

National Organic Standards Board
Handling Subcommittee
Petitioned Material Proposal - Sodium Dodecylbenzene Sulfonate
January 23, 2016

Background

On October 9, 2015 the NOP received a petition to add Sodium Dodecylbenzene Sulfonate (SDBS) (CAS # 25155-30-0) to the National List at §205.605 - Nonagricultural (nonorganic) substances allowed as ingredients in or on processed products labeled as “organic” or “made with organic (specified ingredients or food group(s)) (b) Synthetics Allowed. This petition was forwarded to the Handling Subcommittee on November 2, 2015 for the appropriate petitioned material process to be conducted.

The petition was submitted by Ecolab, Inc. Sodium dodecylbenzene sulfonate is being petitioned for use as an active ingredient (1 of 2 active ingredients, the other is lactic acid) in an antimicrobial formulation, for use in treating fruits and vegetables in the premises of organic food retail establishments. The Ecolab antimicrobial material is: AFVT-Antimicrobial Fruit & Vegetable Treatment.

The petitioner does not manufacture SDBS, but uses it as 1 of 2 active ingredients in their product (AFVT) formulation. They listed 3 companies that SDBS is manufactured by:

1. Pilot Chemical Company – Santa Fe Springs, CA.
2. Stepan Company – Northfield, IL.
3. Unger Fabrikker A.S. – Fredrikstad, Norway

Sodium dodecylbenzene sulfonate is currently used (an anionic surfactant) in industrial, institutional, chemical detergents & cleaners, specialty cleaners, sanitization products, emulsifiers, suspension or wetting agents, absorbents in pesticide and other agricultural chemicals, along with numerous other uses. (Toxnet 2014).

Manufacturing

There are several ways to manufacture Sodium dodecylbenzene sulfonate. The primary source is to start with LAS (Linear alkylbenzene sulfonate) which is made by the sulfonation of alkylbenzenes prepared from petroleum distillates. In one of the most common processes benzene is alkylated by long chain monoalkenes (e.g. dodecene) using hydrogen fluoride as a catalyst. The purified dodecylbenzenes (and related derivatives) then form dodecylbenzene sulfonic acid, which is then subsequently neutralized with sodium hydroxide (Kurt Kosswig, “Surfactants in Ullman’s Encyclopedia of Industrial Chemistry, Wiley-VCH, 2005). The final slurry can then be dried by either drum drying (this forms flakes or powder) or by using a spray drier system, (this forms beads) to create the desired form of Sodium dodecylbenzene sulfonate.

According to information provided in the petition, the sulfonation technology has been considerably improved, with the most modern systems beginning to use falling film reactors (FFR) (mono-tube or multi-tube) and SO₃, found in many sulfonation facilities in Europe. Also mentioned in the petition: in the mid 90’s there was a new form of alkylation technology introduced that is now being used in Europe, based on heterogeneous catalyst in a fixed-bed reactor. This new technology offers: process simplification, elimination of acids handling and disposal (HF, HCl) as well as an overall production yield improvement and improved LAB quality.

Discussion

The petitioner (Ecolab, Inc.) is trying to get SDBS added to the National List as a processing aid, so that it may be used as one of two active ingredients in their antimicrobial product. This product (Ecolab's Antimicrobial Fruit and Vegetable Treatment) specifically formulated for use in food retail environments such as restaurants, cafeterias, food service operations, commissaries and kitchens. They state that it would help to provide the organic users a new reliable tool to aid in the battle against microorganisms that cause food borne illness outbreaks. The petitioner further states that when SDBS is used as one of two active ingredients in their formulated product it is very effective in helping to control pathogens (*Escherchia coli* O157:H7, *Listeria monocytogenes*, and *Salmonella enterica*) when used in wash water or on surfaces of raw or processed fruits and vegetables.

The petitioner states that in the mode of action there are three mechanisms that SDBS works by providing. These are: Protein denaturing; essential enzyme inactivation; and by membrane disruption and alteration of cell permeability.

