National Organic Standards Board
Handling Subcommittee
Petitioned Material Proposal - Chitosan
Spring 2026

Summary of Petition [December 2024 Petition]:

The petitioner is requesting that chitosan be classified as a nonsynthetic and added to the National List of Allowed and Prohibited Substances under 7 CFR 205.605(b) as a nonagricultural (nonorganic). The petition focuses on use of chitosan, derived from fungi, as a processing aid in winemaking, to improve clarification and filterability, prevent and treat volatile aromas, and boost microbial stability.

The petitioner requested its addition to the National List at § 205.605(b) so that chitosan may be used as a processing aid in organic wine production). Winemakers use chitosan for: clarification, filtration, stabilization and preservation, and enzyme and flavor enhancement.

The petitioner bases their request on chitosan's ability to achieve the following objectives:

- preventing microbial contamination and oxidation, thereby maintaining lower levels of sulfur dioxide
- eliminating spoilage microorganisms such as *Brettanomyces bruxellensis*, known for causing off-flavors
- removing oxidative precursors like catechins and inhibiting enzymes such as laccase that contribute to wine spoilage
- chelating pro-oxidant metals like copper and iron, thus reducing the potential for oxidation

Summary of Review:
The Handling Subcommittee finds chitosan, as petitioned, does not meet the OFPA criteria because sulfur dioxide is an already listed alternative.

Chitosan is currently used in nonorganic wine making. wine makers use chitosan derived from *Aspergillus niger* as a clarifying agent. The US Food and Drug Administration (FDA) and the Alcohol and Tobacco Tax and Trade Bureau regulate the relevant legal uses of this substance (Draft 2026 TR). It is also referenced for allowed use in international organic programs such as the EU, UK, and Switzerland.

This petition's focus is on the use of fungi-derived chitosan as a nonsynthetic substance. The NOSB must consider the source, derivation methods, and end use. A previous petition focused on the crustacean extraction methods, which use harsh chemicals, and were previously recommended by NOSB to be synthetic and not allowed. While fungi sources naturally contain chitosan, commercial chitosan manufacturing methods still rely on chemical deacetylation of chitin. Thus, the material, as commercially produced, is synthetic according to the Decision Tree for Classification of Materials as Synthetic or Nonsynthetic (NOP 5033-1). The draft 2026 TR concludes that the fungi source is synthetic. There is potential for a version of this material to be classified as nonsynthetic in the future, if it is produced using enzymatic or other non-chemical methods to deacetylate the chitin to chitosan. At the end of the process, the synthetic materials used in the alkali deproteination and acid extraction are removed from the final product and have no technical or functional effect in the final product. However, after the extraction, chitin undergoes further chemical processing to become chitosan. The Subcommittee finds the commercial production of chitosan still relies on chemicals to produce the product and therefore, it is considered synthetic.

Category 1: Classification

1. Substance is for: ____x___ **Handling** _____ **Livestock**

2. For HANDLING and LIVESTOCK use:
   a. Is the substance _____ **Agricultural** or ___x____ **Non-Agricultural?**
   Describe reasoning for this decision using NOP 5033-2 as a guide:

   The substance is derived from a microorganism and not agriculture or livestock.

   b. If the substance is **Non-agricultural**, is the substance _____ **Non-synthetic** or __x__ **Synthetic?**
   Is the substance formulated or manufactured by a process that chemically changes a substance extracted from naturally occurring plant, animal, or mineral sources? [OFPA §6502(21)] If so, describe, using NOP 5033-1 as a guide:

   While fungi sources naturally contain chitosan, commercial chitosan manufacturing methods still rely on chemical deacetylation of chitin. After extraction, chitin undergoes further chemical processing to become chitosan. Thus, the material, as commercially produced, is synthetic according to the decision tree.

3. For **LIVESTOCK**: Reference to appropriate OFPA category
   Is the substance used in production, and does it contain an active synthetic ingredient in the following categories: [§6517(c)(1)(B)(i)]; copper and sulfur compounds; toxins derived from bacteria; pheromones, soaps, horticultural oils, fish emulsions, treated seed, vitamins and minerals; livestock parasiticides and medicines and production aids including netting, tree wraps and seals, insect traps, sticky barriers, row covers, and equipment cleansers; or (ii) is used in production and contains synthetic inert ingredients that are not classified by the Administrator of the Environmental Protection Agency as inerts of toxicological concern?

