National Organic Standards Board
Livestock Subcommittee
Petitioned Material Proposal
Lignin Sulfonate in aquatic plant production

[+]January 21, 2014

Summary of Proposed Action:

Synthetic lignin sulfonate is proposed to be added to the National List at 205.609 for use only as a chelating agent for micronutrients used in aquatic plant production. Section 205.609 of the National List will contain the list of synthetic substances allowed in organic aquatic plant production.

Synthetic lignin sulfonate is presently approved for use in organic (soil based) crop production as a plant or soil amendment (chelating agent), and as a dust suppressant 205.601(j)(4), and as a floating agent in post-harvest handling (205.601(l)(1)).

Chelating agents are water soluble compounds that have the ability to bind with metal nutrients. The soluble nature of the chelate molecule facilitates root and cell uptake of metal nutrients. Because most micronutrients are metals (e.g., iron, cobalt, zinc, etc.), many fertilizers with micronutrients contain some form of chelating agent.

Micronutrients are essential nutrients to maintain growth, maturation and disease resistance. Micronutrients must be chelated to become available for aquatic plants. Mineral deficiencies result from inadequate intake and lead to poor plant growth.

Lignin sulfonate is a by-product of the wood pulping industry. It is a derivative of lignin, where lignin has been sulfonated in the wood pulping process. There are a number of methods for pulping wood, such as sulfite chemical pulping, the acidic sulfite process, and the Kraft pulping process. Typically the process consists of cooking softwood chips under pressure in sulfur dioxide–containing liquors. Sulfonated lignin is the liquid by-product in the spent liquor when the pulping process is complete.

Although “Lignin Sulfonate” is the petitioned material it actually complexes into several salts, each with a separate CAS number, namely: sodium lignosulfonate; magnesium lignosulfonate; ammonium lignosulfonate; and calcium lignosulfonate. The Organic Materials Review Institute (OMRI) places restriction on use of ammonium lignosulfonate, but otherwise lignin sulfonate can be used with any allowed micronutrient. Petitioner requests addition to National List of sodium lignosulfonate with CAS numbers 8061-51-6 and 9009-75-0, and lignin sulfonic acid, CAS 8062-15-5 which forms a “sulfonate” when chelated to a metal.

Lignin sulfonate salts are soluble in water. Due to their high biological demand (BOD) during breakdown in water, lignosulfonates will remove dissolved oxygen from waterways, and decreased pH may result from lignin sulfonate decomposition in water. Lower pH levels can increase the level of some metals, such as mercury, in aquatic systems leading to higher exposures in fish. However, when lignin sulfonates are used as chelating agents to bind micronutrients for production of algae the amounts used are extremely small, with chelated micronutrients maintained at levels of microgram moles per litre, parts per billion. Further, such use occurs in completely closed systems such as glass flasks, containers, on-shore tanks and ponds, and not in open water. For these reasons, the environmental impact of using lignin sulfonate in these kinds of systems is expected to be minimal or negligible

In reviewing whether use of synthetic lignin sulfonate is compatible with organic agriculture the subcommittee took into consideration the Organic Foods Production Act (OFPA) which limits use of synthetics to various categories one of which is “copper and sulfur compounds” and lignin sulfonate is listed by inference as part of that group.

In determining if the petitioned substance is essential to organic agriculture the subcommittee reviewed availability of any natural, non synthetic alternative material given that OFPA states that “To be sold or labeled as an organically produced agricultural product under this title, an agricultural product shall (1) Have been produced and handled without the use of synthetic chemicals except as otherwise provided in this title;…….” (6504 (1)). Nonsynthetic chelating agents include citric acid. However citric acid is also a nutrient source for algae and when used as a trace mineral chelator it can cause high levels of trace minerals to accumulate in the plant tissue. Nonsynthetic amino acids, humates, fulvates and organic root exudates can be used in soil environments, but presently it is not known if these soil substances would work in aquatic conditions. Therefore there are presently no known alternatives to synthetic lignin sulfonate as a chelating agent which would permit adequate nutrient uptake by micro and macro algae in aquatic containers.

It should be noted that at the time of drafting this proposal there are no federal standards promulgated for aquatic plant or animal production and this proposal is based on NOSB Recommendations of standards voted in 2007, 2008 and 2009.

