
	18 g/kg	curing salt (0,4 - 0,5 % of sodium nitrite)

Binding components:	A	0%
	B	0%
	C	2% Carrot fibre
	D	2% Caseinate, soy isolate Wheat fibre

Cuttering process



Cutter with meat emulsion

Trials A and B show meat emulsions like conventional phosphatemasses. The meat emulsion gets a shiny surface, the mixed dough becomes lithe and lightly tearing.
Influences of additives like carrot fibre, caseinate, soy isolate and wheat fibre are obvious and show direct effects in the cutter, the meat emulsions seem to be more compact with a less shiny surface.

Filling:

Mass of variants of all trials are filled some into saitlingdärme, diameter 22 – 24mm (sheep casings), some into plastic casings, diameter 60mm (Lyoner)

60mm diameter sausage (Lyoner)

Scalding core temperature is 68 °C.
Sensory evaluation took place after one day of storage

Sensory panel at work

000055

The products were packed into vacuum bags and cooled down for later analysis.

Weight of masses:

Whole mass of each trial: 15 kg
weight of products ready for consumption (after scalding and storage):

A: 13,2 kg

B: 12,1 kg

C: 14,2 kg

D: with caseinate 12,1 kg, with soy isolate 13,4 kg, with wheat fibre 13,8 kg

The sample with carrot fibre showed the highest weight, the best water binding capacity.

Sensory evaluation:

A team of five test persons with sensory test experience evaluated the products. These were not assigned to a certain trial type towards the test persons.

Wiener sausages with carrot fibre and other additives

Lyoner sausages with carrot fibre

Results:

A. Standard: description as typical, full tight, crackly, tasty
B. Products with higher contents of fat and water: description as not tasty enough, too soft, not tight enough
C. Same as B, but with addition of carrot fibre: less deviation to standard A, small loss of tightness
D. Same as B with caseinate: soft, straw-like
same as B with soy isolate: not full tight, softer consistency compared with standard
same as B with wheat fibre: full tight, tastes kind of dry, less spicy

Texture measurements:

Device for texture mensurement

Results of measurements

Samples with carrot fibres and wheat fibre showed the best firmness.

Graph of 6 "Wiener" sausages

A:	Standard	green
B:	Poor recipe	light blue
C:	Carrot 2%	black
D:	Caseinate	brown
	Wheat fibre	red
	Soy isolate	dark blue

Summary:

Concerning qualities of taste and texture, the products with high contents of fat and water showed great negativ deviations compared with the standard. With addition of functional agents, properties of the sausages changed decisively to more positive sensoric characteristics. In this trial series, sausages produced with carrot fibre came off best. The wheat fibre sausages reached nearest to the carrot fibre products concerning texture quality. The sausages produced with addition of soy isolate and caseinate showed more negative deviations compared with the other non-standard products.

2. Manufacturing of meatless sausages

Meat sausages are very popular in most European countries because of their fine special taste. Optimal taste is a composition of basic smell, taste and texture of a sausage. This can be guaranteed by use of high amounts of meat in manufacturing process. Replacement of meat and animal fat mass by substitutes of plant origin will not consequently lead to a product of identical sensory properties till today. A perfect original taste is not achieved by any sausage surrogat, based on ingredients of plant origin, on the market today.

So, the challenge of manufacturing a sausage, based on plant ingredients, includes to satisfy the consumers anticipation towards the original meat product. The imitate has to become sensory equal as far as possible. Fried products with ingredients of plant origin like burgers come very near to the sensory anticipated original model because of the frying process aromas.

Nevertheless, an imitation of scalded products with protein and fat material of plant origin is only partially possible because of the specific structure of this kind of meat product.

The task is the manufacturing of scalded products with the new raw material carrot fibre, with properties very much like those of the meat originals.

Scalded sausages (lyoner, frankfurter, wiener) mainly consist of the basics lean meat, fat and water. The components lean meat and fat of animal origin have to be substituted by protein and fat of plant origin. In absence of the special emulsion building and crosslinking properties of animal proteins, agents with water-binding and emulsifying capacities have to be used (additionally) instead.
During the mixing process of the raw materials a structure has to be created, so that in the following scalding the mass denatures in

that way, an ideal meat-like matrix is formed. Basically, a protein framework has to be built up, that, like in the meat model, encloses the, free and emulsified fat after gelling and fixes the added water.

Proceeding of the trials:

Standard recipes:	A		B	
	water	56 %	water	55,5 %
	compound 1	14 %	compound 1	13,5 %
	soy oil	20 %	soy oil	19,5 %
	compound 2	10 %	compound 2	9,5 %
			carrot fibre	2,0 %

Recipe compound 1:

pea protein	64 %
wheat protein	35 %
colour (E 120)	1 %

Recipe compound 2:

chicken protein	45 %
salt	12 %
seasoning	43 %

Manufacturing:

Compound 1 is given to water and well mixed in the cutter. After the addition of compound 2, soy oil is emulsified carefully during low speed running of the cutter.
Afterwards, the meat mass is filled into casings and scalded, conditions like manufacture of conventional frankfurter sausages.

Results:

The meatless products were compared with the wiener sausages from trial 1.
Five trained testers evaluated the sausages, which were not assigned to their manufacturing lot.

The outer appearance of the meatless products was estimated as darker and stronger smoked, besides no other deviation to the normal goods was found.

Meatless sausages

Evaluation of the products texture: The meatless sausages showed the same break-through properties as the conventionally manufactured wieners.

The structure quality of the sausage mass of the products with ingredients of plant origin decreased clearly compared with the originals. The carrot fibre sausages were evaluated as not elastic, somewhat crumbly and easy to be crushed. The texture did not comply with the original model. The products with ingredients of plant origin were homogenous, without settling of water or fat. The typical gum like structure of classical scalded sausages could not be achieved.
In contrast to the texture's evaluation, the taste quality was judged to be excellent.
The products with ingredients from plant origin showed no disadvantages compared with the wiener sausages with meat. Indeed, the special seasoning showed a different taste characteristic, but this was an effect merely due to the kind of spices.

Summary:

It can be concluded, that the manufacturing of a sausage with ingredients of plant origin with satisfying excellent taste qualities compared to a conventional meat product is possible. The technological binding of the raw materials, water and oil respectively, succeeds due to the emulsifying and water-binding properties of the carrot fibre without any problem. The sensory qualitics are similar, however the texture of the conventional meat product can not be achieved.

3. Production of fat-reduced paté

Paté products are very popular in European countries. In France they are marketed as Paté, in Germany more than 100 sorts of liver sausages are discussed.
Apart from high amounts of liver (pig) a lot of fat is used commonly in these products, leading to high calorie mass consumption, which is no more desirable in industrialized countries today. On the other hand the fatty share in liver sausages is the carrier, the matrix of the typical aroma. So, one can hardly do without these compounds without coming into conflict with the consumers wish for typical special taste.
Therefore, the manufacturing of a tasty, spicy and smelly optimal liver sausage with a satisfying texture, combined with calorie reduction of the product, is a challenging task.
Fat substitutes should build fat-like structure with non-calorie matters like water. At the same time, the fat-like structure should serve as a matrix and transmitter fo the special taste.

German guide-lines for liver sausage manufacturing request 15 to 30 % of liver mass as well as lean meat poor in connective and fatty tissue. In some special sausages viscera and crusts are used too.
Prime qualities contain veal, truffles and other valuable ingredients. In our trials, we conceived normal standard quality, equivalents of the classical Belgian/French model recipes for paté.

arotop food creation

Recipe 1, normal standard liver sausage:

30 kg	pig´s liver
30 kg	dewlap
40 kg	fat

Recipe 2, fat reduced

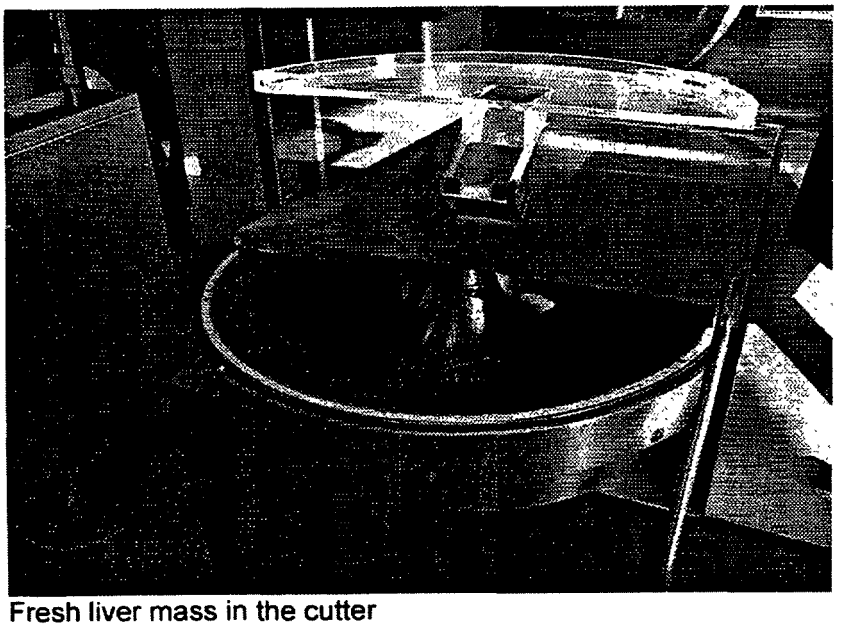
29kg	pig´s liver
14kg	dewlap
19kg	fat
35kg	water
3kg	carrot fibre

Further additives used:

18g/kg	nitrite curing salt
5g/kg	seasoning mix

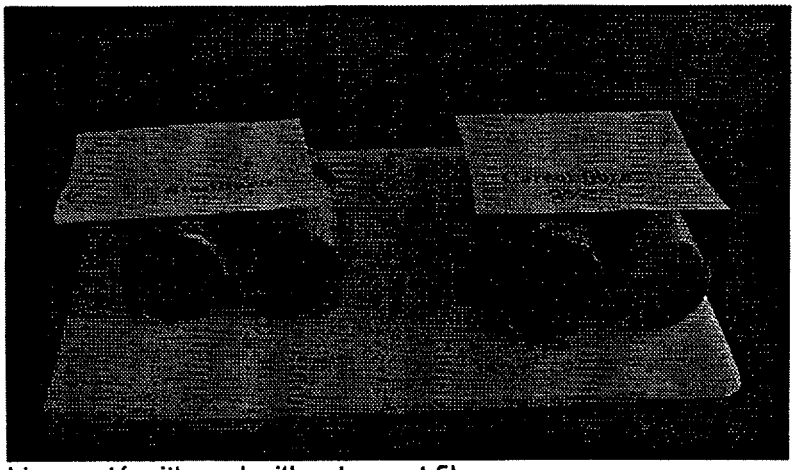
Manufacturing process

The raw liver mass was cuttered with salt, so that meat proteins were set free,which are useful as emulsion agents. Scalded lean meat and fat tissue were chopped hot and the fine minced liver mass was emulsified into the warm meat-fat-mass. It is important to hold the emulsification interval for the liver mass in this process.



Fresh liver mass in the cutter

After filling into plastic casings the sausage was instantly cooked with temperatures of 75 to 80°C and a minimal core temperature of 70°C. After having been cooled through and two days in the cold store the products were evaluated sensorically.



Liver paté with and without carrot fibre

Results:

Sensoric evaluation showed nearly identical quality of both products. The normal standard product as well as the fat reduced one were estimated as prime quality with an equal good spreadabilty view.

Summary:

Trials proved a surprising positive result concerning the fat-reduced variety. Obviously, the use of carrot fibre succeeded in managing optimal water/fat conditions resulting in a taste, not to be differed from the original.

Calorie reduced variety with carrot fibre:

0,8 kg	meat
50 g	breadcrumb (water-binding agent)
400 g	water
17 g	salt
1	egg
20 g	carrot fibre
1 g	ground white pepper

Manufacturing:
The minced meat 600g of each variant is mixed with the special components, burger-like forms are fried in a pan with vegetable oil. Weight losses after the frying process are determined.

Results:
Weight standard product before and after frying process:

	Fresh	Fried	%loss
Standard:	600g	475g	21
Carrot fibre sample:	600g	510g	15

Although having more water content the calorie reduced product resulted in less weight losses than the standard

4. Manufacture of burgers with carrot fibre

The term „burger" is not really uniform concerning product properties.
US chain restaurants like Mac Donald's sell a minced beef meat product with seasoning without further binding agents. The European consumer understands as a burger a fast food product on a bread roll with e.g. seasoning sauces or mayonnaise.
In Europe, products containing binding agents like e.g. bread crumbs apart from meat mass, play a more important role. The characteristic of these products is a light structure of meat mass, which survives the frying process and which causes a crumbly bite and an optimal spread feeling in the mouth. Sensory qualities of these products are characterized by a surface enlargement during chewing process. These burgers are not scalded but fried with very high temperatures in a frying pan or a deep fat frier. With temperatures of 200 to 250 °C, water-binding ability has to prove extreme excellence. A too high loss of water leads to a destruction of the desirable conventional consumption quality.
Water-binding capacity of products on the market these days is guaranteed by bread components mostly based on starch and starch-like matters. Because of the high quality demands of these products it seems to be reasonable to use further water-binding active food components. Besides, a higher quantity of addition of water can be considered, to adapt such products to dietary physiological needs with the same remaining sensory value. For this task burgers were produced in a technology trial.

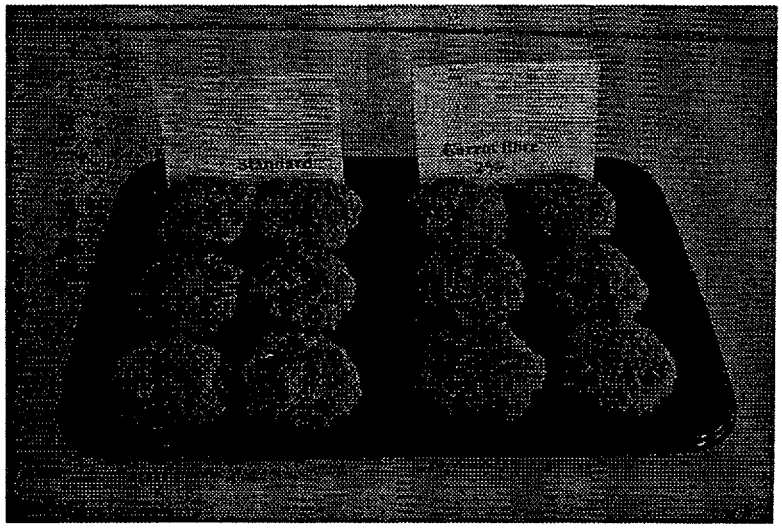
Standard recipe:

1 kg	minced meat (100 % pig)
50 g	breadcrumb (water-binding agent)
17 g	salt
1	egg
200g	water
1g	ground white pepper

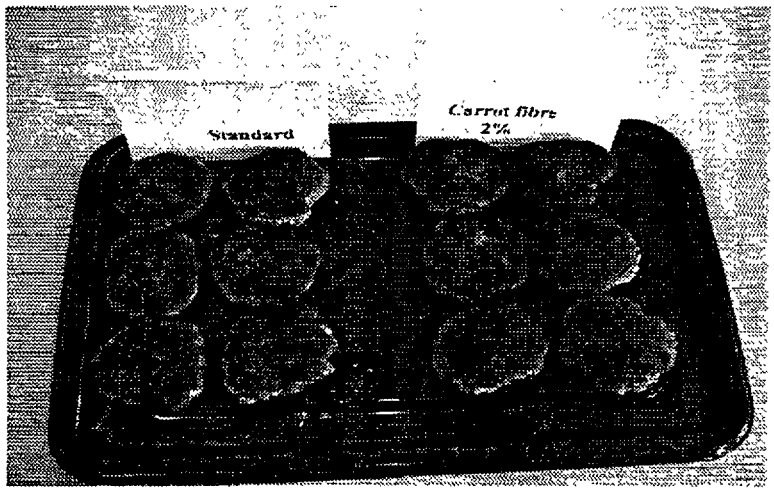
Sensory evaluation:

The evaluation was practised by five experienced testers.

In spite of less share of meat, the carrot fibre products are better in taste than the original model. Especially the lightness of the structure is evaluated as positive. The seasoning seems to be a little bit less intensive in carrot fibre products. This is caused by the higher amount of added water and can easily be corrected by increasing of salt/seasoning shares.



