

Sulfurous Acid

Crop Production

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Identification of Petitioned Substance

		CAS Number: 7782-99-2
Chemical Name:	16	
Sulfurous Acid		Other Codes:
		European Inventory of Existing Commercial Chemical Substances (EINECS) No. 231-973-1
Other Names:	17	
Sulfur Dioxide Solution	18	U.S. Department of Transportation No. UN 1833
	19	
Trade Names:	20	North America Emergency Response Guidebook
	21	Code 154
	22	
	23	Right-to-Know Substance No. 1764
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Characterization of Petitioned Substance

Composition of the Substance:

Sulfurous acid is used as an acidifying agent to neutralize and reduce the excessive alkalinity (bi-carbonates and carbonates) in soil and water to achieve and maintain an ideal agronomic environment for the crop(s) being grown. Also, this substance has bio-cidal properties. The molecular formula for sulfurous acid is H₂SO₃ and the molecular weight is 82.08 (U.S. Environmental Protection Agency, Substance Registry Services).

Properties of the Substance:

Physical State	Liquid (6 - 12% solution)
Color	Clear, almost colorless solution
Odor	Pungent odor of sulfur dioxide
Melting Point	Not applicable
Boiling Point	No information found
pH	Acid
Water Solubility	Miscible in water
Vapor Density	2.8
Stability	Stable under ordinary conditions
Specific gravity	1.03

46 Specific Uses of the Substance:

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48 Sulfurous acid is an acidifying agent added to soil and irrigation water to neutralize and reduce the
49 excessive alkalinity (bi-carbonates and carbonates) in soil and water. The use of sulfurous acid in irrigation
50 waters should prevent the long-term accumulation of various salts (calcium carbonate, magnesium
51 carbonate, sodium bicarbonate, and potassium carbonate) in soils in arid and semi-arid agricultural
52 regions. This would include many areas of the western United States. Because sulfurous acid has bio-cidal
53 properties, it can be used to clean and suppress bacterial growth in irrigation piping systems.
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55 Approved Legal Uses of the Substance:

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57 Sulfurous acid is permitted as an inert ingredient for use in non-food use pesticide products by the
58 U. S. Environmental Protection Agency.

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60 An inert ingredient is defined by the U.S. Environmental Protection Agency as any ingredient in a pesticide
61 product that is not intended to affect a target pest.
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64 Sulfurous acid is not approved for use as a food additive by the U.S. Food and Drug Administration.
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66 Action of the Substance:

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68 Sulfurous acid is an acidifying agent that causes minerals to become more soluble and available for up-take
69 by plants and salts to leach from the soil, thereby, creating a healthier and improved soil environment.

70 Sulfurous acid has bio-cidal properties and will kill micro-organism in the immediate ecosystem,
71 therefore, it can be used to clean and suppress bacterial growth in irrigation piping systems.
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Status

73 U.S. Environmental Protection Agency:

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75
76 Sulfurous acid is permitted as an inert ingredient for use in non-food use pesticide products by the
77 U. S. Environmental Protection Agency.

78
79 The U.S. Environmental Protection Agency proposed to revoke the exemption from the requirement of a tolerance for
80 sulfurous acid (U.S. Environmental Protection Agency – 40 CFR 180.910).
81

82
83 The U.S. Environmental Protection Agency has listed sulfurous acid on the Toxic Substances Control Act (TSCA)
84 Chemical Substance inventory. The TSCA (Section 8(b)) provides the U.S. Environmental protection Agency the
85 authority to “compile, keep current, and publish a list of each chemical substance that is manufactured or processed in
86 the United States.”
87

88 U.S. Food and Drug Administration:

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90 Sulfurous acid is not approved for use as a food additive by the U.S. Food and Drug Administration.
91

92 International:

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94 Sulfurous acid is listed on Canadian Domestic Substances List (DSL- Environment Canada). The DSL is the
95 sole basis for determining whether a substance is new for the purposes of the Canadian Environmental
96 Protection Act (1999).
97