SDBS has been cleared for use as an antimicrobial agent in produce wash water by the Food and Drug Administration (FDA) under 21CFR 173.405. But, it is not listed as GRAS.

Sodium dodecylbenzene sulfonate does not appear to pose any serious human health or environmental concerns under the proposed use pattern. But, according to the New Jersey Department of Health and Senior Services Hazardous Substance Fact Sheet (revised May, 2002) and the MSDS for SDBS, it can be a skin irritant, could possibly cause eye damage, and if inhaled be an irritant of the nose, throat, and lungs. This same fact sheet also states that repeated exposure could cause bronchitis to develop. SDBS according to the Material Data Sheet is listed as: DOT: UN3077, Rq, Environmentally Hazardous Substance, Solid, N.O.S. (Sodium Dodecylbenzene Sulfonate), 9, III, Marine Pollutant (Linear Alkylbenzene Sulfonate). Also, it has been noted that SDBS is slightly toxic to Bobwhite quail and green algae and moderately toxic to some species of fish.

Information provided in the EPA 2006 Registration Eligibility Document (RED) states: No environmental exposure is expected to occur from the majority of linear alkylbenzene sulfonate uses and it is unlikely that any appreciable exposure to terrestrial or aquatic organisms would occur from limited commercial down-the-drain use because of the very small number of pounds for these uses plus their rapid degradation in the environment.

There is one area of possible concern regarding SDBS and its use and compatibility with organic crop production in that according to one report (Estrin et al. 1982), it states that SDBS contains impurities that could include: neutral oil (unsulfonated materials), arsenic (As), iron (Fe), and possibly lead (Pb). The levels of these impurities, was not defined. It is not clear if the new methods of formulation mentioned in the petition further remove any of these impurities or not.

There currently are alternative materials in use by organic handlers which would include: lactic acid, citric acid, acidified sodium chlorite, and peracetic acid. The petitioner states that while these materials are available for use by organic handlers and retailers, that SDBS would enable the petitioner to provide a formulated product for use at the food retail, kitchen, restaurant level, etc. where there currently is not such a product available. It is their position that the other available materials are normally used at the processing level and not necessarily at the food retail levels for raw and ready to eat fruits and vegetables.

It would help the full committee during their deliberation of this material if organic stakeholders could provide us with the following information:

- What are retailers currently using to address these concerns?
- Are any of the alternatives mentioned in the petition currently used at the retail level and if so are they effective in addressing these areas of food safety concerns?
- What are the level (if any) of impurities as mentioned in this document found in SDBS?

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

	Criteria Satisfied?		
1. Impact on Humans and Environment	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
2. Essential & Availability Criteria	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	<input type="checkbox"/> N/A
3. Compatibility & Consistency	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
4. Commercial Supply is Fragile or Potentially Unavailable as Organic (only for §205.606)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input checked="" type="checkbox"/> N/A

Substance Fails Criteria Category: [2] **Comments:** Alternatives available

Subcommittee Action & Vote

Classification Motion: Move to classify sodium dodecylbenzene sulfonate as synthetic.

Motion by: Harold V. Austin IV

Seconded by: Ashley Swaffar

Yes: 7 No: 0 Abstain: 0 Absent: 1 Recuse: 0

Listing Motion: Move to list sodium dodecylbenzene sulfonate at §205.605 - Nonagricultural (nonorganic) substances allowed as ingredients in or on processed products labeled as “organic” or “made with organic (specified ingredients or food group(s))” of the National List.