Raw burgers



Fried burgers

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5. Conclusion of all results:

Four technical trials took place with carrot fibre from the Bolthouse Farm Company:

1. Scalded sausage with increased water content

The tasted products proved to be of excellent quality. They differed insignificantly from the original meat products. Comparison with other, partly very expensive binding agents showed a superiority of the carrot fibre concerning the necessary water-binding capacity for scalded sausages. The meat mass of the carrot fibre products proved to be optimal firm, only wheat fibre achieved a similar result.

2. Manufacture of no-meat sausage products

Products like this, which make possible the pleasurefull consumption of sausages for vegetarians or people with less meat in their food pattern could easily be formulated by the use of carrot fibre. The result in texture did not reach the characteristic properties of conventional meat products. Nevertheless the trial samples resulted in better qualities than the other products in this range on the market till now. Regarding the taste, without considering the texture, these products proved to be excellent. The developed recipe is in an excellent way suitable for diabetic people.

3. Manufacture of fat-reduced liver sausage/paté

Fat-reduced liver sausage with surprising good quality could be produced by the use of carrot fibre. Fat reduction not only leads to less calorie consumption but to better digestible and special diet suitable products too. The sensory evaluation of the carrot fibre products showed a partly better quality than the original's with high fat contents.

4. Manufacture of burgers with a better water-binding capacity

The recipe of burgers with carrot fibre leads to the manufacture of burger masses with an optimal water-binding capacity surviving the brutal frying process of this type of products. Apart from technological advantages (water-binding capacity) these products prove to be superior to the conventional originals with a sensory, somewhat more compact structure. In addition, from a certain point of view, a revaluation of the dietary value is achieved by a decreased share of meat and fat in the product.

STUDY 2

BAFF REPORT (TRANSLATED BY DR. WERNER UBER), NOVEMBER 16, 2001

CARROT FIBER AS BINDING AGENT IN THE PRODUCTION OF CANNED PRODUCTS

DR. WERNER HUBER

food ingredients & technology

TRANSLATION – BAFF REPORT, GERMANY -

CARROT FIBER AS BINDING AGENT IN THE PRODUCTION OF CANNED PRODUCTS

It was evaluated a new ingredient from the bakery industry as binding agent for jelly deposits in canned products. It is a carrot fiber, a by product from the production of carrot juice.
The product name is. Carrot fiber 602 from Bolthouse Farms, Bakersfield, California, USA. This fiber is produced from mashed, cooked carrots (the juice was removed before). The carrot pulp was washed, dried and milled to a fine powder. The fiber has a water binding capacity of 10 of its weight. Up to now the fiber was used in baking area to increase the yield of the dough. Furthermore the dough properties and the freshness of bakery goods were improved, especially in frozen or pre-baked products. The fiber (as fine powder) has a white-cream colour and a neutral smell The pH-value is 5.8 (+/- 0.4) The total plate account is < 500 cfu/g. There is no gluten in the product which has a shelf life of two years

MATERIAL AND METHOD

Minced meat:
First of all there were carried out basic tests using canned minced pork meat, because in this kind of products you can find always negative jelly deposits. Pork meat (S2-quality) was cut with 2 mm disks and pre-cutter. Then 0.5%, 1%, 2% and 5% of carrot fiber were added and 200 g of the mass was filled in tins (99x36) After that the tins were heated up to 115°C to a F-value of > 3
After 5 days at 7°C the tins were checked regarding jelly deposits and organoleptic properties.

Scalding sausage:
Additionally there were produced tins containing scalding sausage mass type "Lyoner" to cover another important area of canned sausages Added carrot fiber amount, tins and heating were identical to minced meat trials

Basic recipe (per 100 kg)
25 kg R2 (beef)
25 kg S3 (pork)
25 kg lard
25 kg ice

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Additional ingredients (per 1 kg meat and fat)
2 g phosphate
0,1 g sodium ascorbate
20 g salt with sodium nitrite
spice mix for Lyoner

The used material had a temperature of 2°C. The meat, the ingredients and the ice were mixed in slow modus in the cutter (5 rounds). After having a good mixture the lard was added in fast modus and the mass was cut up to 12°C and then directly filled up in tins and heated up.

RESULTS

The fiber has an effect on water binding in both products (canned minced meat, canned scalding sausage) During the production at a dosage of 1% there could be seen an effect of the fiber and the meat and the meat mass were more dry and sticky

Canned minced meat:
The products over 2% of dosage were brighter than the control.
Reduction of jelly deposits were found at all used dosages (except control tin):
Following jelly deposits were found

Control. 26%
0,5% fiber: 23,5%
1,0% fiber: 22,5%
2.0% fiber. 19%
5.9% fiber: 6%

There were found no differences in colour looking at the cut surface and the jelly deposits.
At 0.5% taste and smell were nearly like the control. The product has had a typical smell to pork meat and no sterilisation smell was detected The taste was aromatic to pork meat , slightly weaker than the control The consistence was more juice and less dry and fiberlike
At 1.0% the smell was like the control The product was more juicy (like at 0.5%) and the taste was slightly weaker The consistence was less dry and less fiberlike compared to the control
At 2,0% The organoleptic properties were the same like at 1,0% but the consistency was smoother than at 1,0%.
At 5,0% the smell was moody and sweet and the taste was sweet and earthy which reminds eventually on carrots The structure was very smooth and the juiciness was like at 2,0%

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Scalding sausage:

The results were slightly different. No change of colour was found. The control showed a slight jelly deposit in the tin.

At 0,5% smell, taste and mouthfeeling were identical to the control

At 1,0% jelly deposits were reduced (the jelly was slightly turbid). The mouthfeeling was slightly dry and the taste was slightly bread-like and sweet compared to the control. These differences could be identified only against the control and are tolerable

At 2,0% jelly deposits were reduced (the jelly was more turbid) and the taste was bread-like and sweet. The consistence was unchanged.

At 5,0% jelly deposits were not reduced so much but there was a fat deposit. The smell and the taste were not acceptable. The consistence was soft.

CONCLUSIONS:

The fiber has a potential to reduce the jelly deposits in the production of canned meat and canned sausages (depending on the added amount). Up to 3,0% there are practically no changes in colour. Dosages over 1% in scalding sausages could be disturbing especially in Germany, because of the slight different taste and the slight dry mouthfeeling. On the other hand for products in the ready-to-eat segment, which have a different basic flavour, like burger, cevapcici, dosages up to 3% could be used without changing the organoleptical properties of the product. Here is probably the main application of the fiber.

translated by Werner Huber for Bolthouse Farms

16.11.2001

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BAFF
Kulmbach

Federal Center for Meat Research (BAFF)
EC-Baumann-Str. 20 , D-95326 Kulmbach, Germany
Tel. +49 (0)9221 803-1 -- Fax. +49 (0)9221 803-244

- Duties: Research and market studies in order to assure the population of the Federal Republic of Germany of a supply of meat and meat products, including animal fats, as well as poultry products and eggs, that is sufficient in amount, high in nutritional value, and low in residues and contaminants.
- In this regard, the research center advises the Federal Ministries on matters of consumer protection and legislation.

- Dr. P. Nitsch

- TEST OBJECTIVES: The effect of carrot fiber in the meat / canned industry.
- - Effect on the texture
- - Effect on the jelly separation (the less jelly separation the better)

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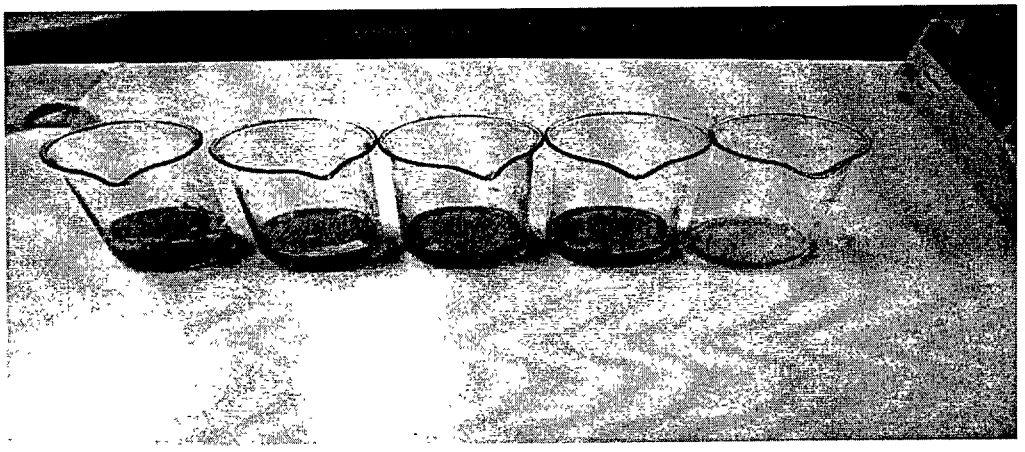
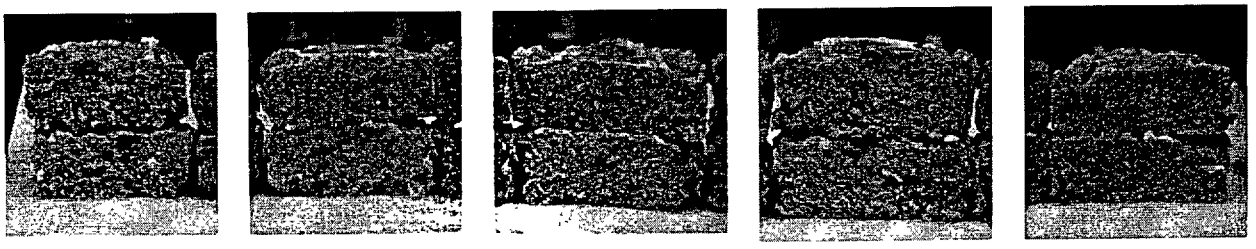
A LOOK AT JELLY SEPARATION and TEXTURE

BAFF Kulmbach



CF = 0% 0.5% 1% 2% 5%



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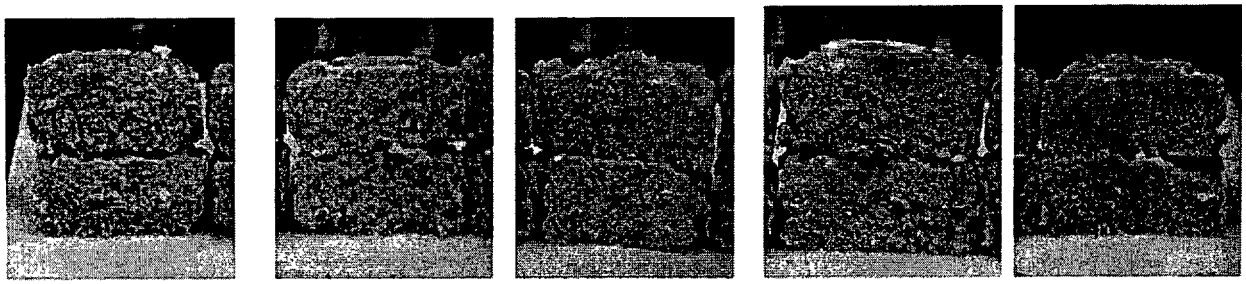
TEXTURE: CANNED PORK MINCED MEAT

BAFF Kulmbach



CF = 0% Control | 0.50% | 1.0% | 2.0% | 5.0%

Canned pork meat:

Carrot fiber

0.5% Similar than control, smoother texture than control, ok smell, better consistency than control.
1% Odor and smell like control, slight decrease in flavor, *less* meat taste and aroma, good structure
2% Odor and taste are ok, structure not typical, could be ok for cheap product.
5% Not tolerable

Canned scalding sausage

0.5% Smell and odor like control - little jelly separation
1% Little dryer than control, slightly sweeter taste, little jelly separation - good results
2% Jelly separation had a different color (cloudier), otherwise could be ok for some countries
5% Not tolerable

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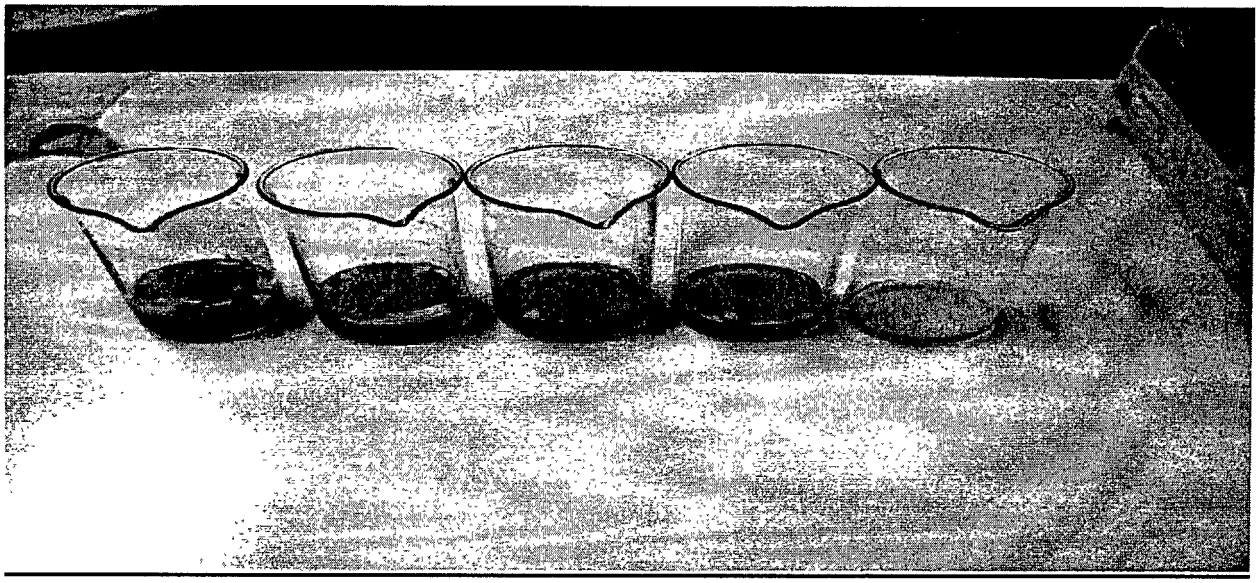
- **<u>JELLY SEPARATION:</u> CARROT FIBER IN CANNED PORK MINCED MEAT**



- **<u>Jelly Separation:</u>** Test on minced meat
- 0% Control showed a jelly separation of 17.9%
- 0.5% Reduce the jelly separation to 12.6%
- **1%** Reduce the jelly separation 9.4%
- **2%** Reduce the jelly separation to 9.1%
- 5% Not tolerable

- **The reducing jelly capability of the carrot fiber is optimum when using 1% to 2%.**
- **As a general rule: 1% CF reduce the jelly separation by 50%**

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STUDY 3

BAFF REPORT (TRANSLATED BY DR. WERNER UBER), AUGUST 8, 2001

BOLTHOUSE CARROT FIBER – APPLICATIONS IN MEAT PRODUCTS

DR. WERNER HUBER

food ingredients & technology

Bolthouse Carrot Fiber - applications in meat products

1. Guidelines

a) Properties of Bolthouse Carrot Fiber

The carrot fiber from Bolthouse Farms contains around 90% of dietary fiber and has a water absorption / adsorption of at least 10 times its weight (as indicated in the product specification). Furthermore fat particles could be absorbed / adsorbed by the carrot fiber.

These water- and fat binding properties makes the fiber favourable for meat products:

1. Reducing of water and fat losses after cooking (for example: burger)
advantages: preserve juiciness, better taste

2. Reducing of losses during freezing (for example: burger)
advantages: preserve juiciness, better taste, more economical

3. Improving of consistency and texture (for example: burger, all kind of sausages)
advantages: more "bite", better appearance, better form stability

4. Stabilising emulsions (for example: scalding sausages)
advantages: more stable against mechanical and heat treatment
the use of additives like milk protein or diphosphate could be reduced (or avoided)

5. Minimising of fat content by using carrot fiber as fat imitation (for example: all kind of sausages)
advantages: low calorie product without changing consistency and mouthfeeling

All recommendations are given without any warranty. It is the sole responsibility of the customer to work with products from Bolthouse Farms as well as to ensure that the use of products from Bolthouse Farms is in compliance with relevant laws and regulations

b) Recommendations of use

The dosage of the carrot fiber should be 0,40 - 1,00% for all meat products (referred to the total mass). Since water will be absorbed / adsorbed by the carrot fiber around 5-10 times additional water should be added (referred to the amount of added carrot fiber).

