



G. Craig Llewellyn, Ph.D.
Trinity Consultants
154 Hansen Road, Suite 201,
Charlottesville, VA 22911

Re: GRAS Notice No. GRN 001125

Dear Dr. Llewellyn:

The Food and Drug Administration (FDA, we) completed our evaluation of GRN 001125. We received the notice that you submitted on behalf of MycoTechnology, Inc. (MycoTechnology) on December 22, 2022 and filed it on July 19, 2023. MycoTechnology submitted amendments to the notice on October 18, 2023, November 28, 2023, November 30, 2023,¹ and December 20, 2023, providing clarification on the toxicology studies, and additional information on dietary exposure and specifications.

The subject of the notice is pea protein fermented by shiitake (*Lentinula edodes*) mycelia for use as an ingredient, formulation aid, and texturizer at levels up to 40% in a variety of foods as described in Table 1.² The notice informs us of MycoTechnology's view that these uses of pea protein fermented by shiitake mycelia are GRAS through scientific procedures.

Table 1. Intended food categories and maximum use levels for pea protein fermented by shiitake mycelia.

Food Category	Maximum Use Levels (%)
Bagels and English Muffins; Cornbread, Corn Muffins, or Tortillas	5
Crackers	5
Biscuits; Cookies	10
French Toast, Pancakes, and Waffles	10
Bread (high protein)	15
Non-Milk Meal Replacements and Protein Drinks	40
Hot Breakfast Cereals (e.g., oatmeal, grits) and Ready-To-Eat Cereals	15
Ready-To-Drink (RTD) and Powdered Specialty Coffee Drinks (lattes, cappuccinos, mochas)	10

¹ The amendment we received on November 28, 2023 was encrypted. We received the same information on November 30, 2023 that resolved that issue.

² MycoTechnology states that pea protein fermented by shiitake mycelia is not intended for use in infant formula or foods under the jurisdiction of the U.S. Department of Agriculture.

Food Category	Maximum Use Levels (%)
RTD and Instant Tea	10
Non-Dairy Milk Beverages and Cream (including coffee whiteners, non-dairy creamers); Soy- and/or Rice-Based Beverages	10
Cream Cheese Substitute	12
Non-Dairy Frozen Desserts	10
Non-Dairy Dips (includes imitation sour cream)	10
Non-Dairy Yogurt	25
Imitation Cheese	25
Cereal Bars, Nutritional Bars, and Meal Replacement Bars	20
Milk-Based Meal Replacements and Protein Drinks	15
Nut Butters and Spread	10
Meat Analogs and Substitutes	30
Butter and Spread Alternative	12
Snack Foods (includes potato chips, pretzels, corn-based savory snacks, and popcorn)	4
Soups and Soup Mixes	5

Our use of the term “pea protein fermented by shiitake mycelia” in this letter is not our recommendation of that term as an appropriate common or usual name for declaring the substance in accordance with FDA’s labeling requirements. Under 21 CFR 101.4, each ingredient must be declared by its common or usual name. In addition, 21 CFR 102.5 outlines general principles to use when establishing common or usual names for nonstandardized foods. Issues associated with labeling and the common or usual name of a food ingredient are under the purview of the Office of Nutrition and Food Labeling (ONFL) in the Center for Food Safety and Applied Nutrition. The Office of Food Additive Safety (OFAS) did not consult with ONFL regarding the appropriate common or usual name for “pea protein fermented by shiitake mycelia.”

MycoTechnology describes pea protein fermented by shiitake mycelia as a light cream-colored powder comprised of $\geq 77\%$ protein on a dry weight basis. MycoTechnology states that pea protein fermented by shiitake mycelia also contains fat, carbohydrates, and up to 5% solids from the fermentation process, of which $< 0.1\%$ wt/wt is shiitake mycelia biomass.

MycoTechnology provides a description of the multi-stage manufacturing process for pea protein fermented by shiitake mycelia. MycoTechnology states that none of the raw materials used during the manufacturing process are derived from major allergens. MycoTechnology states that a starter culture of shiitake mycelia is used to build up the shiitake mycelial biomass in the presence of pea protein concentrate, rice protein concentrate, maltodextrin, mango puree, carrot powder, and an antifoaming agent. This is followed by three successive fermentation steps of 24-28 hours each

under controlled conditions. After the mycelia mass has reached a sufficient density (approximately 2 g/mL), the media is changed by increasing the concentration of pea protein and continuing with a main fermentation of up to 40 hours; after the fermentation medium is changed, the mycelium enter lag phase and do not grow. The fermentation process is then terminated by heat treatment, followed by a concentration step and then spray-drying. MycoTechnology states that pea protein fermented by shiitake mycelia is manufactured in accordance with current good manufacturing practices and that all raw materials and processing aids are food grade and approved for their respective uses in accordance with an appropriate U.S. regulation or are GRAS for their intended use.

MycoTechnology provides specifications for pea protein fermented by shiitake mycelia that include protein content ($\geq 77\%$ on a dry weight basis), and limits for ash ($\leq 10\%$), moisture ($\leq 6\%$), total fat ($\leq 10\%$), carbohydrate ($\leq 15\%$), lead (< 0.1 mg/kg), arsenic (< 0.1 mg/kg), cadmium (< 0.1 mg/kg), mercury (< 0.1 mg/kg), total aflatoxins (< 5 $\mu\text{g}/\text{kg}$ sum of aflatoxins (G1+G2+B1+B2)), and microorganisms including *Listeria monocytogenes* (negative in 25 g), *Escherichia coli* (negative in 10 g), and *Salmonella* (negative in 25 g). MycoTechnology provides results from the analyses of three non-consecutive batches to demonstrate that pea protein fermented by shiitake mycelia can meet the provided specifications. MycoTechnology states that pea protein fermented by shiitake mycelia has a shelf-life of 24 months from the date of manufacture.