98 Sulfurous acid has a classification of E on the Canadian Workplace Hazardous Materials Information
99 System (WHMIS). The WHMIS is Canada’s national hazard communication standard. The key elements

100 of the system are cautionary labeling of containers of WHMIS “controlled products”, the provision of
101 material safety data sheets, and worker education and training programs.
102

103 Sulfurous acid is listed on the Canadian Ingredient Disclosure List (Canadian Centre for Occupational
104 Health and Safety, December 31, 1987).
105

Evaluation Questions for Substances to be used in Organic Crop or Livestock Production

107
108 **Evaluation Question #1: Is the petitioned substance formulated or manufactured by a chemical process?**
109 **(From 7 U.S.C. § 6502 (21).)**
110

111 Sulfurous acid is produced by the reacting sulfur dioxide with water. Sulfur dioxide is produced in a
112 generator by oxidizing elemental sulfur in a burner chamber. By regulating a pressurized side stream of
113 irrigation water through a device called an aspirator, the rate of burning of the elemental sulfur can be
114 regulated. The sulfur dioxide produced is immediately captured to form an aqueous solution of sulfurous
115 acid within a tank.

116 **Evaluation Question #2: Is the petitioned substance formulated or manufactured by a process that**
117 **chemically changes the substance extracted from naturally occurring plant, animal, or mineral sources?**
118 **(From 7 U.S.C. § 6502 (21).)**

119 Sulfurous acid is produced naturally by hydro-thermal vents on the ocean floor, vents on the earth’s
120 surface, volcanic eruptions, and fumaroles emitting sulfur dioxide and reacting with water. Sulfur dioxide
121 is also produced artificially by the burning of coal to produce electricity. Sulfurous acid is produced when
122 the sulfur dioxide reacts with water and has been attributed to the phenomenon of “acid rain”. This
123 sulfurous acid produced either naturally or artificially is not any different than the sulfurous acid
124 produced by the process described in the answer to Question 1.

125
126 **Evaluation Question #3: Is the petitioned substance created by naturally occurring biological**
127 **processes? (From 7 U.S.C. § 6502 (21).)**
128

129 Sulfurous acid is produced naturally by hydro-thermal vents on the ocean floor, vents on the earth’s
130 surface, volcanic eruptions, and fumaroles emitting sulfur dioxide and reacting with water. Sulfur dioxide
131 is also produced artificially by the burning of coal to produce electricity. Sulfurous acid is produced when
132 the sulfur dioxide reacts with water and has been attributed to the phenomenon of “acid rain”.
133

134 **Evaluation Question #4: Is there environmental contamination during the petitioned substance’s**
135 **manufacture, use, misuse, or disposal? (From 7 U.S.C. § 6518 (m) (3).)**
136

137 From the limited information submitted by the petitioner on the manufacturing process, there appears to
138 be fugitive quantities of sulfur dioxide produced in the manufacturing process. However, scrubbers
139 capture the fugitive sulfur dioxide and get it into solution and prevent its release into the atmosphere.
140 Also, nitrogen gas is ventilated to the environment during the manufacturing process.
141

142 **Evaluation Question #5: Is the petitioned substance harmful to the environment? (From 7 U.S.C. § 6517**
143 **(c) (1) (A) (i) and 7 U.S.C. § 6517 (c) (2) (A) (i).)**
144

145 No eco-toxicity or environmental data are available on sulfurous acid. In relation to the Clean Air Act
146 (1990), sulfurous acid is not a hazardous air pollutant, Class 1 ozone depletor, or Class 2 ozone depletor. In
147 relation to the Clean Water Act (1977), sulfurous acid is not a hazardous substance, priority pollutant, or
148 toxic pollutant. Therefore, sulfurous acid should not be harmful to the environment.
149

150 **Evaluation Question #6: Is there potential for the petitioned substance to cause chemical interaction**
151 **with other substances used in organic crop or livestock production? (From 7 U.S.C. § 6518 (m) (1).)**
152

153 Sulfurous acid should not adversely interact with other substances used in organic crop or livestock
154 production. It is classified by the U.S. Environmental Protection Agency as an inert ingredient for use in
155 non-food use pesticide products.