The carrot fiber should be added together with the other dried ingredients in the start phase of the production process (if possible) to give the fiber sufficient time to absorb / adsorb completely the additional added water.

Since additional water and carrot fiber will increase the total mass the taste could be slightly weaker. Therefore other ingredients like spices should be eventually increased.

2. Recipes

BURGER
COOKED BLOOD SAUSAGE
SPREADABLE LIVER SAUSAGE
SCALDING SAUSAGE TYPE FRANKFURTER
SCALDING SAUSAGE TYPE "HOT DOG"
RAW SAUSAGE TYPE SALAMI
RAW SAUSAGE TYPE "METTWURST"

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BURGER

Ingredients	Amount (usual recipe)	Amount (recipe with carrot fiber)
Minced meat (50% beef, 50% fat)	70,00%	70,00%
Bread crumbs	8,00%	8,00%
Eggs	8,00%	8,00%
Water	4,50%	4,50%
Salt	1,70%	1,70%
Spices (pepper, bell pepper)	0,70%	0,70%
Onions (chopped)	7,10%	7,10%
Bolthouse Carrot Fiber	-	0,40%
Water (additional)	-	2,00%
SUMME	100,00 %	102,40 %

Technology:

1. All ingredients were mixed together, kneaded and formed to 100 g portions
2. Frying of the burgers in vegetable fat

Profits of the carrot fiber:

- lower water and fat loss → better taste
- improved texture and consistency
- better form stability

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COOKED BLOOD SAUSAGE

Ingredients	Amount (usual recipe)	Amount (recipe with carrot fiber)
Pork fat cubes (pre-cooked)	59,50%	59,50%
Pork skin (pre-cooked)	9,50%	9,50%
Pork blood (with salt and nitrite)	24,00%	24,00%
Salt with sodium nitrite (0,5%)	1,54%	1,54%
Milk protein	1,00%	0,50%
Bouillon	4,00%	4,00%
Majoram	0,20%	0,20%
Black pepper	0,20%	0,20%
All spice	0,05%	0,05%
Thyme	0,01%	0,01%
Bolthouse Carrot Fiber	-	0,75%
Water (additional)	-	5,25%
SUMME	100,00 %	105,50 %

Technology:

1. Pork skin for crashing into the cutter
2. Adding pork blood
3. Adding of dry ingredients, bouillon and water
4. Adding of pork fat cubes
5. Filling up in sausage skins
6. Cooking at 100°C for 10 minutes
7. Cold smoke treatment

Profits of the carrot fiber:

- better texture and consistency
- reduced amount of milk protein

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SCALDING SAUSAGE TYPE FRANKFURTER

Ingredients	Amount (usual recipe)	Amount (recipe with carrot fiber)
Pork meat (low fat)	42,00%	42,00%
Pork meat (high fat)	26,45%	26,45%
Salt with sodium nitrite (0,5%)	1,40%	1,40%
White pepper	0,15%	0,15%
Water / ice	30,00%	30,00%
Bolthouse Carrot Fiber	-	1,00%
Water (additional)	-	6,00%
SUMME	100,00 %	107,00 %

Technology:

1. Pork meat, dry ingredients, and water/ ice are crushed in the cutter machine (= all in one process)
2. Filling up in sausage skins
3. Hot smoke treatment
4. Cooking at 72-75°C for 15 min

Profits of the carrot fiber:

- higher yield → reduced costs
- better stability of the emulsion

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RAW SAUSAGE TYPE SALAMI

Ingredients	Amount (usual recipe)	Amount (recipe with carrot fiber)
Beef meat (frozen)	20,00%	20,00%
Pork meat	39,80%	39,80%
Pork fat	35,00%	35,00%
Salpeter (potassium nitrate)	0,03%	0,03%
Fermenting cultures	1,50%	1,50%
Salt	2,77%	2,77%
Sugar	0,50%	0,50%
White pepper	0,25%	0,25%
Ginger	0,05%	0,05%
Garlic oil	0,10%	0,10%
Bolthouse Carrot Fiber	-	1,00%
Water (additional)	-	4,00%
SUMME	100,00 %	105,00%

Technology:

1. Frozen beef meat is crushed in the cutter
2. Dry ingredients are added
3. Adding of water and pork meat
4. Adding of pork fat
5. Filling up in sausage skins at 4-6° C
6. Drying and smoke treatment

Profits of the carrot fiber:

- better texture
- higher yield

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SCALDING SAUSAGE TYPE "HOT DOG"

Ingredients	Amount (usual recipe)	Amount (recipe with carrot fiber)
Beef meat (from bull)	35,00%	35,00%
Pork meat	14,00%	14,00%
Pork fat	18,84%	18,84%
Salt with nitrite	1,40%	1,40%
Diphosphate	0,25%	-
White pepper	0,14%	0,14%
Bell pepper	0,35%	0,35%
Cardamom	0,02%	0,02%
Water / ice	30,00%	30,00%
Bolthouse Carrot Fiber	-	1,00%
Water (additional)	-	6,25%
SUMME	100,00 %	107,00%

Technology:

1. Beef meat, pork meat, pork fat, dry ingredients, and water/ ice are crushed in the cutter machine (= all in one process)
2. Filling up in sausage skins
3. Hot smoke treatment
4. Cooking at 72-75°C for 15 min

Profits of the carrot fiber:

- diphospate was eliminated → clean labelling
- stable emulsion

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RAW SAUSAGE TYPE "METTWURST"

Ingredients	Amount (usual recipe)	Amount (recipe with carrot fiber)
Pork meat	47,00%	47,00%
Beef meat (high fat)	25,00%	25,00%
Pork fat	25,00%	25,00%
Salt with sodium nitrite	2,40%	2,40%
Sugar	0,20%	0,20%
Ascorbic acid	0,05%	0,05%
White pepper	0,20%	0,20%
Bell pepper	0,15%	0,15%
Bolthouse Carrot Fiber	-	1,00%
Water (additional)	-	8,00%
SUMME	100,00 %	109,00%

Technology:

1. First beef meat, then pork meat and finally pork fat are crushed in the same cutter machine.
2. Adding of dry ingredients and of water
3. Filling up in sausage skins
4. Storage of 3-4 days at 15-18°C
5. Cold smoke treatment

Profits of the carrot fiber:

- improved consistency
- higher yield → lower raw material costs

issued on 15.08.01

All recommendations are given without any warranty. It is the sole responsibility of the customer to work with products from Bolthouse Farms as well as to ensure that the use of products from Bolthouse Farms is in compliance with

STUDY 4

ABC RESEARCH CORPORATION, AUGUST 30, 2002

EVALUATION OF CARROT FIBER 602 IN BEEF PATTIES

FOOD MICROBIOLOGY AND FOOD CHEMISTRY SINCE 1967

ABC Research Corporation
(Originally American Bacteriological & Chemical Research Corporation)

3437 S.W. 24th Avenue
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(352) 372-0436
Fax (352) 378-6483
e-mail: info@abcr.com

PROJECT REPORT
PRODUCT DEVELOPMENT DEPARTMENT

DATE: August 30, 2002

PREPARED FOR: Wm. Bolthouse Farms

CLIENT CONTACT: Don Bailey

PROJECT: Evaluation of Carrot Fiber 602 in Beef Patties

OBJECTIVE: The objective of this study is to manufacture and compare product characteristics of a variety of meat products formulated with Carrot Fiber 602 to a control product.

EXPERIMENTAL APPROACH:

Phase I:

The initial phase of this project was to determine usage level for each class of product. The client supplied ABC Research with the carrot fiber 602 required to complete the study. Small batches of meat patties were produced using 0%, 0.5%, 1% and 2% of Carrot Fiber 602. Each product was served to 8-10 trained panelists for sensory evaluation. Based on the results, a usage level was determined and used in the second phase of this study.

Phase II:

ABC Research manufactured two 10-lb. batches of meat patties. Based on the results of phase I, one batch of beef patties was formulated with a predetermined percentage of carrot fiber 602 (treated) and the other batch was formulated without carrot fiber 602 and used as a control for comparison. Upon manufacturing, the following analysis was conducted:

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Microbiological Analysis:

- Total Plate Count
- Total Coliform
- E.coli

Organoleptic Evaluation:

Each product was cooked and evaluated by a 10 person trained taste panel for appearance, color, texture, flavor, and overall acceptability using the following 7 point hedonic scale: 0 = unacceptable, 1 = very poor, 2 = poor, 3 = fair, 4 = good, 5 = very good, and 6 = excellent. Appropriate statistical analysis of the taste panel results was conducted.

On day 0, additional texture analysis was conducted on each product (control and treated) using a Universal Testing Machine.

Proximate analysis and cooking yields of each product were evaluated on raw and cooked beef patties. Digital photos were taken of both the raw and cooked products.

Materials and Methods:

A total of 20-lbs of 81:19 (lean/fat) ground beef was purchased from a local vendor. The control product was formulated by mixing 10-lbs of ground beef in a bowl chopper for 2 minutes. After mixing, approximately 100 grams of emulsion was weighed and patties were formed using a manual patty machine. The treated product was formulated using 9.8 lbs. ground beef and 0.2 lbs. of carrot fiber 602. The product was mixed for approximately 2 minutes in a bowl chopper. After mixing, approximately 100 grams of emulsion was weighed and patties were formed using a manual patty machine. Both the control and the treated product were vacuum packaged and stored in a freezer for 24hrs prior to cooking or sampling.

Cooking
Each control and treated frozen patty was cooked on a flat top grill to an internal temperature of 160°F Patties were cooked for 4 minutes on one side, turned and finished on the other side. The internal temperature was measured with a thermocouple probe inserted in the geometric center of each patty.

Allo-Kramer Shear
After cooking 10 patties were taken from each treatment and allowed to cool to room temperature. A 2 x 4 cm strip was dissected from the central part of each patty and used for Allo-Kramer Shear measurement. Each strip was individually loaded onto the center of an Allo-Kramer Shear cell fitted to an Instron Universal Testing Machine. Shear force value was recorded and calculated as kg/g sample.

Statistical Analysis
Shear force value, organoleptic evaluation, and cooking yields were subjected to analysis of variance using SAS. Significance was judged at the 0.05 level.

Discussion:

Table 1 summarizes the sensory panel results for phase1. The result indicates that there was very little difference between adding 0% - 2% of carrot fiber 602. Therefore, two- percent carrot fiber 602 was added to the treated product in the second phase of this study.

Table 2 summarizes the proximate composition and the microbiological results of the raw and cooked control and treated beef patties. After cooking, both products had increases in fat and protein and decreases in moisture and carbohydrates. After cooking, the treated product had higher moisture and carbohydrate retention, than the control. However, the protein content was higher in the control than the treated. Both treatments had similar microbial profiles in the raw and cooked state.

Table 3 summarizes the results of the average percent yield of the control and the treated beef patties. The results indicated that there was significant difference between the control and treated beef patties. The treated patties had a cook yield of 83.1%, while the control patties had a cook yield of 71.9%.

Table 4 summarizes the results of the average shear force for the control and treated beef patties. The results indicated that there was a significant difference between the treatments. The treated patties required less force to shear than the control patties.

Table 5 summarizes the sensory panel data for the control and treated beef patties. The results indicate that there was no significant difference in appearance, color, texture, flavor or overall acceptability. Although, there were no significant difference, the treated product received scores that are more favorable for all attributes evaluated. In addition, the panelists indicated that the texture of the treated product was more favorable than the control.

Results:

Table1: Phase I Sensory Analysis Results of Cooked Beef Patties Using Various Percentage of Carrot Fiber 602.

	0%	0.5%	1%	2%
Color	4.3	4.5	4.0	3.9
Texture	4.0	4.3	3.9	4.1
Flavor	3.6	4.1	3.9	4.1
Overall	4.1	4.4	4.0	4.1

Table 2: Proximate Compositions[a] and Microbiological Results[b] of Treated and Control Beef Patties:

	Control Raw	Control Cooked	Treated Raw	Treated Cooked
Moisture	61.45	51.48	61.19	54.22
Fat	19.16	21.18	18.77	21.74
Protein	17.51	25.98	17.53	21.59
Carbohydrate	1.04	0.43	1.62	1.46
Total Plate Count /gm	19,500	<10	16,500	<45
Total Coliform /gm	355	<10	645	<10
E. Coli /gm	250	<10	590	<10

[a]Means of five replicates
[b]Means of three replicates

Table 3: Average percent Yield[a] of Cooked Control and Treated Beef Patties

Treatment	Cook Yield (%)[b]
Control	71.9
Treated	81.3
Significant?[c]	Yes

[a] Percent yield (%) = (cooked wt / raw wt) x 100
[b] Means of twenty replicates
[c] Samples were judged significantly different at the 0.05 level.

Table 4: Average Shear Force[a] of Cooked Control and Treated Beef Patties.

Treatment	Force (kg/g)
Control	118.3
Treated	81.9
Significant?[b]	Yes

[a] Means of ten replicates
[b] Samples were judged significantly different at the 0.05 level.

Table 5: Average Sensory Panel Results on Cooked Control and Treated Beef Patties.

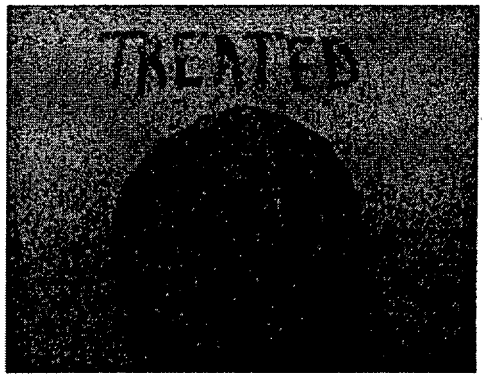
Treatment	Appearance	Color	Texture	Flavor	Overall Acceptability
Control	4.2	4.4	3.8	3.6	3.8
Treated	5.5	4.4	4.7	3.7	3.6
Significant?[a]	No	No	No	No	No

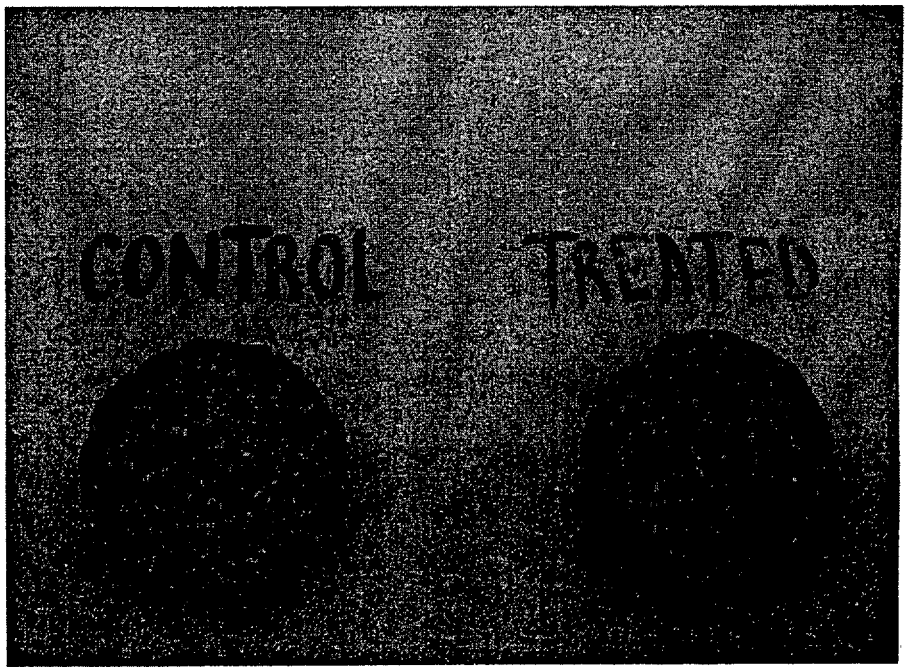
[a]Samples were judged significantly different at the 0.05 level.