MycoTechnology estimates the dietary exposure to pea protein fermented by shiitake mycelia from the intended uses to be 22 g/person (p)/d (0.34 g/kg body weight (bw)/d) at the mean and 54 g/p/d (0.79 g/kg bw/d) at the 90th percentile for the U.S. population aged 2 years and older based on food consumption data from the 2017-2018 National Health and Nutrition Examination Survey (NHANES).

MycoTechnology also estimates the mean and 90th percentile consumption of shiitake mycelia, which is present at $< 0.1\%$ wt/wt in the final product, to be 0.4 mg/kg bw/d and 0.9 mg/kg bw/d, respectively. MycoTechnology states that pea protein fermented by shiitake mycelia is intended to substitute for, or be used in conjunction with, pea protein, rice protein, and other protein sources in conventional food products. Thus, MycoTechnology states that the intended uses of pea protein fermented by shiitake mycelia will not increase the overall consumption of protein.

MycoTechnology discusses publicly available data and information pertinent to the safety of pea and rice protein fermented by shiitake mycelia and references GRN 000848³ where the safety of consumption of pea and rice protein concentrates was discussed. Additionally, the safety of consumption of shiitake mycelium was also discussed where, citing published literature, the notifier concluded that there are no substantial differences in the composition of shiitake mycelium and fruiting bodies, the latter is already used as food.

³Pea and rice protein fermented by shiitake mycelia was the subject of GRN 000848. We evaluated GRN 000848 and responded in a letter dated January 9, 2020, stating that we had no questions at that time regarding the notifier's GRAS conclusion.

Mycotechnology states that neither shiitake mushrooms nor shiitake mycelia are known to produce mycotoxins during the growth of the mycelia or during the fruiting phase (production of mushrooms). Based on several published safety studies in animals and tolerance studies in humans, MycoTechnology states that shiitake mycelia used to ferment pea protein is safe for oral consumption at the intended use level.

Mycotechnology notes that a literature search did not identify any information that would contradict its conclusion that the proposed use of pea protein fermented by shiitake mycelia is safe.

Based on the totality of the data and information, MycoTechnology concludes that pea protein fermented by shiitake mycelia is GRAS for its intended use.

Standards of Identity

In the notice, MycoTechnology states its intention to use pea protein fermented by shiitake mycelia in several food categories, including foods for which standards of identity exist, located in Title 21 of the Code of Federal Regulations. We note that an ingredient that is lawfully added to food products may be used in a standardized food only if it is permitted by the applicable standard of identity.

Potential Labeling Issues

Under section 403(a) of the Federal Food, Drug, and Cosmetic Act (FD&C Act), a food is misbranded if its labeling is false or misleading in any way. Section 403(r) of the FD&C Act lays out the statutory framework for labeling claims characterizing a nutrient level in a food or the relationship of a nutrient to a disease or health-related condition (also referred to as nutrient content claims and health claims). If products that contain pea protein fermented by shiitake mycelia bear any nutrient content or health claims on the label or in labeling, such claims are subject to the applicable requirements and are under the purview of ONFL in the Center for Food Safety and Applied Nutrition. OFAS did not consult with ONFL on this issue or evaluate any information in terms of labeling claims. Questions related to food labeling should be directed to ONFL.

Section 301(ll) of the FD&C Act

Section 301(ll) of the FD&C Act prohibits the introduction or delivery for introduction into interstate commerce of any food that contains a drug approved under section 505 of the FD&C Act, a biological product licensed under section 351 of the Public Health Service Act, or a drug or a biological product for which substantial clinical investigations have been instituted and their existence made public, unless one of the exemptions in section 301(ll)(1)-(4) applies. In our evaluation of MycoTechnology's notice concluding that pea protein fermented by shiitake mycelia is GRAS under its intended conditions of use, we did not consider whether section 301(ll) or any of its exemptions apply to foods containing pea protein fermented by shiitake mycelia. Accordingly, our response should not be construed to be a statement that foods containing pea protein fermented by shiitake mycelia, if introduced or delivered for introduction into interstate commerce,

would not violate section 301(l).

Conclusions

Based on the information that MycoTechnology provided, as well as other information available to FDA, we have no questions at this time regarding MycoTechnology's conclusion that pea protein fermented by shiitake mycelia is GRAS under its intended conditions of use. This letter is not an affirmation that pea protein fermented by shiitake mycelia is GRAS under 21 CFR 170.35. Unless noted above, our review did not address other provisions of the FD&C Act. Food ingredient manufacturers and food producers are responsible for ensuring that marketed products are safe and compliant with all applicable legal and regulatory requirements.

In accordance with 21 CFR 170.275(b)(2), the text of this letter responding to GRN 001125 is accessible to the public at www.fda.gov/grasnoticeinventory.

Sincerely,

Susan J.
Carlson -S

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Carlson -S
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Susan J. Carlson, Ph.D.
Director
Division of Food Ingredients
Office of Food Additive Safety
Center for Food Safety
and Applied Nutrition