   N/A

Category 2: Adverse Impacts

1. What is the potential for the substance to have detrimental chemical interactions with other materials used in organic farming systems? [§6518(m)(1)]

   EPA has determined this ingredient to be of minimal risk. On January 9, 2023, the Environmental Protection Agency (EPA) added a substance commonly referred to as chitosan (also known by its chemical name: poly-D-glucosamine) (CAS No. 9012-76-4) to the list of active ingredients eligible for use in minimum risk pesticide products exempt from registration and other requirements of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). In doing so, EPA is specifying that the listing also includes those chitosan salts that can be formed when chitosan is mixed with the acids that are listed as active or inert ingredients eligible for use in minimum risk pesticide products.

2. What is the toxicity and mode of action of the substance and of its breakdown products or any contaminants, and their persistence and areas of concentration in the environment? [§6518(m)(2)]

   In agricultural practice, chitosan acts as an induced resistance promoter characterized by its ability to stimulate internal mechanisms of treated plants to resist plant pathogens (US EPA, 2007). As an antimicrobial pesticide, chitosan employs antibacterial properties to protect fabrics from bacterial and fungal growth (US EPA, 2007). Antibacterial modes of action may include, but are not limited to, disruption of bacterial cell membranes or cell wall integrity, inhibition of respiration, interactions with bacterial DNA/RNA, and/or physical deposition (smothering) (review by Malerba and Cerana, 2016). No known adverse effects have been reported for humans and other non-target organisms following agricultural, biopharmaceutical, biomedical, cosmetic, textile, and food additive applications of products containing chitosan.

3. Describe the probability of environmental contamination during manufacture, use, misuse or disposal of such substance? [§6518(m)(3)]

   Chitosan is widely used in agricultural, biopharmaceutical, biomedical, cosmetic, textile, and food additive applications with no known reports of adverse effects to humans and the environment. Based on information obtained from studies submitted to the EPA in support of product registrations, and from the open technical literature, chitosan has been shown to have minimal acute and sub-chronic toxicity, is not a sensitizer or an allergen, and is not genotoxic, mutagenic, or carcinogenic. In addition to exposure to humans and the environment via intentional uses of chitosan-containing products, naturally occurring chitosan, as well as its sole natural source, chitin, are widespread in the environment in the form of shells of aquatic organisms (e.g., marine and freshwater crustaceans and molluscs), soil microorganisms, and insect exoskeletons. The apparent ubiquitous presence of chitosan-degrading bacteria in soils indicates that chitosan is readily biodegraded in soils and may be important in the biocycling of chitin and chitin derivatives (likely derived from soil fungi) in the environment. Chitosan applied as a minimum-risk pesticide likely would not persist in the environment due to ubiquitous presence of chitosan-degrading microorganisms.

4. Discuss the effect of the substance on human health. [§6517 (c)(1)(A)(i); §6517 (c)(2)(A)(i); §6518(m)(4)].

   Chitosan has minimal acute toxicity and is classified in Toxicity Category IV for acute oral toxicity, acute dermal toxicity, acute inhalation toxicity, acute eye irritation, and acute dermal irritation; it is not a skin sensitizer (Draft 2026 TR).

5. Discuss any effects the substance may have on biological and chemical interactions in the agroecosystem, including the physiological effects of the substance on soil organisms (including the salt index and solubility of the soil), crops and livestock. [§6518(m)(5)]

   No adverse effects are expected when non-target organisms are exposed to chitosan. Chitosan is produced naturally in several species of marine bacteria, fungi, and some insects and may serve as a protective mechanism against pathogen infection (Draft 2026 TR). Positive effects on plant growth and the suppression of plant pathogens in the soil rhizosphere and plant foliage have been reported by numerous authors (Draft 2026 TR).

6. Are there any adverse impacts on biodiversity? (§205.200)

   At the rates this substance is applied, no adverse impacts on biodiversity are expected. The environmental fate of chitosan (poly-D-glucosamine) has not been thoroughly investigated, although many soil types have been reported to contain chitosan-degrading bacteria. The apparent ubiquitous presence of chitosan-degrading bacteria in diverse soil types indicates that chitosan may be readily degraded in soils and may be important it the biocycling of chitin and chitin derivatives in the environment(Draft 2026 TR). Few studies were identified that assessed the rates of Chitosan biodegradation in soil.