PREPARED BY:

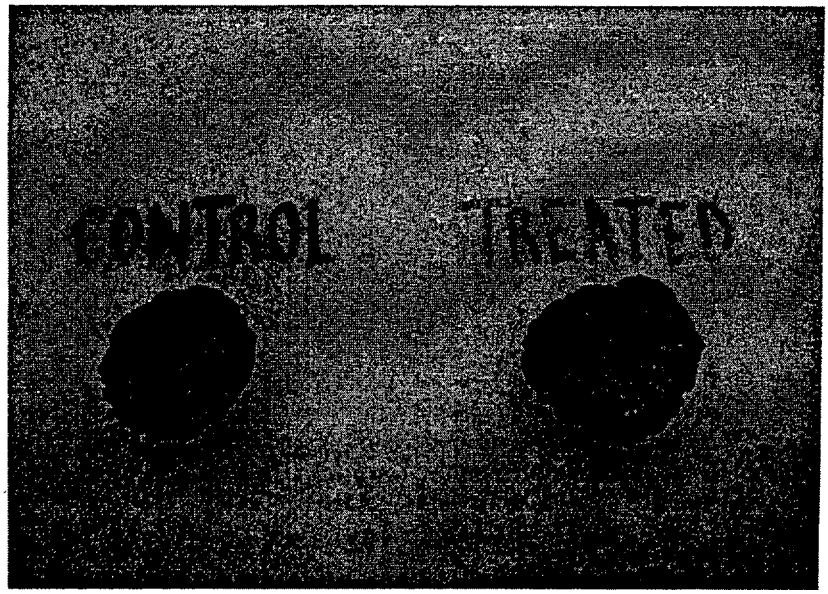
Lloyd Gabay
Manager, Product Development

Raw Control and Treated Beef Patties





Cooked Control and Treated Beef Patty



STUDY 5

ABC RESEARCH CORPORATION, AUGUST 30, 2002

EVALUATION OF CARROT FIBER 602 IN SAUSAGE PATTIES

FOOD MICROBIOLOGY AND FOOD CHEMISTRY SINCE 1967

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(Originally American Bacteriological & Chemical Research Corporation)

PROJECT REPORT
PRODUCT DEVELOPMENT DEPARTMENT

DATE: August 30, 2002

PREPARED FOR: Wm. Bolthouse Farms

CLIENT CONTACT: Don Bailey

PROJECT: Evaluation of Carrot Fiber 602 in Sausage Patties

OBJECTIVE: The objective of this study is to manufacture and compare product characteristics of a variety of meat products formulated with Carrot Fiber 602 to a control product.

EXPERIMENTAL APPROACH:

Phase I:

The initial phase of this project was to determine usage level for each class of product. The client supplied ABC Research with the carrot fiber 602 required to complete the study. Small batches of sausage patties were produced using 0%, 0.5%, 1% and 2% of Carrot Fiber 602. Each product was served to 10 trained panelists for sensory evaluation. Based on the results, a usage level was determined and used in the second phase of this study.

Phase II:

ABC Research manufactured two 10-lb. batches of sausage patties. Based on the results of phase 1, one batch of sausage patties was formulated with a predetermined percentage of carrot fiber 602 (treated) and the other batch was formulated without carrot fiber 602 and used as a control for comparison. Upon manufacturing, the following analysis was conducted:

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Microbiological Analysis:

- Total Plate Count
- Total Coliform
- E.coli

Organoleptic Evaluation:

Each product was cooked and evaluated by a 10 person trained taste panel for appearance, color, texture, flavor, and overall acceptability using the following 7 point hedonic scale: 0 = unacceptable, 1 = very poor, 2 = poor, 3 = fair, 4 = good, 5 = very good, and 6 = excellent. Appropriate statistical analysis of the taste panel results was conducted.

Additional texture analysis was conducted on each product (control and treated) using a Universal Testing Machine.

Proximate analysis, sensory panel, and cooking yields of each product were evaluated on raw and cooked sausage patties. Digital photos were taken of both the raw and cooked products.

Materials and Methods:

Twenty pounds of pork butts was purchased from a local vendor and ground through a 1/4" plate. The control product was formulated by mixing 10-lbs of ground pork, one cup of ice water, and a seasoning blend. The emulsion was mixed in a bowl chopper for 3 minutes. After mixing, approximately 75 grams of emulsion was weighed and patties were formed using a manual patty machine. The treated product was formulated using 9.8-lbs. ground pork, 0.2 lbs. of carrot fiber 602, one cup of ice water, and a seasoning blend. The product was mixed for approximately 3 minutes in a bowl chopper. After mixing, approximately 75 grams of emulsion was weighed and patties were formed using a manual patty machine. Both the control and the treated product were vacuum packaged and stored in a freezer for 24hrs prior to cooking or sampling.

Cooking
Each frozen patty was cooked on a flat top grill to an internal temperature of 160°F. Patties were cooked for 3 minutes on one side, turned and finished on the other side. The internal temperature was measured with a thermocouple probe inserted in the geometric center of each patty.

Allo-Kramer Shear
After cooking 10 patties were taken from each treatment and allowed to cool to room temperature. A 2 x 4 cm strip were dissected from the central part of each patty and used for Allo-Kramer Shear measurement. Each strip was individually loaded onto the center of an Allo-Kramer Shear cell fitted to an Instron Universal Testing Machine. Shear force value was recorded and calculated as kg/g sample.

Statistical Analysis
Shear force value, organoleptic evaluation, and cooking yields were subjected to analysis of variance using SAS and significance was judged at the 0.05 level.

Discussion:

Table 1 summarizes the sensory panel results for phase1. The result indicates that there was very little difference between adding 0% - 2% of carrot fiber 602. Therefore, two- percent carrot fiber 602 was added to the treated product in the second phase of this study.

Table 2 summarizes the proximate composition and the microbiological results of the raw and cooked control and treated sausage patties. After cooking, both products had increases in fat and protein and decreases in moisture and carbohydrates. After cooking, the treated product had a much higher carbohydrate retention and slightly higher moisture retention, than the control. However, the protein content was slightly higher in the control than the treated.

Table 3 summarizes the results of the average percent yield for the control and the treated sausage patties. The results indicated that there was a significant difference between the control and treated sausage patties. The treated patties had a cook yield of 87.1%, while the control patties had a cook yield of 81.6%.

Table 4 summarizes the results of the average shear force for the control and treated sausage patties. The results indicated that there was a significant difference between the treatments. The control patties required less force to shear than the treated patties.

Table 5 summarizes the sensory panel data for the control and treated sausage patties. The results indicate that there was no significant difference in appearance, color, texture, flavor or overall acceptability.

Results:

Table1: Phase I Sensory Analysis Results of Cooked Sausage Patties Using Various Percentage of Carrot Fiber 602.

	0%	0.5%	1%	2%
Color	4.3	4.4	4.2	4.4
Texture	3.7	4.2	4.2	3.9
Flavor	2.7	3.4	3.4	3.4
Overall	3.2	3.7	3.4	3.6

Table 2: Proximate Compositions[a] and Microbiological Results[b] of Treated and Control Sausage Patties.

	Control Raw	Control Cooked	Treated Raw	Treated Cooked
Moisture	65.58	60.6	64.76	60.5
Fat	14.04	16.1	13.32	15.2
Protein	16.12	19.7	16.12	18.7
Carbohydrate	1.24	0.4	2.5	2.1
Total Plate Count /gm	3,600	<10	2,170	170
Total Coliform /gm	70	<10	<10	<10
E. Coli /gm	<10	<10	590	<10

[a]Means of five replicates
[b]Means of three replicates

000103

Table 3: Average percent Yield[a] of Cooked Control and Treated Sausage Patties.

Treatment	Cook Yield (%)[b]
Control	81.6
Treated	87.1
Significant?[c]	Yes

[a] Percent yield (%) = (cooked wt / raw wt) x 100
[b] Means of twenty replicates
[c] Samples were judged significantly different at the 0.05 level.

Table 4: Average Shear Force[a] of Cooked Control and Treated Sausage Patties.

Treatment	Force (kg/g)
Control	42.6
Treated	55.2
Significant?[b]	Yes

[a] Means of ten replicates
[b] Samples were judged significantly different at the 0.05 level.

Table 5: Average Sensory Panel Results on Cooked Control and Treated Sausage Patties.

Treatment	Appearance	Color	Texture	Flavor	Overall Acceptability
Control	4.2	4.3	3.9	4.3	4.5
Treated	5.5	3.8	3.9	3.9	3.8
Significant?[a]	No	No	No	No	No

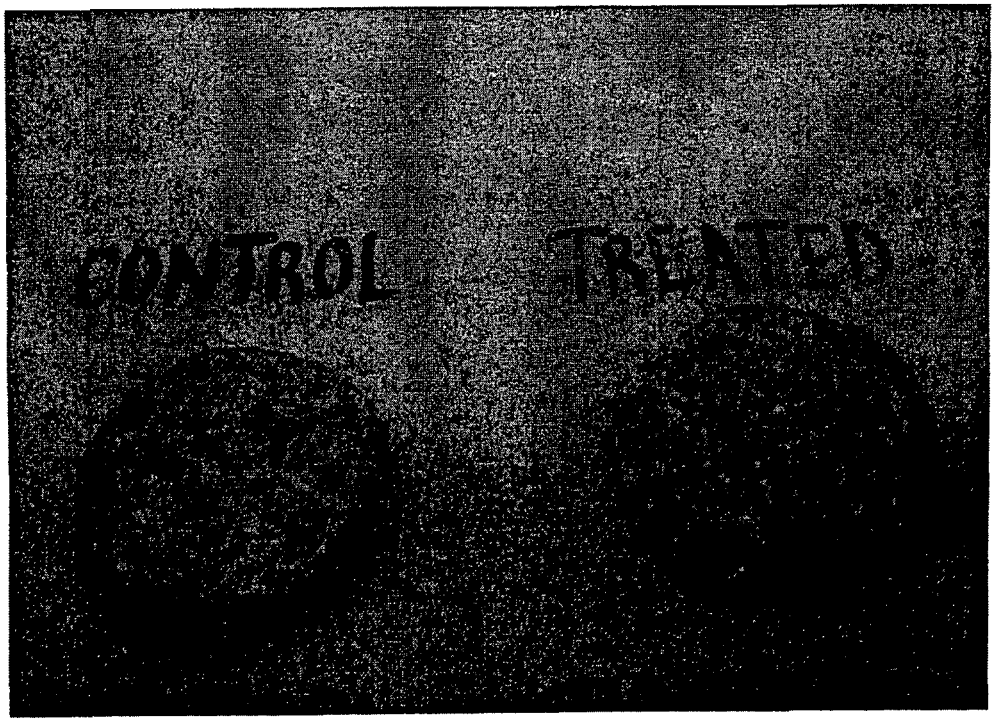
[a]Samples were judged significantly different at the 0.05 level.

PREPARED BY:

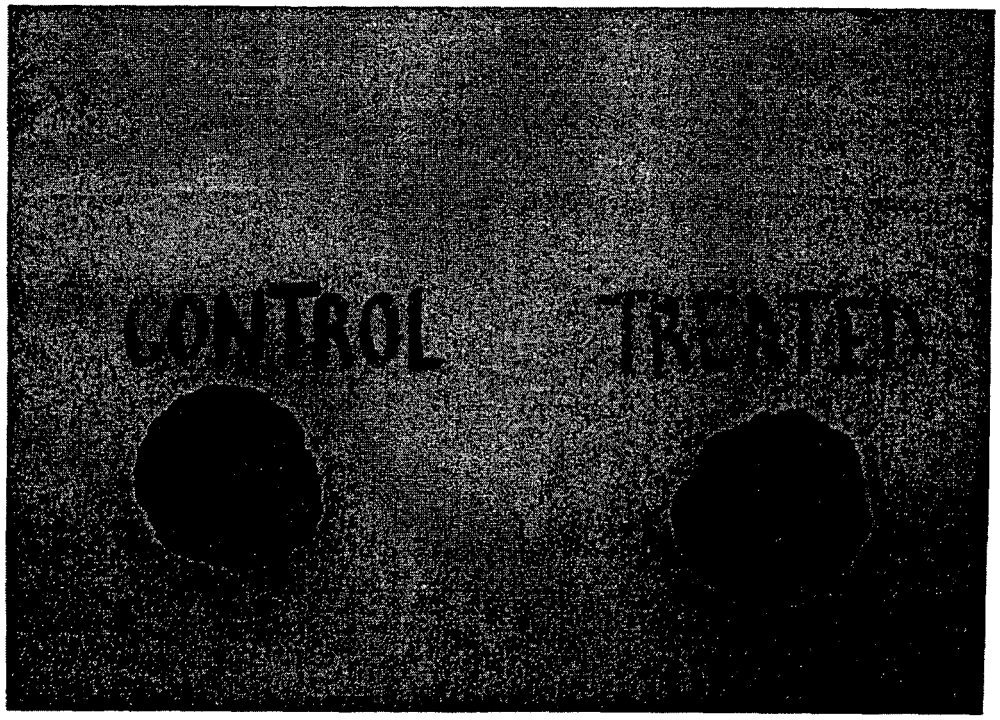
Lloyd Gabay
Manager, Product Development

000104

Raw Control and Treated Sausage Patties



Cooked Control and Treated Sausage Patties



STUDY 6

ABC RESEARCH CORPORATION, AUGUST 29, 2002

EVALUATION OF CARROT FIBER 602 IN SAUSAGE LINKS

000107

FOOD MICROBIOLOGY AND FOOD CHEMISTRY SINCE 1967

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(Originally American Bacteriological & Chemical Research Corporation)

PROJECT REPORT
PRODUCT DEVELOPMENT DEPARTMENT

DATE: August 29, 2002

PREPARED FOR: Wm. Bolthouse Farms

CLIENT CONTACT: Don Bailey

PROJECT: Evaluation of Carrot Fiber 602 in Sausage Links

OBJECTIVE: The objective of this study is to manufacture and compare product characteristics of a variety of meat products formulated with Carrot Fiber 602 to a control product.

EXPERIMENTAL APPROACH:

ABC Research manufactured two 10-lb. batches of sausage links. Based on the results of from an initial study, one batch of sausage links was formulated with 2% carrot fiber 602 (treated) and another batch was formulated without carrot fiber 602 and used as a control for comparison. Upon manufacturing, the following analysis was conducted:

Microbiological Analysis:

- Total Plate Count
- Total Coliform
- E.coli

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Organoleptic Evaluation:

Each product was cooked and evaluated by a 10 person trained taste panel for appearance, color, texture, flavor, and overall acceptability using the following 7 point hedonic scale: 0 = unacceptable, 1 = very poor, 2 = poor, 3 = fair, 4 = good, 5 = very good, and 6 = excellent. Appropriate statistical analysis of the taste panel results was conducted.

Additional texture analysis was conducted on each product (control and treated) using a Universal Testing Machine.

Proximate analysis, sensory panel, and cooking yields of each product were evaluated on raw and cooked sausage links. Digital photos were taken of both the raw and cooked products.

Materials and Methods:

Twenty pounds of pork butts was purchased from a local vendor and ground through a 1/4" plate. The control product was formulated by mixing 10-lbs of ground pork, one cup of ice water, and a seasoning blend in a bowl chopper for 3 minutes. After mixing, the sausage links were stuffed in a 28-mm cellulose casing. The treated product was formulated using 9.8-lbs. ground pork, 0.2 lbs. of carrot fiber 602, one cup of ice water, and a seasoning blend. The product was mixed for approximately 3 minutes in a bowl chopper. After mixing, the sausage links were stuffed in a 28-mm cellulose casing. Both the control and the treated links were partially cooked in a smokehouse. The links were cooked to an internal temperature of 150°, vacuum packaged and stored frozen for 24hrs.

Cooking
The links were fully cooked in a conventional oven set at 350°F to an internal temperature of 160°F. The internal temperature was measured with a thermocouple probe inserted in the geometric center of the product.

000109

Warner Bratzler Shear
After cooking, 10 links were taken from each treatment and allowed to cool to room temperature. A 14-mm diameter long section was extracted from the central part of each link and used for shear measurement. Each section was individually loaded onto a Warner Bratzler shear attachment fitted to an Instron Universal Testing Machine. Shear force value was recorded and calculated as kg/g sample.

Statistical Analysis
Shear force value, organoleptic evaluation, and cooking yields were subjected to analysis of variance using SAS and significance was judged at the 0.05 level.