Evaluation Criteria (see attached checklist for criteria in each category)

	Criteria Satisfied?		
1. Impact on Humans and Environment	x☐ Yes	No	☐ N/A
2. Essential & Availability Criteria	x☐ Yes	No	☐ N/A
3. Compatibility & Consistency	x☐ Yes	No	☐ N/A

Substance Fails Criteria Category: Comments: N/A

Subcommittee Action & Vote

Classification Motion: Move to classify Lignin Sulfonate CAS numbers: 8062-15-5 (lignin sulfonic acid), 8061-51-6 (sodium lignosulfonate/ lignin sulfonic acid sodium salt) and 9009-75-0 (sodium lignosulfonate), as synthetic.

Motion by: C. Reuben Walker
Seconded by: Mac Stone
Yes: 6 No: 1 Absent: 0 Abstain: 0 Recuse: 0

Listing Motion: Motion to list Lignin Sulfonate (CAS #s: 8062-15-5 (lignin sulfonic acid), 8061-51-6 (sodium sulfonate/lignin sulfonic acid sodium salt), and 9009-75-0 (sodium lignosulfonate), as chelating agents at §**205.609** of the National List

Motion by: C. Reuben Walker
Seconded by: Mac Stone
Yes: 6 No: 1 Absent: 0 Abstain: 0 Recuse: 0

Proposed Annotation (if any): none

Basis for annotation: ☐ To meet criteria above ☐ Other regulatory criteria ☐ Citation

Approved by Tracy Favre, Subcommittee Chair, to transmit to NOSB January 21, 2014

NOSB Evaluation Criteria for Substances Added To the National List: Crops

Category 1. Adverse impacts on humans or the environment? Lignin Sulfonate for aquatic plants

Question	Yes	No	N/A	Comments/Documentation (TAP; petition; regulatory agency; other)
1. Is there a probability of environmental contamination during use or misuse,? [§6518(m)(3)]		x		Lignin sulfonates are soluble in water with potential for decrease in BOD and pH (TR 332-226), but with chelated micronutrients maintained at levels of microgram moles per litre, parts per billion, (Petition p. 3) and used in completely closed tanks, or containers for algae production, environmental damage through use or misuse is unlikely.
2. Is there a probability of environmental contamination during manufacture or disposal? [§6518(m)(3)]		x		Lignin sulfonates are bi-products of the Paper Industry. There are several processes used for production of lignin sulfonates: sulfite chemical pulping, the Kraft process, acid sulfite pulping (TR 239-258). While there may be adverse impacts from high levels of lignin sulfonates, normal use indicates no evidence of toxicity. (TR 300-330). Concerns about presence of dioxins and furans in lignin sulfonates produced by the Kraft process have largely been put to rest, with tests indicating non-detect levels (TR 339-348). Large spills of paper mill effluent could negatively impact nearby waterways and environmentally sensitive area (TR 366-368). Production of chelated micronutrients may require that dump water containing lignosulfonates be processed in a treatment system.
3. Are there any adverse impacts on biodiversity? (§205.200)		X		See 1 and 2 above

4. Does the substance contain inerts classified by EPA as 'inerts of toxicological concern'? [§6517 (c)(1)(B)(ii)]		x		Lignin sulfonate is listed by inference as part of the group "copper and sulfur compounds" in the OFPA Section 6517 c)1) B) i) and Lignin sulfonate is a synthetic inert ingredient that is not classified by EPA as an inert of biological concern. And it is exempt from requirement of tolerance under 40 CFR parts 180.910 and 180.930 (TR 227-232)
5. Is there potential for detrimental chemical interaction with other materials used in organic farming systems? [§6518(m)(1)]		x		
6. Is there a toxic or other adverse action of the material or its breakdown products? [§6518(m)(2)]		x		As noted in 1 and 2 above. Lignin sulfonates are water soluble so it is possible for dissolved lignosulfonates to enter waterways through direct contamination or run off from land surfaces, and lignosulfonates may be toxic to fish (TR 332-337) However, in the ppb amounts and enclosed containers/tanks to be used no concerns are raised in the TR
7. Is there persistence or concentration of the material or breakdown products in the environment? [§6518(m)(2)]		x		As noted in 1 and 2 and 5 above. Little information is available on bioaccumulation of lignosulfonates (TR 276-278) Lignosulfonates break down in soil in about a year
8. Would the use of the substance be harmful to human health or the environment? [§6517 (c)(1)(A)(i); §6517 (c)(2)(A)(i); §6518(m)(4)]		x		There is no research indicating any negative human health impacts (TR 491-496) Environmental impacts are noted in 1, 2, & 8