Motion by: Harold V. Austin IV

Seconded by: Tom Chapman

Yes: 1 No: 5 Abstain: 1 Absent: 1 Recuse: 0

Approved by Harold Austin, Handling Subcommittee Chair, to transmit to NOSB February 23, 2016

NOSB Evaluation Criteria for Substances Added To the National List – Handling

Category 1. Adverse impacts on humans or the environment? Sodium dodecylbenzene sulfonate (SDBS)

Question	Yes	No	N/A	Comments/Documentation. (TAP; petition; regulatory agency; other)
1. Are there adverse effects on the environment, or is there a probability of environmental contamination during use or misuse of the substance? [§205.600(b)(2), §6518(m)(3)]		X		Information provided in the EPA 2006 Registration Eligibility Document (RED) states: No environmental exposure is expected to occur from the majority of linear alkylbenzene sulfonate uses and it is unlikely that any appreciable exposure to terrestrial or aquatic organisms would occur from limited commercial down-the-drain use because of the very small number of pounds for these uses plus their rapid degradation in the environment.
2. Are there adverse effects on the environment or is there a probability of environmental contamination during manufacture or disposal of the substance? [§6518(m)(3)]				See answer to question 5 below.
3. Are there any adverse impacts on biodiversity? (§205.200)		X		
4. Does the substance contain inerts classified by EPA as ‘inerts of toxicological concern’? [§6517 (c)(1)(B)(ii)]		X		
5. Is there undesirable persistence or concentration of the material or breakdown products in the environment? [§6518(m)(2)]		X		It is biodegraded rapidly under aerobic conditions with a half-life of approximately 1-3 weeks; oxidative degradation initiating at the alkyl chain. Under anaerobic conditions it degrades very slowly or not at all, causing it to exist in high concentrations in sewage sludge. This is thought to not be of a concern as it will rapidly degrade once returned to an oxygenated environment. (Jenson, John February 1999, “Fate and effects of linear alkylbenzene sulfonates (LAS) in the terrestrial environment”).
6. Are there any harmful effects on human health from the main substance or the ancillary substances that may be added to it? [§6517(c)(1)(A)(i); 6517 (c)(2)(A)(i); §6518(m)(4), 205.600(b)(3)]	X			According to the New Jersey Department of Health and Senior Services Hazardous Substance Fact Sheet (revised May, 2002) and the MSDS for this material, it can be a skin irritant, could possibly cause eye damage, and if inhaled can be an irritant to the nose, throat, and lungs. Repeated exposure could cause bronchitis to develop, according to the N.J. Dept.of Health Fact Sheet.

7. Is the substance, and any ancillary substances, GRAS when used according to FDA's good manufacturing practices? [§205.600(b)(5)]		X		
8. Does the substance contain residues of heavy metals or other contaminants in excess of FDA tolerances? [§205.600 (b)(5)]		X		SDBS contains impurities that include neutral oil (unsulfonated materials), arsenic (As), iron (Fe), and lead (Pb). (Estrin et al.1982). The level of these impurities was not defined. It is not clear if the new methods for formulating SDBS (as stated in the petition) further remove any of these impurities or not.

Category 2. Is the Substance Essential for Organic Production? Sodium dodecylbenzene sulfonate (SDBS)

Question	Yes	No	N/A	Comments/Documentation. (TAP; petition; regulatory agency; other)
1. Is the substance agricultural? [§6502(1)]		X		
2. Is the substance formulated or manufactured by a chemical process? [§6502(21)]	X			<p>There are multiple ways to manufacture SDBS: One process is by reacting dodecylbenzene with sulfuric acid (Oleum Process) or air/SO₂ to produce dodecylbenzene acid (CTFA 1991a). The dodecylbenzene sulfonic acid is then neutralized with sodium hydroxide.</p> <p>The most common process is: Benzene is alkylated by long chain monoalkenes (e.g. dodecene) using hydrogen fluoride as a catalyst. The purified dodecylbenzenes (and related derivatives) then form dodecylbenzene sulfonic acid, which is then subsequently neutralized with sodium hydroxide (Kurt Kosswig, "Surfactants in Ullman's Encyclopedia of Industrial Chemistry, Wiley-VCH, 2005). The final slurry can then be dried by either drum drying (this forms flakes or powder) or by using a spray drier system (this forms beads).</p> <p>According to information provided in the petition the sulfonation technology has been considerably improved, with the modern systems beginning to use falling film reactors (FFR) (mono-tube or multi-tube) and SO₃, in many of the sulfonation facilities in Europe. Also mentioned in the petition: in the mid 90's there was a new form of alkylation technology introduced that is now being used in Europe, based on heterogeneous</p>