Discussion:

Tables 1 summarize the proximate composition and the microbiological results of the raw and cooked control and treated sausage links. After cooking, both treatments had a decrease in percent fat and a slight decrease in carbohydrates. After cooking, the treated product retained more moisture than the control and both treatments had increases in percent protein. Both treatments had a similar microbial profile before and after cooking.

Table 2 summarizes the results of the average percent yield of the control and the treated sausage links. The results indicated that there was a significant difference between the control and treated sausage links. The treated links had a cook yield of 82.9%, while the control links had a cook yield of 71.2%.

Table 3 summarizes the results of the average shear force for the control and treated sausage links. The results indicated that there was a significant difference between the treatments. The control links required less force to shear than the treated links.

Table 4 summarizes the sensory panel data for the control and treated sausage links. The results indicate that there was no significant difference in color, texture, flavor or overall acceptability. The panelist did rate the treated sausage links significantly higher than the control for appearance.

Results:

Table 1: Proximate Compositions[a] and Microbiological Results[a] of Treated and Control Sausage Links

	Control Raw	Control Cooked	Treated Raw	Treated Cooked
Moisture	61.96	55.43	59.22	57.13
Fat	18.33	15.77	19.13	15.93
Protein	15.10	23.63	15.46	20.10
Carbohydrate	1.70	1.50	2.76	2.73
Total Plate Count /gm	4,033,300	410	3,300,000	410
Total Coliform /gm	730	<10	1130	<10
E. Coli /gm	<70	<10	<70	<10

[a]Means of three replicates

Table 2: Average percent Yield[a] of Cooked Control and Treated Sausage Links.

Treatment	Cook Yield (%)[b]
Control	71.2
Treated	82.9
Significant?[c]	Yes

[a] Percent yield (%) = (cooked wt / raw wt) x 100
[b] Means of twenty replicates
[c] Samples were judged significantly different at the 0.05 level.

Table 3: Average Shear Force[a] of Cooked Control and Treated Sausage Links.

Treatment	Force (kg/g)
Control	1.66
Treated	1.35
Significant?[b]	Yes

[a] Means of ten replicates
[b] Samples were judged significantly different at the 0.05 level.

000111

Table 4: Average Sensory Panel Results on Cooked Control and Treated Sausage Links.

Treatment	Appearance	Color	Texture	Flavor	Overall Acceptability
Control	3.0	2.8	3.2	3.9	3.5
Treated	5.5	2.9	3.1	3.4	3.5
Significant? [a]	Yes	No	No	No	NO

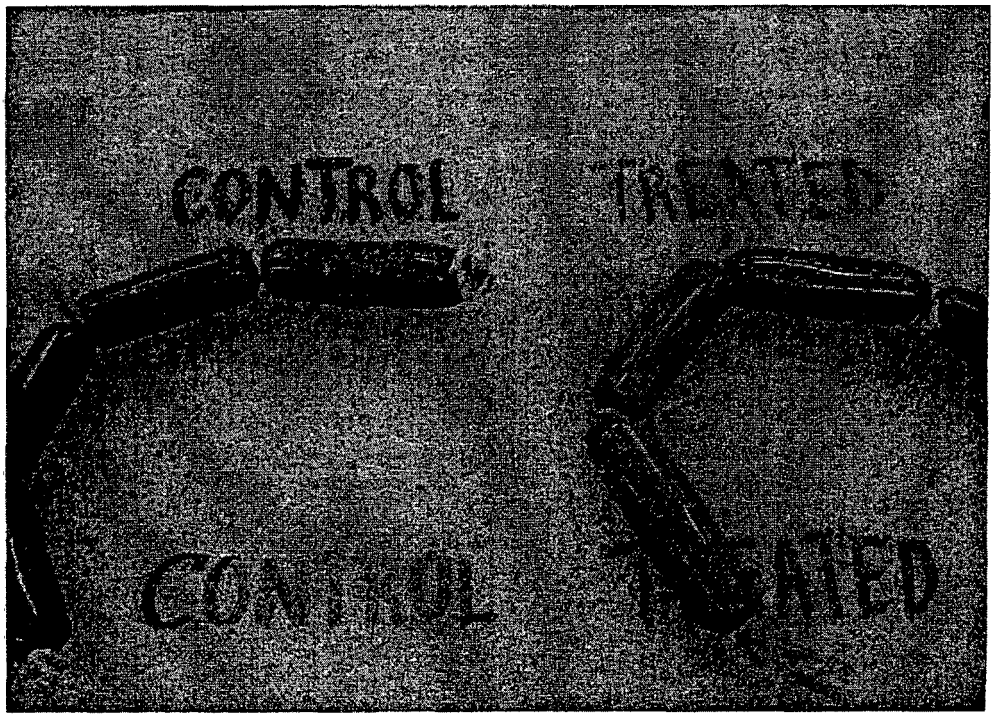
[a]Samples were judged significantly different at the 0.05 level.

PREPARED BY:

Lloyd Gabay
Manager, Product Development

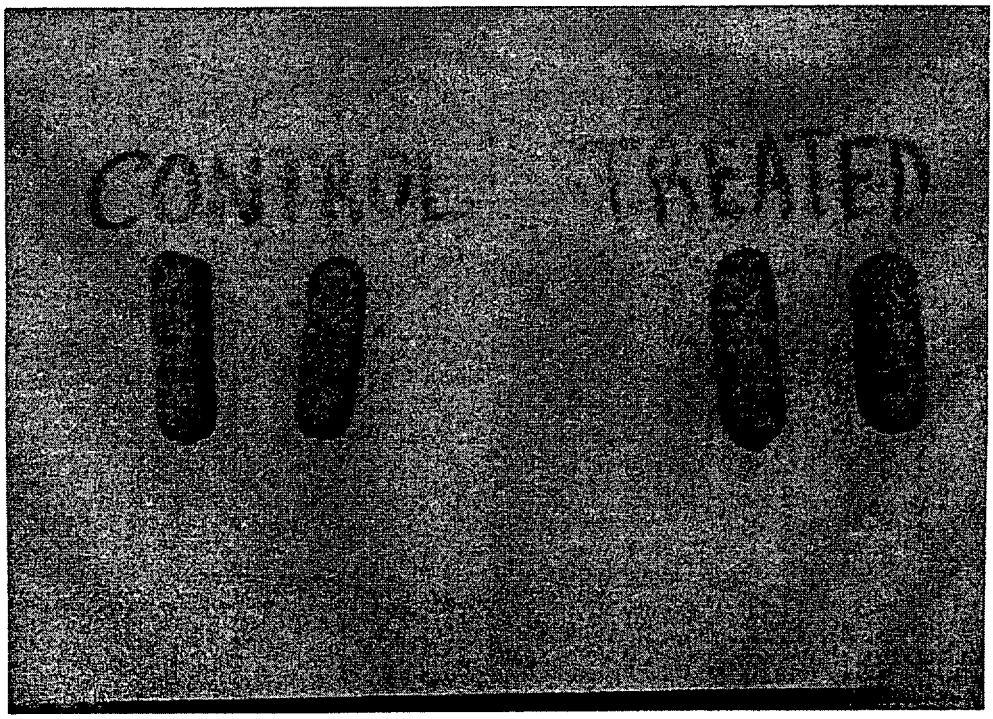
000112

Raw Control and Treated Sausage Links



000113

Cooked Control and Treated Sausage Links



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STUDY 7

ABC RESEARCH CORPORATION, AUGUST 30, 2002

EVALUATION OF CARROT FIBER 602 IN BOLOGNA

000115

FOOD MICROBIOLOGY AND FOOD CHEMISTRY SINCE 1967

ABC Research Corporation

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(Originally American Bacteriological & Chemical Research Corporation)

PROJECT REPORT
PRODUCT DEVELOPMENT DEPARTMENT

DATE: August 30, 2002

PREPARED FOR: Wm. Bolthouse Farms

CLIENT CONTACT: Don Bailey

PROJECT: Evaluation of Carrot Fiber 602 in Bologna

OBJECTIVE: The objective of this study is to manufacture and compare product characteristics of a variety of meat products formulated with Carrot Fiber 602 to a control product.

EXPERIMENTAL APPROACH:

ABC Research manufactured two 10-lb. batches of bologna. One batch of bologna was formulated with a predetermined percentage (2%) of carrot fiber 602 (treated) and the other batch was formulated without carrot fiber 602 and used as a control for comparison. Upon manufacturing, the following analysis was conducted:

Microbiological Analysis:

- Total Plate Count
- Total Coliform
- Yeast and Mold
- Listeria

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Organoleptic Evaluation:

Each product was cooked and evaluated by a 10 person trained taste panel for appearance, color, texture, flavor, and overall acceptability using the following 7 point hedonic scale: 0 = unacceptable, 1 = very poor, 2 = poor, 3 = fair, 4 = good, 5 = very good, and 6 = excellent. Appropriate statistical analysis of the taste panel results was conducted.

Additional texture analysis was conducted on each product (control and treated) using a Universal Testing Machine.

Proximate analysis and cooking yields of each product were evaluated on raw and cooked bologna. Digital photos were taken of both the raw and cooked products.

Materials and Methods:

The control product was formulated by grinding 8-lbs of ground lean beef chucks and 2-lbs of regular pork trimmings through a 1/4-inch plated. Meat samples were then mixed with 2-lbs of ice, a liquid oleoresin-seasoning blend, along with the appropriate amount of sodium nitrite. The treated product was formulated by grinding 7.84-lbs of ground lean beef chucks and 1.96-lbs of regular pork trimmings through a 1/4-inch plated. Meat samples were then mixed with 0.2-lbs of Carrot Fiber 602, 2-lbs of ice, a liquid oleoresin-seasoning blend, along with the appropriate amount of sodium nitrite. Both the control and the treated products were each stuffed in a fibrous casing. Products were then hung in a 38°F cooler for 24 hours. Thereafter, both treatments were cooked to an internal temperature of 150°F. The product was then showered to an internal temperature of 100°F. Internal temperature was monitored by inserting a thermocouple probe in the geometric center of each product.

Warner Bratzler Shear
After cooking, 10 half-inch thick slices were taken from each treatment and used for shear measurement. A 2 x 4 cm strip was dissected from the central part of each slice and individually loaded onto a Warner Bratzler shear attachment fitted to an Instron Universal Testing Machine. Shear force value was recorded and calculated as kg/g sample.

Statistical Analysis
Shear force value, organoleptic evaluation, and cooking yields were subjected to analysis of variance using SAS and significance was judged at the 0.05 level.

Discussion:

Table 1 summarizes the proximate composition and the microbiological results of the raw and cooked control and treated bologna. After cooking, both products had increases in fat and protein and decreases in moisture. The carbohydrate decreased in the control product, but increased in the treated. Both products had similar microbial profiles before and after cooking.

Table 2 summarizes the results of the average percent yield of the control and the treated bologna. The results indicated that there was no significant difference between the control and treated products. The treated bologna had a cook yield of 90.45%, while the control bologna had a cook yield of 90.20%.

Table 3 summarizes the results of the average shear force for the control and treated bologna. The results indicated that there was no significant difference between the products evaluated.

Table 4 summarizes the sensory panel data for the control and treated bologna. The results indicated that there was no significant difference in appearance, color, texture, flavor or overall acceptability.

Results:

Table 1: Proximate Compositions[a] and Microbiological Results[a] of Treated and Control Bologna.

	Control Raw	Control Cooked	Treated Raw	Treated Cooked
Moisture	64.96	57.0	63.27	55.90
Fat	16.43	19.50	16.53	18.60
Protein	14.80	19.30	14.60	18.50
Carbohydrate	1.0	0.5	2.4	3.1
Total Plate Count /gm	4,700,000	<10	9,000,000	<10
Total Coliforms /gm	1,000	<10	1,120	<10
E. Coli /gm	Y=2,500 M=90	Y=<10 M=<10	Y=3000 M=70	Y=<10 M=<10
Listeria Species /25gm	*Listeria Monocytogenes*	Negative	*Listeria Monocytogenes*	Negative

[a]Means of three replicates

Table 3: Average percent Yield[a] of Cooked Control and Treated Bologna.

Treatment	Cook Yield (%)[b]
Control	90.20
Treated	90.45
Significant?[c]	No

[a] Percent yield (%) = (cooked wt / raw wt) x 100
[b] Means of three replicates
[c] Samples were judged significantly different at the 0.05 level.

Table 4: Average Shear Force[a] of Cooked Control and Treated Bologna.

Treatment	Force (kg/g)
Control	0.77
Treated	0.80
Significant?[b]	No

[a] Means of ten replicates
[b] Samples were judged significantly different at the 0.05 level.

Table 5: Average Sensory Panel Results on Cooked Control and Treated Bologna.

Treatment	Appearance	Color	Texture	Flavor	Overall Acceptability
Control	4.2	4.1	4.1	3.8	3.8
Treated	5.5	4.4	4.3	4.3	4.2
Significant? [a]	No	No	No	No	No

[a]Samples were judged significantly different at the 0.05 level.

PREPARED BY:

Lloyd Gabay
Manager, Product Development

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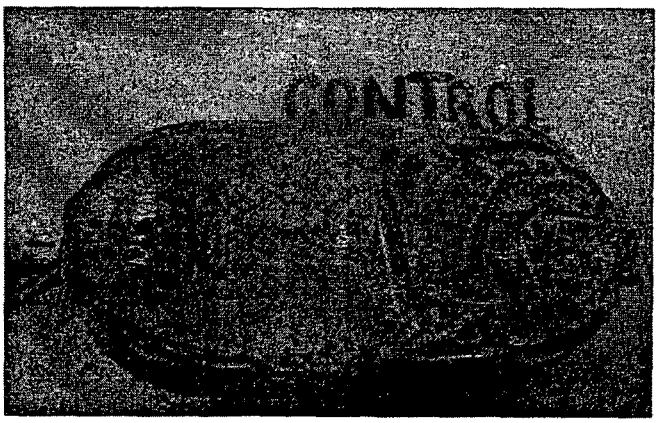
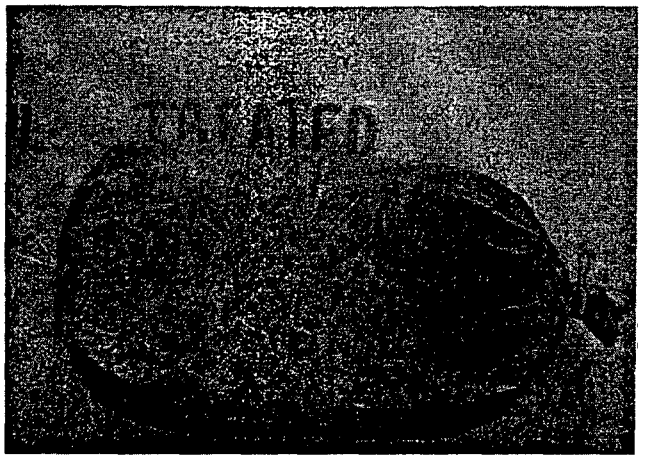
Raw Control and Treated Bologna





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Raw Control and Treated Bologna

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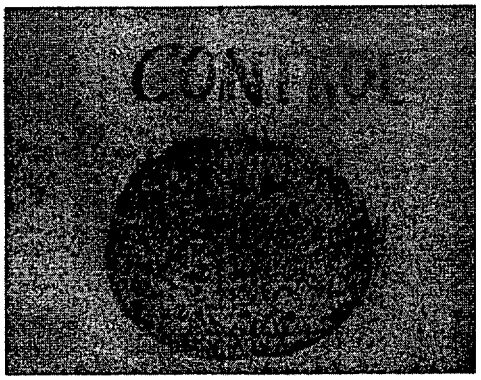
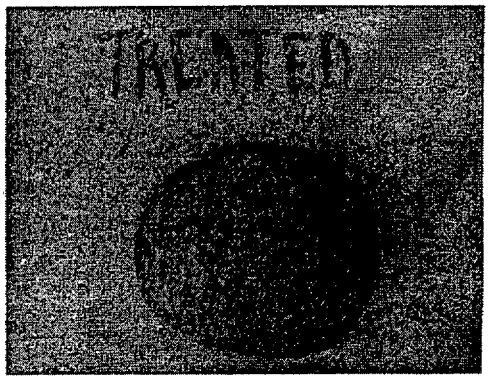
Cooked Control and Treated Bologna