156

157 **Evaluation Question #7: Are there adverse biological or chemical interactions in the agro-ecosystem by**
158 **using the petitioned substance? (From 7 U.S.C. § 6518 (m) (5).)**

159

160 Sulfurous acid when used in irrigated agricultural regions may have beneficial effects by preventing
161 soil salinity. However, if sulfurous acid is over-used, the soil will become too acidic and crops will not
162 grow. This condition can be reversed by applying agricultural lime.

163

164 **Evaluation Question #8: Are there detrimental physiological effects on soil, organisms, crops, or**
165 **livestock by using the petitioned substance? (From 7 U.S.C. § 6518 (m) (5).)**

166

167 Sulfurous acid should have no detrimental physiological effects on soil, organisms, crops, or livestock
168 when used carefully and monitored closely. Irrigation waters and soils should be closely monitored for pH
169 so that the application rate of sulfurous acid can be adjusted. Sulfurous acid has bio-cidal properties and
170 will kill micro-organism in the immediate ecosystem, therefore, it can be used to clean and suppress
171 bacterial growth in irrigation piping systems. Again in this case, the use of sulfurous acid needs to be
172 carefully monitored.

173

174 **Evaluation Question #9: Is there a toxic or other adverse action of the petitioned substance or its**
175 **breakdown products? (From 7 U.S.C. § 6518 (m) (2).)**

176

177 Sulfurous acid (100%) causes burns by all exposure routes. It can cause eye, skin, gastro-intestinal tract,
178 and respiratory tract burns if it comes into contact with the eyes or skin, is swallowed, or is inhaled. Also,
179 it may be harmful, if absorbed through the skin. The chronic effects of sulfurous acid are not known,
180 however, repeated exposure may cause damage to the tissues of the mucous membranes, upper respiratory
181 tract, eyes, and skin. Persons with pre-existing skin disorders or impaired respiratory function may be
182 more susceptible to the effects of sulfurous acid.

183

184 Sulfurous acid is degraded to a hydrogen ion and a bi-sulfite ion (HSO_3). Through microbial
185 decomposition, the bi-sulfite ion is broken down into a hydrogen ion and a sulfate ion (SO_4). The
186 hydrogen ions are what give sulfurous acid its acidifying effects. If sulfurous acid is applied to the soil or
187 through irrigation waters, the pH should be monitored closely. The sulfate ion can be used as a nutrient by
188 plants and micro-organisms.

189

190 **Evaluation Question #10: Is there undesirable persistence or concentration of the petitioned substance**
191 **or its breakdown products in the environment? (From 7 U.S.C. § 6518 (m) (2).)**

192

193 As mentioned in the answer to Question 9, if sulfurous acid is applied to soils or through irrigation waters,
194 the pH needs to be monitored closely, so that the soils and/or water do not become too acidic. If this
195 occurs, the pH of acidic soil can be raised by applying agricultural lime.

196

197 The sulfate ion (SO_4) can be utilized as a nutrient by plants and micro-organisms as long as the soil remains
198 aerobic. However, if the soil becomes water-logged for an extended period of time and anaerobic
199 conditions develop, anaerobic bacteria could convert the sulfate ion to hydrogen sulfide. If enough
200 hydrogen sulfide is produced, it could exert a toxic effect on the immediate eco-system.

201

202 **Evaluation Question #11: Is there any harmful effect on human health by using the petitioned**
203 **substance? (From 7 U.S.C. § 6517 (c) (1) (A) (i), 7 U.S.C. § 6517 (c) (2) (A) (i) and), 7 U.S.C. § 6518 (m) (4).)**

204

205 Sulfurous acid (100%) can cause burns by all routes of exposure. The following personal
206 protection/exposure controls are recommended:

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208 Eye protection: Wear protective eyewear or splash-proof goggles.