				catalyst in a fixed-bed reactor. This new technology offers: process simplification, elimination of acids handling and disposal (HF, HCl) as well as an overall production yield improvement and improved LAB quality.
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		
4. Is the substance created by naturally occurring biological processes? [§6502(21)]		X		
5. Is there a natural source of the substance? [§ 205.600(b)(1)]		X		
6. Is there an organic substitute? [§205.600(b)(1)]	X			According to information provided by the petition citric or lactic acid could serve as possibly substitutes (For the AFVT product's intended use).
7. Is the substance essential for handling of organically produced agricultural products? [§205.600(b)(6)]		X		
8. Is there a wholly natural substitute product? [§6517(c)(1)(A)(ii)]	X			According to information provided by the petition either citric or lactic acid could possibly be used as a substitute for this material for microbial control.
9. Are there any alternative substances? [§6518(m)(6)]	X			Yes for the overall intended use of the material (when used in the finished product that the petitioner is requesting this material be added to the National List so it can be used as one of two active ingredients in), then acidified sodium chlorite or peracetic acid could be used instead. But they do mention that these materials are more apt to be used in commercial food processing establishments and not in restaurants, kitchens, etc. as is the intended area of use proposed by the AFVT product label.
10. Is there another practice (in farming or handling) that would make the substance unnecessary? [§6518(m)(6)]	X			Current processes in place utilizing materials already allowed for use in organic handling and processing.
11. Have the ancillary substances associated with the primary substance been reviewed? Describe, along with any proposed limitations.			X	

NOSB Evaluation Criteria for Substances Added To the National List - Handling

Category 3. Is the substance compatible with organic handling practices? Sodium dodecylbenzene Sulfonate (SDBS)

Question	Yes	No	N/A	Comments/Documentation. (TAP; petition; regulatory agency; other)
1. Is the substance consistent with organic handling? [§6517(c)(1)(A)(iii); 6517(c)(2)(A)(ii)]	X			
2. Is the manner of the substance's use, manufacture, and disposal compatible with organic handling? [§205.600(b)(2)]		X		
3. Is the substance compatible with a system of sustainable agriculture? [§6518(m)(7)]			X	
4. Are the ancillary substances reviewed compatible with organic handling [?]			X	none
5. Is the nutritional quality of the food maintained with the substance? [§205.600(b)(3)]		X		
6. Is the primary use as a preservative? [§205.600(b)(4)]		X		
7. Is the primary use to recreate or improve flavors, colors, textures, or nutritive values lost in processing (except when required by law)? [§205.600(b)(4)]		X		

Category 4. Is the commercial supply of an organic agricultural substance fragile or potentially unavailable?
 [§6610, 6518, 6519, §205.2, § 205.105(d), §205.600(c)] **Sodium Dodecylbenzene Sulfonate**

Question	Yes	No	N/A	Comments/Documentation. (TAP; petition; regulatory agency; other)
1. Is the comparative description as to why the non-organic form of the material /substance is necessary for use in organic handling provided?			X	
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?			X	
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?			X	

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?			X	
5. Does the industry information about unavailability include (but is not limited to) the following?:			X	
a. Regions of production (including factors such as climate and number of regions);			X	
b. Number of suppliers and amount produced;			X	
c. Current and historical supplies related to weather events such as hurricanes, floods, and droughts that may temporarily halt production or destroy crops or supplies;			X	
d. Trade-related issues such as evidence of hoarding, war, trade barriers, or civil unrest that may temporarily restrict supplies; or			X	
e. Other issues which may present a challenge to a consistent supply?			X	