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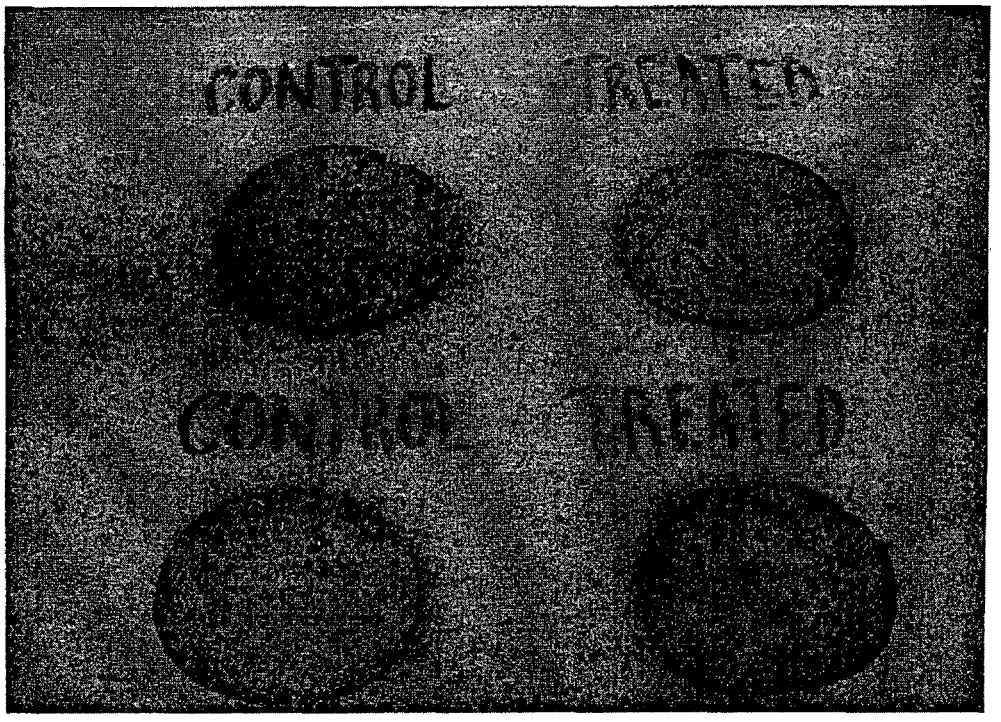
Cooked Control and Treated Bologna



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STUDY 8

ABC RESEARCH CORPORATION, AUGUST 30, 2002

EVALUATION OF CARROT FIBER 602 IN FRANKFURTERS

ABC Research Corporation

3437 SW 24th Avenue Fax: 352-378-6483
Gainesville, FL 32607 E-mail: info@abcr.com
Tel: 352-372-0436 Web: www.abcr.com

A FOOD TESTING LABORATORY
SINCE 1967

PROJECT REPORT
PRODUCT DEVELOPMENT DEPARTMENT

DATE: September 4, 2002

PREPARED FOR: Wm. Bolthouse Farms

CLIENT CONTACT: Don Bailey

PROJECT: Evaluation of Carrot Fiber 602 in Frankfurters

OBJECTIVE: The objective of this study is to manufacture and compare product characteristics of a variety of meat products formulated with Carrot Fiber 602 to a control product.

EXPERIMENTAL APPROACH:

Phase I:

The initial phase of this project was to determine usage level for each class of product. The client supplied ABC Research with the carrot fiber 602 required to complete the study. Small batches of frankfurters were produced using 0%, 0.5%, 1% and 2% of Carrot Fiber 602. Each product was served to 10 trained panelists for sensory evaluation. Based on the results, a usage level was determined and used in the second phase of this study.

Phase II:

ABC Research manufactured two 10-lb. batches of frankfurters. Based on the results of phase I, one batch of frankfurters was formulated with a predetermined percentage (2%) of carrot fiber 602 (treated) and the other batch was formulated without carrot fiber 602 and used as a control for comparison. Upon manufacturing, the following analysis was conducted:

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Microbiological Analysis:

- Total Plate Count
- Total Anaerobic Plate Count
- Yeast and Mold
- Lactic Acid Bacteria
- Listeria

Organoleptic Evaluation:

Each product was cooked and evaluated by a 10 person trained taste panel for appearance, color, texture, flavor, and overall acceptability using the following 7 point hedonic scale: 0=unacceptable, 1=very poor, 2=poor, 3=fair, 4=good, 5=very good, and 6=excellent. Appropriate statistical analysis of the taste panel results was conducted.

On day 0, additional texture analysis was conducted on each product (control and treated) using a Universal Testing Machine.

Proximate analysis and cooking yields of each product were evaluated on raw and cooked frankfurters. Digital photos were taken of both the raw and cooked products.

Materials and Methods:

81:19 (lean/fat) ground beef and pork trimmings were purchased from a local vendor. The control product was formulated by mixing 4.8-lbs of ground Beef, 3.2 lbs. of ground pork trimmings, 2-lbs. ice, 16 grams of dextrose, 72.7 grams salt, 1.1 grams of a custom seasoning blend, and 0.56 grams of sodium nitrite. After mixing, the frankfurters were stuffed in a 28-mm cellulose casing. The treated product was formulated by mixing 4.704-lbs of ground Beef, 3.136 lbs. of ground pork trimmings, 0.16 lbs. of Carrot fiber 602, 2-lbs. ice, 16 grams of dextrose, 72.7 grams salt, 1.1 grams of a custom seasoning blend, and 0.56 grams of sodium nitrite. The product was mixed in a bowl chopper. After mixing, the frankfurters were stuffed in a 28-mm cellulose casing.

Cooking

Both the control and the treated were cooked in a smokehouse to an internal temperature of 160°F. Thereafter, products were showered to room temperature and then chilled in a cooler set at 4°C, for 24 hours. The internal temperature was measured with a thermocouple probe inserted in the geometric center of the product.

Purge
After processing, the products were vacuum packaged and stored refrigerated (40°F). Free package moisture (% purge) was determined on the products following 21 days of storage.

Warner Bratzler Shear
A 20-mm diameter long section was dissected from the central part of each frank and used for Shear measurement. Each section was individually loaded onto a Warner Bratzler shear attachment fitted to an Instron Universal Testing Machine. Shear force value was recorded and calculated as kg/g sample.

Statistical Analysis
Shear force value, organoleptic evaluation, and cooking yields were subjected to anâlysis

of variance using SAS and significance was judged at the 0.05 level.

Discussion:

Tables 1 summarizes the proximate composition and the microbiological results of the raw and cooked control and treated frankfurters. After cooking, the control had a decrease in fat while the treated had an increase in fat. The percent moisture decreased in both products and the protein increased in both products. The percent carbohydrates increased after cooking in the control, but had a slight decrease in the treated. Both raw products tested positive for *Listeria Non-Monocytogenes* and both tested negative after cooking.

Table 2 summarizes the results of the average percent yield of the control and the treated frankfurters. The results indicated that there was a significant difference between the control and frankfurters. The treated franks had a cook yield of 88.1%, while the control had a cook yield of 82.1%.

Table 3 summarizes the results of the average shear force for the control and treated frankfurters. The results indicated that there was a no significant difference between the products evaluated.

Table 4 summarizes the sensory panel data for the control and treated frankfurters. The results indicate that there was no significant difference in color, texture, flavor or overall acceptability. The panelist did rate the treated frankfurters significantly higher than the control for appearance.

Table 5 summarizes the purge data for the control and the treated frankfurters. The results indicated that there was significantly more percentage purge in the control frankfurters than the treated frankfurters.

Results:

Table 1: Proximate Compositions[a] and Microbiological Results[a] of Treated and Control Frankfurters.

	Control Raw	Control Cooked	Treated Raw	Treated Cooked
Moisture %	66.06	63.80	63.80	60.66
Fat %	17.73	16.80	18.80	20.03
Protein %	13.53	16.26	13.17	15.1
Carbohydrate %	0.3	1.03	2.0	1.90
Total Plate Count /gm	32,000,000	500	30,000,000	220
Total Anaerobic Plate Count/gm	16,000,000	120	19,000,000	<20
Lactic Acid Bacteria /gm	10,500,000	250	28,000,000	80
Yeast and Mold /gm	Y=6,200 M=270	Y=<50 M=<10	Y=6,600 M=140	Y=20 M=<10
Listeria species /25gm	Listera.sp	Negative	Listera.sp	Negative

[a]Means of three replicate

Table 2: Average percent Yield [a] of Cooked Control and Treated Frankfurters.

Treatment	Cook Yield (%)[b]
Control	82.1
Treated	88.1
Significant? [c]	Yes

[a] Percent yield (%) = (cooked wt / raw wt) x 100
[b] Means of twenty replicates
[c] Samples were judged significantly different at the 0.05 level.

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Table 3: Average Shear Force [a] of Cooked Control and Frankfurters.

Treatment	Force (kg/g)
Control	1.11
Treated	1.13
Significant? [b]	No

[a] Means of ten replicates
[b] Samples were judged significantly different at the 0.05 level

Table 4: Average Sensory Panel Results on Cooked Control and Treated Frankfurters.

Treatment	Appearance	Color	Texture	Flavor	Overall Acceptability
Control	2.6	3.1	2.9	2.7	2.3
Treated	5.5	2.4	3.0	2.4	3.1
Significant? [a]	Yes	No	No	No	No

[a]Samples were judged significantly different at the 0.05 level.

Table 5: Average Percent Purge of Cooked Control and Treated Frankfurters.

Treatment	Purge (%)[a]
Control	1.3
Treated	0.7
Significant? [b]	Yes

[a] Means of five replicates
[b] Samples were judged significantly different at the 0.05 level.

PREPARED BY:

Lloyd Gabay
Manager, Product Development

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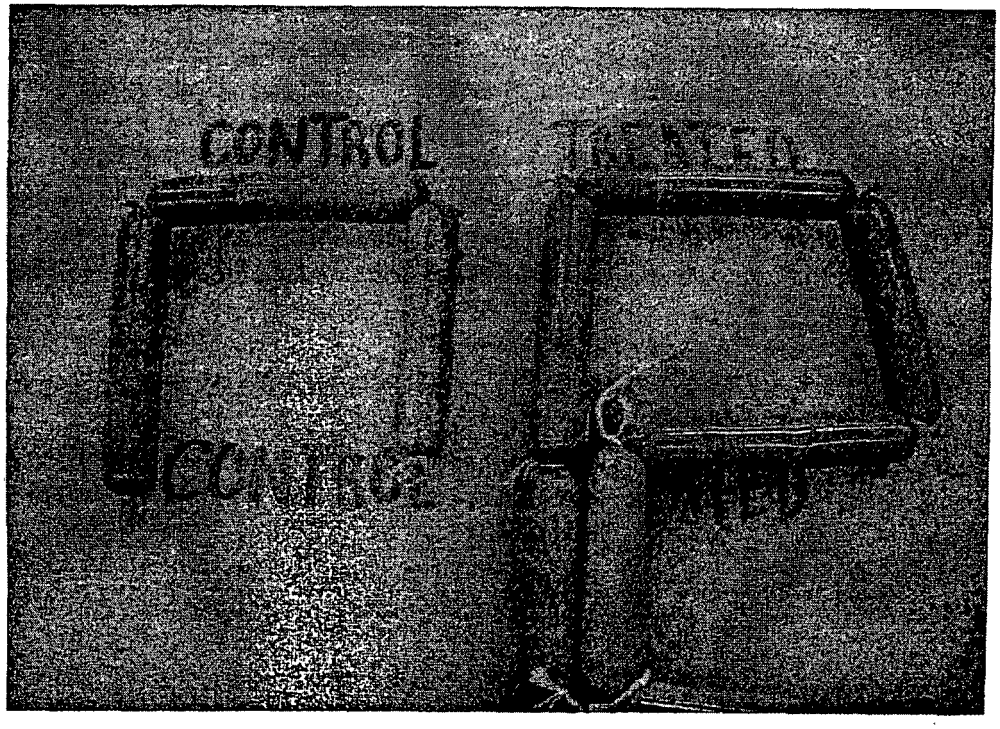
Raw Control and Treated Frankfurters



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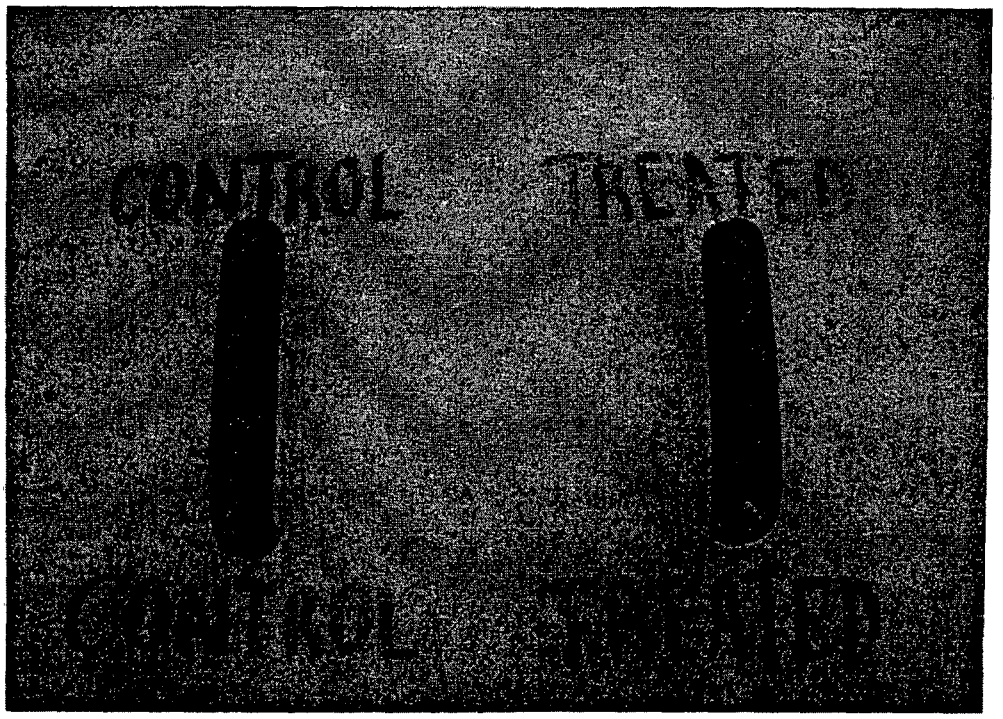
Cooked Control and Treated Frankfurters



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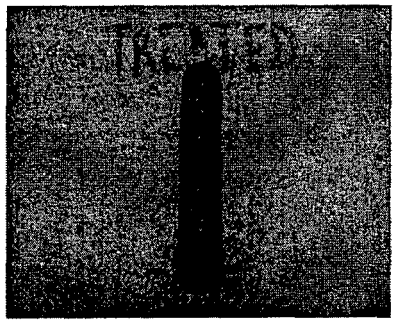
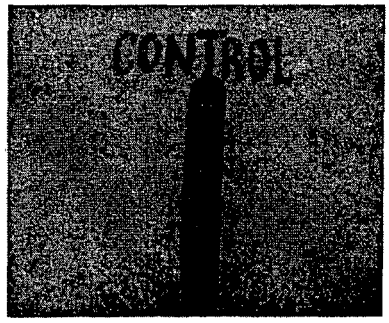
Cooked Control and Treated Frankfurters





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STUDY 9

ROVITA

WATER AND FAT BINDING CAPACITY USING PLANT FIBERS IN SCALDING SAUSAGES

Rovita
A firm foundation for sensitive products

To improve water and fat binding capacity using plant fibers in scalding sausages

Wheat fiber V1 - Carrot fiber V2 - Potato fiber V 3

Meat recipe	Kg	%	Additives (g)	V1	V2	V3	V4
S III	1.855	37.1					
R I	0.58	11.6	Lactonate HV 0271	68	68	68	
Ruckenspeck (lard)	0.512	9.7	Wheat fiber 9137	52	0	0	0
Putenhaut Emulsion, turkey emulsion	0.35	7	Carrot fiber 9/609	0	52	0	0
Ice	1.503	30.6	Potato fiber 9/609	0	0	52	0
			Kogal	30	30	30	0
NPS (salt w sodium nitrate)	0.09	1.8	Soya protein 9/219	0	0	0	200
6122 Kutterhilfsmittel mit Gewurzmischung (additives and spices)	0.055	1.1					
TOTAL	**4.945**	**98.9**	**TOTAL**	**150**	**150**	**150**	**200**
			Loss of water	12.85%	7.33%	11.23%	7.82%
			Std deviation	2.8	1.96	2.94	2.93

Texture of the mixture was better using V1, V2, V3 compare to V4

The taste of V1,V2,V3 was similar; V4 was different than the other 3

Water binding: carrot fiber has a clear advantage in this recipe

VII. REFERENCES

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Exhibits

EXHIBIT 1

EXPONENT, INC., REPORT

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Exponent®
(formerly Novigen Sciences, Inc.)