Category 3: Alternatives/Compatibility

1. Are there alternatives to using the substance? Evaluate alternative practices as well as non-synthetic and synthetic available materials. [§6518(m)(6)]

The National List currently includes a number of fining agents, filter aids, antioxidants, and antimicrobials for use in wine: nonsynthetic bentonite, carrageenan, diatomaceous earth, enzymes, gums, yeast, kaolin, and perlite, and synthetic sulfur dioxide, activated carbon, ascorbic acid, and silicon dioxide (Draft 2026 TR).

2. **For Livestock substances, and Nonsynthetic substances used in Handling**: In balancing the responses to the criteria above, is the substance compatible with a system of sustainable agriculture? [§6518(m)(7)].

   N/A

Category 4: Additional criteria for synthetic substances used in Handling (does not apply to nonsynthetic or agricultural substances used in organic handling):

Describe how the petitioned substance meets or fails to meet each numbered criterion.

1. The substance cannot be produced from a natural source and there are no organic substitutes; (§205.600(b)(1))

   Chitin, from which chitosan derives, is the second most abundant polysaccharide biosynthesized on earth, after cellulose (Roberts, 1992). Chitin is an important constituent of the exoskeleton in many shelled aquatic (e.g., crustacea) and land (e.g., molluscs, insects) organisms (Draft 2026 TR). In addition, it is the principal fibrillar polymer in the cell wall of certain fungi (Draft 2026 TR). Both chitin and chitosan occur naturally as structural components in the cell walls of fungal classes Basidiomycota, Ascomycota, Mucoromycota (formerly Zygomycota), and Deuteromycota (Draft 2026 TR). Chitosan is chemically extracted from naturally occurring organisms that contain chitin. *Aspergillus niger* is one fungal species that naturally produces chitosan in its cell walls.

   Most commercial production of chitosan relies on artificially deacetylating chitin from crustaceans in order to produce chitosan (Draft 2026 TR). Unlike with crustacean sources, chitosan derived from fungi avoids the need for the demineralization and decolorization steps. Chitosan is neutral pH (6-7) and presents several interesting functional properties such as antimicrobial activity, antioxidant activity, absorptivity, metal chelation ability, film- and coating-forming ability, flocculation, and biocompatibility (Draft 2026 TR).

2. The substance's manufacture, use, and disposal do not have adverse effects on the environment and are done in a manner compatible with organic handling; (§205.600(b)(2))

   The environmental impact and disposal costs of processing waste have benefits and drawbacks. The benefits are that chitosan is more environmentally friendly and has lower disposal costs of effluents as compared to the traditional methods for disposing of shellfish waste. Utilizing the shellfish waste stream as a source of raw materials is upcycling the materials that would otherwise be the waste. The drawbacks are with potential risks of dispersal of pathogenic fungi when dealing with species not satisfying the generally regarded as safe (GRAS) requirements.

3. The nutritional quality of the food is maintained when the substance is used, and the substance, itself, or its breakdown products do not have an adverse effect on human health as defined by applicable Federal regulations; (§205.600(b)(3))

   In 2011, the FDA released GRAS Notice No. GRN 397 pertaining to the use of chitosan from the fungus *Aspergillus niger* (Draft 2026 TR). According to numerous sources cited in the draft 2026 TR, chitosan is nearly non-toxic to humans and most other animals, and its degradation products do not cause side effects in the body (Draft 2026 TR).

4. The substance's primary use is not as a preservative or to recreate or improve flavors, colors, textures, or nutritive value lost during processing, except where the replacement of nutrients is required by law; (§205.600(b)(4))

   The petition focuses on use of chitosan, derived from fungi, as a processing aid in winemaking, to improve clarification and filterability, prevent and treat volatile aromas, and boost microbial stability.

   The petitioner requested its addition to the National List at § 205.605(b) so that chitosan may be used as a processing aid in organic wine production. Winemakers use chitosan for clarification, filtration, stabilization and preservation, and enzyme and flavor enhancement.