209 Hand protection: Wear protective gloves.

210

211 Ventilation: Well-ventilated workplace and use the chemical fume hood if working with this material in a
212 laboratory.

213

214 Protective clothing: Wear protective clothing.

215

216 Work and hygiene practices: Provide readily accessible eye wash stations and safety showers. Wash at the
217 end of each work shift and before eating, smoking, or using the toilet.

218

219 **Evaluation Question #12: Is there a wholly natural product that could be substituted for the petitioned
220 substance? (From 7 U.S.C. § 6517 (c) (1) (A) (ii).)**

221

222 There are not any wholly natural products that could be substituted for sulfurous acid.

223

224 **Evaluation Question #13: Are there other already allowed substances that could be substituted for the
225 petitioned substance? (From 7 U.S.C. § 6517 (m) (6).)**

226

227 Humic acid is on the National List of Synthetic Substances as a soil amendment in organic crop production
228 (7 CFR 205.601) that could possibly be substituted for sulfurous acid to acidify irrigation waters and soils.

229 Humic acid is one of the major components of humic substances, which are dark brown and major

230 constituents of soil organic matter. Humus contributes to soil chemistry and physical quality and also is

231 precursors of some fossil fuels. A substantial fraction of the mass of the humic acids is the carboxylic acid

232 functional groups (Stevenson, 1994), which allow these molecules to chelate (bind) positively charged

233 multivalent ions (Mg^{+2} , Ca^{+2} , Fe^{+2} , Fe^{+3} , as well as others). The chelation of ions is probably the most

234 important role of humic acids with respect to living organisms and systems. By chelating the ions, they

235 facilitate the uptake of these ions by several different mechanisms. One mechanism is the prevention of the

236 precipitation of the multivalent ions. Another mechanism seems to be a direct and positive influence on

237 their bio-availability. Therefore, the prevention of the precipitation of these multivalent ions and their

238 increased bio-availability for uptake by plants should lessen the accumulation of salts in arid and semi-arid

239 soils that are irrigated.

240

241 Also, synthetic ethanol and iso-propanol are listed on the National List of Synthetic Substances as algicides
242 (7 CFR 205.601) for cleaning and suppressing bacterial growth in irrigation piping systems.

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244 **Evaluation Question #14: Are there alternative practices that would make the use of the petitioned
245 substance unnecessary? (From 7 U.S.C. § 6517 (m) (6).)**

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247 As found in 7 CFR 205.205, organic crop producers must implement a crop rotation including, but not

248 limited to sod, cover crops, green manure crops, and catch crops that provides for the management of

249 deficient or excess plant nutrients. When these practices prove insufficient to manage deficient or excess

250 nutrients, a substance on the National List of Synthetic Substances allowed for use in organic crop

251 production (7 CFR 205.601) may be applied (see response to Question 13).

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254 **References**

255

256 Canadian Centre for Occupational Health and Safety. Ingredient Disclosure List. December 31, 1987.
257 (see: <http://www.ccohs.ca>).

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259 Clean Air Act. 1990. U.S. Environmental Protection Agency. (see: <http://www.epa.gov/air/caa/>)

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261 Clean Water Act. 1977. U.S. Environmental Protection Agency. (see:

262 <http://www.epa.gov/lawsregs/laws/cwa.html>)

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264 Environment Canada. Sulfurous acid is listed on Canadian Domestic Substances List (see:
265 http://www.ec.gc.ca/Substances/nsb/eng/lists_e.shtml
266
267 Health Canada. Sulfurous acid has a classification of E on the Canadian Workplace Hazardous Materials
268 Information System (see: [http://www.hc-sc.gc.ca/ewh-semt/occup-travail/whmis-simdut/index-
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274 U.S. Environmental Protection Agency. Office of Prevention, Pesticides, and Toxic Substances. Inert
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276 http://www.epa.gov/opprd001/inerts/inert_nonfooduse.pdf - Last updated January 27, 2009
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283 U.S. Environmental Protection Agency. Toxic Substances Control Act inventory – see:
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