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CONFIDENTIAL CLIENT ADVISORY

SUMMARY OF GRAS STATUS OF HYDROBIND™ CARROT FIBER FOR PROPOSED USES IN VARIOUS BAKERY AND PROCESSED MEAT PRODUCTS

PREPARED FOR:
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Wm. Bolthouse Farms, Inc.
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PREPARED BY:
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September 6, 2002

WD00595.000-F0T0-0001

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CONFIDENTIAL CLIENT ADVISORY

SUMMARY OF GRAS STATUS OF HYDROBIND™ CARROT FIBER FOR PROPOSED USES IN VARIOUS BAKERY AND PROCESSED MEAT PRODUCTS

At the request of Bolthouse, Exponent, Inc. (Exponent) (formerly Novigen Sciences, Inc.) has critically evaluated both generally available and company confidential information relating to the potential GRAS status of Hydrobind™ Carrot Fiber/Carrot Isolate. This information included:

- Published literature on the historical consumption of carrots;
- Published literature on the physiology of carrots;
- Information from the literature and from Bolthouse concerning the production of fresh carrots;
- Information from Bolthouse about their processing methods for fresh carrots and Hydrobind™ Carrot Fiber, including quality assurance procedures and results of safety testing;
- Information and data from Bolthouse about proposed uses of Hydrobind™ in baked goods and standardized and nonstandardized processed meat products.

This Advisory summarizes our findings.

Hydrobind™ is substantially similar, in fact identical, to the fiber portion of fresh carrot. The production of Hydrobind™ involves physical processes, common in food processing, that remove water from fresh carrots and mill the fiber to desired size. No chemical extraction or modification is performed.

Bolthouse assures the safety and quality of Hydrobind™, through a number of certifications and laboratory analyses on the raw material (fresh carrots) and the finished product.

There is extensive common knowledge of a long history of human consumption of carrot, both fresh and cooked, including the fiber portion.

Carrots, and the fiber they contain, have been consumed for centuries; they were among the vegetables eaten by early Mediterranean civilizations (McGee 1984). Modern carrot was reported to be consumed in Western Europe by the early 12th century (Schneider 2001). Brought to America by early explorers, this root crop was adopted by Native Americans and introduced to early settlers.

There is extensive published data about the quantitative intake of carrot fiber in the US diet. Using data and information available in USDA and FDA publications (Smith et al 2001; USDA 2001; USDA 2000; Lucier 1997), Exponent estimated the consumer exposure associated with the proposed uses. Based on the latest available USDA information, mean US *per capita* consumption of fiber from carrots in the diet is about 0.3 g/day. According to Bolthouse, production capacity for Hydrobind™ is, at maximum, 6 million lb/yr. Some of the material is exported. Conservatively assuming that 133% of Hydrobind™ production is consumed in the US, mean *per capita* consumption of the fiber portion of fresh carrot would increase by 0.03 g/day. This amount corresponds to the addition of 0.01 medium whole carrot/day to the US diet.

For a heavy consumer of Hydrobind™-containing foods, intake may be 0.35 g/day. One average whole fresh carrot weighs about 80 g; therefore, these intakes are the equivalent of adding 1 g –12 g of fresh carrot per day to the US diet. Details of these calculations are included in the Attachment.

Exponent has concluded that Hydrobind™, meeting appropriate specifications and used according to Good Manufacturing Practice, is GRAS by scientific procedures, corroborated by common use in foods, for use in the bakery and standardized and nonstandardized meat products at the proposed levels.

Nancy J. Rachman, Ph.D.
Principal Scientist

Barbara J. Petersen, Ph.D.
Principal Managing Scientist

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McGee H. (1984) *On Food and Cooking*. Collier Books, New York.

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ATTACHMENT

I. ESTIMATION OF CARROT AND CARROT FIBER CONSUMPTION

Carrot and carrot fiber consumption estimates are summarized in Table 1 below.

A. Current Intake

1. Using USDA Food Consumption Data

Carrot consumption (from all sources in the diet) was calculated with Exponent's proprietary FARE™ software using data from the Continuing Survey of Food Intake by Individuals (CSFII), popularly known as the "What We Eat in America Survey," for the years 1994-1996 and 1998. For the US population, *per capita* mean carrot consumption is 9 g/day and the 90th percentile intake is 30 g/day. Assuming that a carrot weighs approximately 80 g and is composed of 3% fiber, the mean *per capita* intake is 0.11 carrot/day or 0.27 g carrot fiber/day. Carrot intake at the 90th percentile is 0.38 carrot/day or 0.90 g carrot fiber/day.

2. USDA Reported Estimates

Carrot consumption calculated by FARE™ may be compared to USDA published estimates of carrot consumption. USDA data are generally a useful upper bound for the FARE™ calculations. For 1996 (the most recent year for which data was available), USDA reported that approximately 15 lbs of carrots were consumed per person in the US.[1] The range of carrot consumption in the 1990s was reported as approximately 10 to 14 pounds/person in another publication.[2] The USDA numbers are equivalent to a *per capita* mean of 19 g carrots/day, which is equivalent to 0.24 carrot/day or 0.57 g carrot fiber/day. Note that the USDA estimates of carrot and carrot fiber consumption are approximately two times the consumption estimates obtained from FARE™. Detailed calculations are as follows:

Per capita mean = (15 lb carrots/year x 453.6 g/lb) / 365 days/year = 19 g carrots/day

= (19 g carrots/day) / (80 g/carrot) = 0.24 carrot/day

= 19 g carrots/day x 0.03 g carrot fiber/g carrot = 0.57 g carrot fiber/day

[1] Lucier G. (1997) What's up, Doc? Carrots! *Agricultural Outlook*. US Department of Agriculture, Economic Research Service. November 1997.

[2] Anonymous. (1996) California agriculture. *Rural Migration News*. April 1996.

B. Estimated Daily Intake (EDI) Associated with Proposed Uses

1. Mean Intake

According to Bolthouse, the annual production of carrot fiber is 8 million lb/yr. Assuming that all of the carrot fiber produced is consumed in the US and using an estimate of the 2002 US population (287,663,958),[3] the *per capita* mean additional carrot fiber intake is 0.03 g/day. A typical fresh carrot weighs about 80 g.[4] Therefore, the proposed uses of Hydrobind™ are equivalent to adding 1 g carrot/person/day or 0.01 whole carrot/person/day to the U.S. diet. Detailed calculations are as follows:

- (8×10^6 lb carrot fiber/year x 453.6 g/lb) / (365 days/year x 287,663,958 persons)

  = 0.03 g carrot fiber/person/day

- (0.03 g carrot fiber/person/day) / (0.03 g carrot fiber/g carrot)

  = 1 g carrot/person/day

- (1 g carrot/person/day) / (80 g/carrot) = 0.01 whole carrot/person/day

2. "90th Percentile" Intake

An estimate of the carrot fiber consumption by highly exposed persons in the population may be obtained by using the *per capita* intake x 10 (PCI x 10) method. The method is an accepted approach for conservatively estimating intake, by highly exposed persons in the population, of substances used broadly in the food supply.[5] The PCI x 10 method assumes that only 10% of the U.S. population consumes 100% of the reported annual production of the substance. Using this method, the intake of carrot fiber by highly exposed persons associated with the proposed uses of Hydrobind™ is 0.35 g carrot fiber/day or 12 g carrot/day. This is equivalent to adding 0.15 whole carrot/day to the diet, as follows:

- (8×10^6 lb carrot fiber/year x 453.6 g/lb) / (365 days/year) x (28,766,400 persons)

  = 0.35 g carrot fiber/person/day

- (0.35 g carrot fiber/person/day) / (0.03 g carrot fiber/g carrot)

  = 12 g carrot/person/day

  = (12 g carrot/person/day) / (80 g/carrot) = 0.15 carrot/person/day

---

[3] U.S. Census Bureau, national population estimate at 13:19 EDT July 31, 2002.
[4] 21 CFR 101, Appendix C; information from Bolthouse Farms, Inc.
[5] Smith RL, Doull J, Feron VJ, Goodman JI, Munro IC, Newberne PM, Portoghese PS, Waddell WJ, Wagner BM, Adams TB, McGowen MM. (2001) GRAS flavoring substances 20. *Food Technology*. 55:34-55.

The total intake of carrots and carrot fiber, including proposed uses of Hydrobind™, may be approximated by summing the results of the FARE™ analysis with the EDI estimates. The total *per capita* mean intake is 0.30 g fiber/day, or 10 g carrot/person/day; this is the equivalent of 0.12 whole carrots/person/day. In summary, the proposed uses of Hydrobind™ would add the equivalent of an additional 0.01 whole carrot/day to the U.S. diet, a negligible increment.

TABLE 1

SUMMARY OF DAILY *PER CAPITA* CARROT CONSUMPTION

	Carrot Intake (g)	Carrot Fiber Intake (g)	Whole Carrot Intake[6] (# of carrots)
Current Intake			
***Exponent* FARE™ Analysis**			
Mean	9	0.27	0.11
90th Percentile	30	0.90	0.38
USDA Estimates			
Mean	19	0.57	0.24
EDI[7], Hydrobind™ Uses			
Mean	1	0.03	0.01
"90th Percentile"	12	0.35	0.15
Total Intake (Approximation)			
Mean	10	0.30	0.12

[6] Weight of average standard carrot is approximately 80g.
[7] Estimated Daily Intake

EXHIBIT 2

HYDROBIND™ NUTRITIONAL DATA SHEET

EXHIBIT 2

HYDROBIND™ NUTRITIONAL DATA SHEET

NUTRITIONAL ANALYSIS OF HYDROBIND™ (PATENT PENDING)

Nutrients	Per 100 g[1]
Total Carbohydrates	86.40 g
Total Dietary Fiber	86.00 g
Soluble	24.60 g
Insoluble	61.40 g
Sugars (Sucrose, Fructose, Glucose)	0.40 g
Total Fat	0.39 g
Saturated Fat	0.13 g
Cholesterol	none
Calories from Fat	3.5
Protein, 6.25 Factor	2.45 g
Gluten	none
Ash	4.40 g
Sodium	0.18 g
Calcium	1.36 g
Potassium	335 mg
Iron	6.45 mg
Moisture	6.40 g
Calories	124

[1] The above information may vary due to the natural variations that occur as a result of climate and growing region. No guarantee is implied by furnishing the above information.

EXHIBIT 3

USDA NUTRIENT DATABASE FOR STANDARD REFERENCE: NUTRIENT DATA FOR FRESH CARROTS

EXHIBIT 3

USDA NUTRIENT DATABASE FOR STANDARD REFERENCE NUTRIENT DATA FOR FRESH CARROTS

Carrots, raw

Scientific Name: *Daucus carota*

NDB No: 11124

Nutrient	Units	Value Per 100 Grams of Edible Portion	Sample Count	Std. Error
Proximates				
Water	g	87.79	237	0.070
Energy	kcal	43	0	
Energy	kj	180	0	
Protein	g	1.03	182	0.010
Total lipid (fat)	g	0.019	28	0.020
Carbohydrate, by difference	g	10.14	0	
Fiber, total dietary	**g**	**3.0**	**0**	
Ash	g	0.87	46	0.026
Minerals				
Calcium, Ca	mg	27	235	0.667
Iron, Fe	mg	0.50	241	0.019
Magnesium, Mg	mg	15	236	0.348
Phosphorus, P	mg	44	236	0.803
Potassium, K	mg	323	238	2.680
Sodium, Na	mg	35	243	1.218
Zinc, Zn	mg	0.20	222	0.024
Copper, Cu	mg	0.047	90	0.002
Manganese, Mn	mg	0.142	229	0.007
Selenium, Se	mcg	1.1	6	0.355
Vitamins				
Vitamin C, total ascorbic acid	mg	9.3	162	0.168
Thiamin	mg	0.097	179	0.002
Riboflavin	mg	0.059	177	0.001
Niacin	mg	0.928	23	0.082
Pantothenic acid	mg	0.197	11	0.020
Vitamin B-6	mg	0.147	21	0.013
Folate, total	mcg	14	9	0.874
Folic acid	mcg	0	0	
Folate, food	mcg	14	9	0.874
Folate, DFE	mcg_DFE	14	0	
Vitamin B-12	mcg	0.00	0	
Vitamin A, IU	IU	28129	162	152.919
Vitamin A, RE	mcg_RE	2813	162	15.292
Vitamin E	mg_ATE	0.460	0	

Carrots, raw (cont'd)

Nutrient	Units	Value Per 100 Grams of Edible Portion	Sample Count	Std. Error
Lipids				
Fatty acids, total saturated	g	0.030	0	
4:0	g	0.000	0	
6:0	g	0.000	0	
8:0	g	0.000	0	
10:0	g	0.000	0	
12:0	g	0.002	1	
14:0	g	0.001	1	
16:0	g	0.023	2	
18:0	g	0.001	2	
Fatty acids, total monounsaturated	g	0.008	0	
16:1 undifferentiated	g	0.002	1	
18:1 undifferentiated	g	0.006	2	
20:1	g	0.000	0	
22:1 undifferentiated	g	0.000	0	
Fatty acids, total polyunsaturated	g	0.077	0	
18:2 undifferentiated	g	0.067	2	
18:3 undifferentiated	g	0.010	2	
18:4	g	0.000	0	
20:4 undifferentiated	g	0.000	0	
20:5 n-3	g	0.000	0	
22:5 n-3	g	0.000	0	
22:6 n-3	g	0.000	0	
Cholesterol	mg	0	0	
Phytosterols	mg	12	0	
Amino acids				
Tryptophan	g	0.011	57	
Threonine	g	0.038	60	
Isoleucine	g	0.041	60	
Leucine	g	0.043	60	
Lysine	g	0.040	64	
Methionine	g	0.007	64	
Cystine	g	0.008	12	
Phenylalanine	g	0.032	60	
Tyrosine	g	0.020	13	
Valine	g	0.044	60	
Arginine	g	0.043	59	
Histidine	g	0.016	59	
Alanine	g	0.059	12	
Aspartic acide	g	0.137	12	
Glutamic acid	g	0.202	12	
Glycine	g	0.030	12	
Proline	g	0.029	11	
Serine	g	0.035	12	

USDA Nutrient Database for Standard Reference, Release 14 (July 2001)

EXHIBIT 4

HYDROBIND™ MSDS

EXHIBIT 4

HYDROBIND™ MSDS

MATERIAL SAFETY DATA SHEET
OSHA Standard 29 CFR 1910.1200

Manufacturer's Name:	Wm. Bolthouse Farms, Inc.
Address:	7200 East Brundage Lane Bakersfield, CA 93307-3099 USA
Phone:	661-366-7270
Fax:	661-366-2834

SECTION I: PRODUCT IDENTIFICATION EMERGENCY INFORMATION

Trade Name:	Bolthouse Hydrobind™
Description:	Hydrobind™ is the fiber (cellulose) portion of the carrot that is extracted, purified, dried and ground into an off-white free-flowing powder.

SECTION II: HAZARDOUS COMPONENTS OF MIXTURES

None

SECTION III: HEALTH INFORMATION AND PROTECTION

Exposure limits: not established

Exposure effects:

Eye: no specific hazard known, contact may cause transient irritation.
Skin: low hazard risk with proper handling.
Inhalation: low hazard risk with proper handling.
Ingestion: no specific hazard known.

Special Handling:

Avoid prolonged exposure to dust, eye protection and dust masks recommended in high dust areas.

First Aid:

Inhalation: none needed
Skin: none needed
Eye: Flush eyes with water
Ingestion: none needed

MATERIAL SAFETY DATA SHEET
OSHA Standard 29 CFR 1910.1200

SECTION IV: FIRE AND EXPLOSION DATA

Flash point: N/A

Special Fire Fighting Procedures:
Use water spray to keep down dust. Self-contained breathing apparatus recommended for protection from any hazardous combustion products.

Unusual Fire and Explosion Hazards:
Moderate fire and explosion hazard in the form of dust when exposed to heat or flame.