5. The substance is listed as generally recognized as safe (GRAS) by the Food and Drug Administration (FDA) when used in accordance with FDA's good manufacturing practices (GMP) and contains no residues of heavy metals or other contaminants in excess of tolerances set by FDA; (§205.600(b)(5))

   In 2011, the FDA released GRAS Notice No. GRN 397 pertaining to the use of chitosan from the fungus *Aspergillus niger* (US FDA, 2011). Chitosan currently used in wine making: Wine makers use chitosan derived from *Aspergillus niger* as a clarifying agent. The US Food and Drug Administration (FDA) and the Alcohol and Tobacco Tax and Trade Bureau regulate the relevant legal uses of this substance (US FDA, 2023a). It is also referenced for allowed use in reciprocal Organic programs such as the EU, UK, and Switzerland.

6. The substance is essential for the handling of organically produced agricultural products. (§205.600(b)(6))

   Not essential. Multiple materials currently included on the National List serve similar functions.

7. In balancing the responses to the criteria in Categories 2, 3 and 4, is the substance compatible with a system of sustainable agriculture [§6518(m)(7)] and compatible with organic handling? (see NOSB Recommendation, Compatibility with Organic Production and Handling, April 2004)

   The Subcommittee finds that the substance as petitioned is synthetic and does not meet the OFPA criteria. This petition's focus is on the use of fungi derived chitosan. A previous petition focused on the crustacean extraction methods, which use harsh chemicals, and were previously ruled as not allowed. While fungi sources naturally contain chitosan, commercial chitosan manufacturing methods still rely on chemical deacetylation of chitin. Thus, the material, as commercially produced, is synthetic according to the decision tree. Potential for this to be nonsynthetic in the future using enzymatic or other non-chemical methods to deacetylate the chitin to chitosan. Synthetic chitosan is not essential to organic production, because materials already included on the National List can be used for the petitioned uses.

Category 5: Additional criteria for agricultural substances used in Handling (review of commercial unavailability of organic sources):

N/A. Chitosan is non-agricultural.

1. Is the comparative description as to why the non-organic form of the material /substance is necessary for use in organic handling provided?

2. Does the current and historical industry information, research, or evidence provided explain how or why the material /substance cannot be obtained organically in the appropriate **form** to fulfill an essential function in a system of organic handling?

3. Does the current and historical industry information, research, or evidence provided explain how or why the material /substance cannot be obtained organically in the appropriate **quality** to fulfill an essential function in a system of organic handling?

4. Does the current and historical industry information, research, or evidence provided explain how or why the material /substance cannot be obtained organically in the appropriate **quantity** to fulfill an essential function in a system of organic handling?

5. Does the industry information about unavailability include (but is not limited to) the following?:
   Regions of production (including factors such as climate and number of regions);
   Product is readily available and supply is not a concern.
   a. Number of suppliers and amount produced.
   b. Current and historical supplies related to weather events such as hurricanes, floods, and droughts that may temporarily halt production or destroy crops or supplies.
   c. Trade-related issues such as evidence of hoarding, war, trade barriers, or civil unrest that may temporarily restrict supplies; or none.
   d. Other issues which may present a challenge to a consistent supply?

6. In balancing the responses to the criteria in Categories 2, 3 and 5, is the substance compatible with a system of sustainable agriculture [§6518(m)(7)] and compatible with organic handling? (see NOSB Recommendation, Compatibility with Organic Production and Handling, April 2004)

In order to determine if a substance, its use, and manufacture are compatible with a system of sustainable agriculture and consistent with organic farming and handling, and in consideration of the NOSB Principles of Organic Production and Handling, the following factors are to be considered:

- Does the substance promote plant and animal health by enhancing the soil's physical chemical, or biological properties?

  Chitosan extracted from chitin is in its pure chemical form and does not contain ancillary ingredients. However, the petitioner mentions that their product contains inactivated yeast, ascorbic acid (E 300) and lactic acid (E 270), all of which are on the National List at §205.605(a) or (b). Other commercial chitosan products used in wine processing might contain other ingredients (e.g., enzymes, colloidal silica) that also function in wine clarification, as described in *Combinations of the Substance*.

- Does use of the substance encourage and enhance preventative techniques including cultural and biological methods for management of crop, livestock, and/or handling operations?