9. Are there adverse biological and chemical interactions in the agro-ecosystem, including biodiversity? [§6518(m)(5)]		x		Lignosulfonates discharged into water bodies may cause foaming and discoloration (TR 274-276) and may contaminate waterways following rain events (TR 370-373). Due to their high biological oxygen demand (BOD) during breakdown in water, lignosulfonates increase acidity, lower oxygen and can lead to benthic changes, and decreased biodiversity unless properly monitored and regulated with the goal of increasing biodiversity in open systems and can corrode aluminum in absence of calcium. (TR 452-454). However, chelated micronutrients for micro and macro-algal production will be used in completely closed containers and there should be no ecosystem or biodiversity impact .
10. Are there detrimental physiological effects on soil organisms, crops, or livestock? [§6518(m)(5)]		x		See 6 and 8 above. Lignosulfonates used as chelating agents in aquatic plant production are used in entirely enclosed containers and should not run off onto soils.

Category 2. Is the Substance Essential for Organic Production: Lignin Sulfonate for aquatic plants

Question	Yes	No	N/A	Comments/Documentation (TAP; petition; regulatory agency; other)
1. Is the substance agricultural? [§6502(1)]		x		See 3 below
2. Is the substance formulated or manufactured by a chemical process? [§6502(21)]	x			TR 239-258, and Petition p. 5
3. Is the substance formulated or manufactured by a process that chemically changes a substance extracted from naturally occurring plant, animal, or mineral sources? [§6502(21)]	x			Lignin sulfonate is a by-product of paper pulping and thus has already been chemically altered prior to use as a chelating agent in production of micronutrients for algae production
4. Is the substance created by naturally occurring biological processes? [§6502(21)]		x		See 3 above
5. Is there a natural source of the substance? [§ 205.600(b)(1)]		x		Lignin occurs naturally in wood, but lignin sulfonate does not have a natural source.
6. Is there an organic substitute? [§205.600(b)(1)]		x		

7. Is there a wholly natural substitute product? [§6517(c)(1)(A)(ii)]		x		Nonsynthetic amino acids and nonsynthetic citric acid are allowed for use as chelating agents (TR 544-547) However, Citric acid is non-functional in aquatic environments and could lead to micronutrient toxicity due to uptake of excess citric acid and attached metals. Naturally occurring chelates include humates, fulvates and organic root exudates in soils (TR 585-590), but are not available and cannot be used in aquatic substrate.
8. Are there any alternative substances? [§6518(m)(6)]		x		See 7 above
9. Are there other practices that would make the substance unnecessary? [§6518(m)(6)]		x		None provided in Petition or TR for aquatic production. Further, it should be noted that micronutrients are essential for aquatic plant growth, and can only be taken up by plants if chelated.

Category 3. Is the substance compatible with organic production practices? Lignin Sulfonate for aquatic plants

Question	Yes	No	N/A	Comments/Documentation (TAP; petition; regulatory agency; other)
1. Is the substance consistent with organic farming and handling? [§6517(c)(1)(A)(iii); 6517(c)(2)(A)(ii)]	x			Lignin sulfonate is presently on the National List as chelating agent in plant or soil amendments. At present there are no federal standards for aquatic plant production
2. Is the substance compatible with a system of sustainable agriculture? [§6518(m)(7)]	x			As in 1 above and 6 below
3. If used in livestock feed or pet food, is the nutritional quality of the food maintained with the substance? [§205.600(b)(3)]			x	
4. If used in livestock feed or pet food, is the primary use as a preservative? [§205.600(b)(4)]			x	
5. If used in livestock feed or pet food, is the primary use to recreate or improve flavors, colors, textures, or nutritive value lost in processing (except when required by law)? [§205.600(b)(4)]			x	

6. 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	x			Lignin sulfonate is listed by inference as part of the group “copper and sulfur compounds” in the OFPA section 6517(c)(1)(B)(i)
toxins derived from bacteria		x		
pheromones, soaps, horticultural oils, fish emulsions, treated seed, vitamins and minerals		x		
livestock parasiticides and medicines		x		
production aids including netting, tree wraps and seals, insect traps, sticky barriers, row covers, and equipment cleansers		x		