Extinguishing Media: Water, foam, dry chemical or carbon dioxide.

SECTION V: SPILL CONTROL PROCEDURE

Sweep up and dispose of the material according to local, state and federal regulations.

SECTION VI: NOTES

None

SECTION VII: TYPICAL PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	off-white free-flowing powder
Water Solubility:	slightly soluble in water
Solids:	more than 92%
Boiling Point:	N/A

SECTION VIII: REACTIVITY DATA

None

SECTION IX: STORAGE AND HANDLING

Store in a dry, well-ventilated area.

SECTION X: HAZARDOUS CLASSIFICATION

None

EXHIBIT 5

PRODUCT SPECIFICATIONS

EXHIBIT 5

PRODUCT SPECIFICATIONS

WM BOLTHOUSE FARMS, INC.
7200 EAST BRUNDAGE LANE • BAKERSFIELD, CA 93307-3099
661/366-7205 • FAX 661/366-2834

Bolthouse Carrot Fiber 602

NOMENCLATURE: Carrot Fiber

APPEARANCE:

Color	Creamy White
Flavor and Odor	Bland and Neutral
Granulation	Minimum 98% through a U.S.A. #100 testing sieve
pH (at 1% solution)	5.0

PROXIMATE:*

Component	Typical Percent
Total Dietary Fiber	92.0% of dry solids
Soluble	27.0% of dry solids
Insoluble	65.0% of dry solids
Ash	4.5% of dry solids
Protein	2.5% of dry solids
Fat	0.5% of dry solids
Moisture	8.0% overall

* Because this product is derived from a natural ingredient, proximate values may vary slightly.

WATER RETENTION: at least 10x by weight (AACC Method 56-20)

BULK DENSITY: 306 g/L

STORAGE: Protect from heat and moisture. Shelf life is one year or more if stored at 70 °F or less.

Revised 15 June 2001

EXHIBIT 6

PRODUCT COMPOSITION ANALYSIS REPORT, 1/30/2001

EXHIBIT 6

PRODUCT COMPOSITION ANALYSIS REPORT, 1/30/2001

Woodson-Tenent Laboratories, Inc.

PO Box 1292
3507 Delaware Ave. (50313)
Des Moines, IA 50305
(515) 265-1461

W-T Sample DM2001-003426
Sample of: Carrot Fiber
Sample ID: No Ident
PO Number: 4K261DT
Cust #: 5568900

W-T Reporting Date: 1/30/01
W-T Entry Date: 1/17/01

Wm. Bolthouse Farms, Inc.
Attn: Cristina Lang
7200 E. Brundage Lane
Bakersfield CA 93307-3099

REPORT OF ANALYSIS

Test	Result	Units
Protein	2.51	%
Ash	4.95	%
Fiber, Dietary, Total	86.2	%
Fiber, Dietary, Insoluble	63.0	%
Fiber, Dietary, Soluble - Calc	23.2	%
Carbohydrates, Calculated	85.71	%
Calories, Calculated	1,633	KCAL/LB
Crude Fat By Acid Hydrolysis	0.76	%
Moisture By Vacuum Oven	6.07	%

Respectfully Submitted,
Woodson-Tenent Laboratories, Inc

David Gross, Mgr of Support Svcs

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Page 1 of 1

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P O Box 1292 Des Moines IA 50305-1292 Fax 515-266-5453

EXHIBIT 7

PRODUCT COMPOSITION ANALYSIS REPORT, 2/20/2001

EXHIBIT 7

PRODUCT COMPOSITION ANALYSIS REPORT, 2/20/2001

Woodson-Tenent Laboratories, Inc.

PO Box 1292
3507 Delaware Ave (50313)
Des Moines, IA 50305
(515) 265-1461

W-T Sample DM2001-007317
Sample of: Carrot Fiber
Sample ID: 602
PO Number: 4K261DT
Cust #: 5568900

W-T Reporting Date: 2/20/01
W-T Entry Date: 2/2/01

Wm. Bolthouse Farms, Inc.
Attn: Cristina Lang
7200 E. Brundage Lane
Bakersfield CA 93307-3099

REPORT OF ANALYSIS

Test	Result	Units
Fiber, Dietary, Total	87.3	%
Fiber, Dietary, Insoluble	67.9	%
Fiber, Dietary, Soluble - Calc	19.4	%
Calcium	1.29	%
Copper	2	PPM
Iron	0.0082	%
Magnesium	0 21	%
Manganese	0.0011	%
Phosphorus	0.05	%
Potassium	0.35	%
Selenium	< 0.10	PPM
Sodium	0.17	%
Zinc	0.0008	%

Respectfully Submitted,
Woodson-Tenent Laboratories, Inc

David Gross, Mgr of Support Svcs

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EXHIBIT 8

ASH COMPOSITION ANALYSIS REPORT, 9/21/2000

EXHIBIT 8

ASH COMPOSITION ANALYSIS REPORT, 9/21/2000

Accredited Nutrient Analysis

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Food, Beverage and Dietary Supplement Testing

BOLTHOUSE FARMS
Ms. Cristina Lang
7200 E. Brundage Lane
Bakersfield CA 93307
USA

FAX : 661-366-9236

Analytical report # ENI-010287/01

Our reference : 03210226 **Your reference :** Cararot Fiber - 9
Transport by : Client/UPS **Reception Date :** 09/08/2000 **Report Date :** 09/21/2000

Minerals		Results	Units	Estimates (if known)
J1045	Potassium (K)	2850	ppm	
J1046	Magnesium (Mg)	2110	ppm	
J1038	Calcium (Ca)	14600	ppm	
J1048	Sodium (Na)	2230	ppm	
J1050	Phosphorus (P)	364	ppm	
J1042	Copper (Cu)	2.82	ppm	
J1061	Zinc (Zn)	20.8	ppm	
J1043	Iron (Fe)	115	ppm	
J1047	Manganese (Mn)	9.21	ppm	
B0139*	Selenium (Se)	0.0476	ppm	

Our reference : 03210227 **Your reference :** Carrot Fiber - March
Transport by : Client/UPS **Reception Date :** 09/08/2000 **Report Date :** 09/21/2000

Minerals		Results	Units	Estimates (if known)
J1045	Potassium (K)	2780	ppm	
J1046	Magnesium (Mg)	1720	ppm	
J1038	Calcium (Ca)	13800	ppm	
J1048	Sodium (Na)	2550	ppm	
J1050	Phosphorus (P)	389	ppm	
J1042	Copper (Cu)	4.13	ppm	
J1061	Zinc (Zn)	8.17	ppm	
J1043	Iron (Fe)	51.8	ppm	
J1047	Manganese (Mn)	6.98	ppm	
B0139*	Selenium (Se)	0.0234	ppm	

Printed on: 07/15/2002 Page 1/2

Committed to uncompromising science and customer support

EUROFINS SCIENTIFIC

Accredited Nutrient Analysis

Analytical report # ENI-010287/01

Accreditation
The laboratory is accredited by A2LA according to ISO/IEC Guide 25-1990 under the number 1313-01 for tests identified by the symbol *. Interpretation is not covered by the accreditation. This document can only be reproduced in full.

Catherine Wo, PhD
Technical Director

If you have any questions concerning this report, please contact Client Services at (732) 355-3263 or (732) 329-2999 or via e-mail at CustomerServiceUS@Eurofins.com.

EXHIBIT 9

FIBER COMPOSITION ANALYSIS

EXHIBIT 9

FIBER COMPOSITION ANALYSIS

Woodson-Tenent Laboratories, Inc.

PO Box 1292
3507 Delaware Ave. (50313)
Des Moines, IA 50305
(515) 265-1461

W-T Sample DM2001-017227
Sample of: Carrot Fiber 602
Sample ID: 01038
PO Number: 4K261DT
Cust #: 5568900

W-T Reporting Date: 4/13/01
W-T Entry Date: 3/22/01

Wm. Bolthouse Farms, Inc.
Attn: Cristina Lang
7200 E. Brundage Lane
Bakersfield CA 93307-3099

REPORT OF ANALYSIS

Test	Result	Units
Moisture - Forced Draft Oven	6.78	%
Crude Fat/Oil	0.34	%
Protein	2.53	%
Ash	4.13	%
Fiber, Crude	22 1	%
Fiber, Acid Detergent	24.2	%
Lignin	11.4	%
Fiber, Neutral Detergent	32.0	%
Fiber, Dietary, Total	84.5	%
Fiber, Dietary, Insoluble	58.0	%
Fiber, Dietary, Soluble - Calc	26.5	%
Carbohydrates, Calculated	86.22	%
Cellulose	12.8	%
Hemicellulose	7.8	%
Calcium	1.42	%
Phosphorus	0 02	%
Iron	0.0047	%
Magnesium	0.23	%

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P.O. Box 1292 Des Moines IA 50305-1292 Fax 515-266-5453

Woodson-Tenent Laboratories, Inc.

W-T Sample No: DM2001-017227 Sample ID: 01038

REPORT OF ANALYSIS

Test	Result	Units
Manganese	0.0009	%
Potassium	0.32	%
Sodium	0.19	%
Zinc	0.0010	%
Arsenic	< 1.00	PPM
Copper	< 1	PPM
Lead	< 1.00	PPM
Mercury	< 0.200	PPM
Selenium	0.114	PPM

Respectfully Submitted,
Woodson-Tenent Laboratories, Inc.

David Gross, Mgr of Support Svcs.

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EXHIBIT 10

SAFETY AND QUALITY ASSURANCE

EXHIBIT 10

SAFETY AND QUALITY ASSURANCE

MEMBER ACIL

Sani-Pure Food Laboratories

CHEMISTS TO THE FOOD INDUSTRY

178-182 Saddle River Road • Saddle Brook, New Jersey 07663-4619

VOICE (201) 843-2525 • FAX (201) 843-4934 • E-MAIL sanipure.labs@verizon.net

April 20, 2001

Client:

Wm. Bolthouse Farms, Inc.
7200 E. Brundage Lane
Bakersfield, California 93307-3099

Date of Receipt of Sample: April 17, 2001

Reference Procedures

AOAC Official Method 970.52 • Locator Number 10.1.01 • Group II, Nonfatty Foods
rganochlorine & Organophosphorous Pesticide Residues • General Multiresidue Meth
AOAC Official Method 985.22 • Locator Number 10.1.02
ganochlorine & Organophosphorous Pesticide Residues • Gas Chromatographic Meth
Official Methods of Analysis of AOAC International, 17th Edition

Product Identification

CARROT FIBER 602

Pesticide Results

Pesticide Chemical	Detection Level	Findings
2-chlorophenol	0.32 ppb	ND
4-chlorophenol	0.34 ppb	ND
2,4-dichlorophenol	0.41 ppb	ND
2,6-dichlorophenol	0.64 ppb	ND
2,4,6-trichlorophenol	0.64 ppb	ND

Respectfully submitted,

Ronald A. Schnitzer
Director

Lab Reference #01,015,c,127

WM BOLTHOUSE FARMS, INC
7200 EAST BRUNDAGE LANE • BAKERSFIELD, CA 93307-3099
661/ 366-7205 • FAX 661/ 366-2834

To Whom It May Concern:

Steps we take to insure our carrots are grown safely and legally with regards to pesticide use, when procuring carrots for processing and packing:

- Our contract with the grower must be signed and agreed to, before planting, and reads: Grower guarantees (i) that the Carrots shall be free from contamination, adulteration and misbranding within the meaning of all applicable federal, state and local laws and regulations and, (ii) all pesticides, herbicides, fertilizers and other regulated materials applied to the Carrots and/or the Acreage are in compliance with label instructions and all applicable governmental regulations. Grower shall retain records for at least two (2) years, evidencing the identity of such materials and the dates, rates and methods of application and shall make such records available to Bolthouse upon request. This guarantee shall survive the termination of the Contract.

- The California Department of Pesticide Regulation (DPR) requires all growers must have a permit to apply <u>any</u> pesticide, a site-map location where the application is to be made and <u>mandatory</u> reporting to the county Agricultural Commissioner's office every month of any pesticide used on any crop. This is a mandatory compliance and all reports are filed with DPR for monitoring and enforcement.

- All pesticides purchased by growers from a supplier are also regulated by DPR. All pesticides sold are required to be registered for use on the target crop; the growers permit and site number must be attached to the bill of sale. Also, the recommendation for that pesticide, for a particular crop and pest, must be made under strict guidelines by DPR. DPR audits all dealers and suppliers of pesticides.

- Custom applicators are all licensed by DPR and must file an application report to the county Agricultural Commissioner's office for each application made. These reports must be accompanied by a written recommendation for a particular use, on a specific site, for a specific pest. All recommendations and applications are monitored and inspected by the county Agricultural Commissioner's Office for DPR.

- Bolthouse Farms takes monthly carrot samples from production (both peeled and unpeeled) and sends them to a California State Certified Laboratory to be tested. The laboratory uses the California Department of Food and Agriculture approved multi-residue screen (see attachment).

WM. BOLTHOUSE FARMS, INC
7200 EAST BRUNDAGE LANE • BAKERSFIELD, CA 93307-3099
661/366-7205 • FAX: 661/366-2834

Wm. Bolthouse Farms

Pesticides Most Commonly Used on our Carrots

Herbicides

Treflan (trifluralin) – Applied before planting (typical use rate: 1 – 1.2 pts/acre)

Lorox (linuron) – Applied very early in the growing season after planting
(typical use rate: 2.5 – 3 lbs/acre)

Fusilade (fluazifop-butyl) – seldom used; applied very early in the growing season after planting (typical use rate: 8 – 24 oz/acre)

Fungicides

Ridomil (metalaxyl) – Applied very early in the growing season after planting
(typical use rate 16 – 24 oz/acre)

Rovral (iprodione) – Applied early in the growing season – not usually used late in the season; applied to the foliage only (typical use rate: 2 – 6 pts/acre).

Bravo (chlorothalonil) – Applied same as above; alternatively used with Rovral
(typical use rate: 1.4 – 1.8 lbs/acre)

Soil Fumigant

Vapam (metam sodium) – Applied to the soil before planting
(typical use rate: 25 – 40 gals/acre)

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- www.primuslabs.com

[ ] Certified *
[ ] Inspected *
[X] Tested

Pesticide Residue Analysis

Issued to: Bolthouse Farms, Inc.
Grower: .
Commodity: Unpeeled Carrots
Location: Kern
Ranch:
Plot/Lot: 115986
Acres/Pallets:
Beds/Cartons:
Sample Time:
Sample ID: BV #24
Sample Date:
Date Analyzed: 1/17/2002
Authorization Number: 02.00265

** To meet U.S. EPA Tolerance Levels or FDA Action Levels for those compounds analyzed.*

CHEMICAL CLASS	COMPOUND	QUANTITY (ppm)	COMMENTS
ORGANOPHOSPHATES	ND	N/A	LDL 0.05 ppm
ORGANONITROGENS	ND	N/A	LDL 0.1 ppm
ORGANOHALIDES	ND	N/A	LDL 0.05 ppm
METHYL CARBAMATES	ND	N/A	LDL 0.05 ppm

ND = None Detected WT = Within Tolerance OT = Over Tolerance UAR = Unidentified Analytical Response
A = FDA Action Level B = U S EPA Tolerance SLN = Special Local Needs C = Canadian Tolerance LDL = Lower Detection Limit

Notes:

Method(s) of Extraction: PAM 232.4

Page 1 of 1

Approved by: _____ Supervising Chemist

Date Approved 7/31/02

Rev 10/98

EXHIBIT 11

HYDROBIND™ ALLERGENS STATEMENT

EXHIBIT 11

HYDROBIND™ ALLERGENS STATEMENT

Allergens Statement

This document certifies that Hydrobind™, manufactured by Wm. Bolthouse Farms, Inc., does not contain nor has been exposed to potential contamination from any of the following listed known allergens:

Artificial Colors
Egg or egg products
Milk or milk products
Peanuts or peanut products
Seed or seed products (cotton, poppy, sesame, sunflower)
Seafood or seafood products (including crustaceans or mollusks)
Soybeans or soybean products
Tree nuts (almonds, brazils, cashews, chestnuts, hazelnuts, pine nuts, pistachios, pecans, Macadamias, walnuts)
Wheat or wheat products
Sulfites

_____ _____

Authorized Signature Date

SUBMISSION END

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