  Yes chitosan can be derived from an abundant natural resource. Chitosan is a relatively benign product and also has the advantage of taking a waste stream of seafood shells and converting them into a useful recycled product. Both chlorine and sodium hydroxide are energy-intensive, toxic chemicals used in the production of chitosan, and must be considered.

- Is the substance made from renewable resources? If the source of the product is non-renewable, are the materials used to produce the substance recyclable? Is the substance produced from recycled materials? Does use of the substance increase the efficiency of resources used by organic farms, complement the use of natural biological controls, or reduce the total amount of materials released into the environment?

  Chitin, from which chitosan derives, is the second most abundant polysaccharide biosynthesized on earth, after cellulose (Roberts, 1992). Chitosan is chemically extracted from naturally occurring organisms that contain chitin. *Aspergillus niger* is one fungal species that naturally produces chitosan in its cell walls. Most commercial production of chitosan relies on artificially deacetylating chitin from crustaceans in order to produce chitosan (Shigemasa & Minami, 1996). Unlike with crustacean sources, chitosan derived from fungi avoids the need for the demineralization and decolorization steps.

- Does use of the substance have a positive influence on the health, natural behavior, and welfare of livestock?

  According to numerous sources cited in the draft 2026 TR, chitosan is nearly non-toxic to humans and most other animals, and its degradation products do not cause side effects in the body.

- Does the substance satisfy expectations of organic consumers regarding the authenticity and integrity of organic products?

Chitosan is chemically extracted from naturally occurring organisms that contain chitin. *Aspergillus niger* is one fungal species that naturally produces chitosan in its cell walls. Fungal chitosan is usually produced by fermenting *Aspergillus niger* on standard culture. The 2020 Crops TR provides more information on chitosan extraction from crustacean sources. Compared with fungal chitosan, extraction of chitosan from crustaceans generally involves two additional steps: demineralization and decolorization.

- Does the substance allow for an increase in the long-term viability of organic farm operations?

  There is no history of using chitosan in USDA certified organic handling/processing. However, chitosan of fungal origin is approved as a clarifying agent in organic winemaking in the European Union and the UK since 2009 (International Organization of Vine and Wine, 2009). If chitosan could be utilized as a total replacement option for SO2 compounds then it would have clear need.

- Is there evidence that the substance is mined, manufactured, or produced through reliance on child labor or violations of applicable national labor regulations?

  None

- If the substance is already on the National List, is the proposed use of the substance consistent with other listed uses of the substance?

  No, the petitioner is requesting a change in classification from synthetic to nonsynthetic and allowance for use at 205.605. A final rule, published December 10, 2007 (72 FR 69569), clarifies that chitosan is covered under "EPA List 4" listing at § 205.601(m).

- Is the use of the substance consistent with other substances historically allowed or disallowed in organic production and handling?

  The US Food and Drug Administration (FDA) and the Alcohol and Tobacco Tax and Trade Bureau regulate the relevant legal uses of this substance (Draft 2026 TR).

- Would approval of the substance be consistent with international organic regulations and guidelines, including Codex?

  Chitosan of fungal origin is approved as a clarifying agent in organic winemaking in the European Union and the UK (Draft 2026 TR).

- Is there adequate information about the substance to make a reasonable determination on the substance's compliance with each of the other applicable criteria? If adequate information has not been provided, does an abundance of caution warrant rejection of the substance?

  There is sufficient information to make a determination about compliance, as it has been reviewed multiple times. Documents used for this review include the 2020 Crops Technical Report, the October 2021 NOSB Subcommittee Proposal (plant disease control), the October 2021 NOSB Recommendation (plant disease control), and the December 2024 Petition requesting classification as a nonsynthetic substance.

- Does use of the substance have a positive impact on biodiversity?

  At the rates this substance is applied, no adverse impacts on biodiversity are expected.

Classification Motion:

Motion to classify chitosan as petitioned as synthetic
Motion by: Andrea Hatziyannis
Seconded by: Allison Johnson
Yes: 4 No: 0 Abstain: 0 Absent: 0 Recuse: 0

National List Motion:

Motion to add Chitosan as petitioned to the national list, § 205.605(b)
Motion by: Andrea Hatziyannis
Seconded by: Amanda Felder
Yes: 0 No: 4 Abstain: 0 Absent: 0 Recuse: 0