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2005 OCT 26 P 2: 02

October 10, 2005

National Organic Standards Board
c/o Robert Pooler
Agricultural Marketing Specialist
USDA/AMS/TM/NOP
Room 2510-So
Ag Stop 0268
P.O. Box 96456
Washington, D.C. 20090-6456

To the National Organics Standards Board,

Enclosed is a petition entitled "Addition of Sea Water Salts as Nonsynthetics to 205.605a". If you have any questions or comments, please direct them to:

Marsha Kopral
marshakopral@amyskitchen.net
707-578-7270

Respectfully submitted,

Marsha Kopral
Technical Service

William Twieg
Technical Director

cc:

Arthur Neal, USDA
Rosie Koenig, NOSB
Tom Hutcheson, OTA

PETITION
ADDITION OF SEA WATER SALTS AS NONSYNTHETICS TO 205.605a

This petition requests that salts concentrated from sea water be added to the National List under 205.605a -- nonsynthetic, nonagricultural substances allowed as ingredients in or on processed products labeled as "organic" or "made with organic (specified ingredients or food group(s))". The specific request includes four (4) salts that have been previously accepted as suitable for use in organic foods:

- Sodium chloride from sea water
- Potassium chloride from sea water
- Magnesium chloride from sea water
- Magnesium sulfate from sea water

The following specific changes are requested:

Add to 205.605a:

Salts from sea water – sodium chloride, potassium chloride, magnesium chloride, magnesium sulfate (optional addition – food grade*)

* Because concern has been expressed in the past about the level of heavy metals in sea water salts, it may be useful to provide a clarification that the salts must meet the requirements of the Food Chemical Codex or food grade purity.

Delete from 205.605b:

Magnesium chloride – derived from sea water

Because these four salts from sea water are well known to the NOP/NOSB through previous reviews and communications, this is an abbreviated petition.

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1. Specific Components and Common Names

   - Sodium chloride (NaCl) from sea water
   - Magnesium salts ($MgCl_2$ magnesium chloride, $MgSO_4$ magnesium sulfate) from sea water – often referred to as magnesium chloride even though there may be some residual magnesium sulfate in the substance
   - Potassium chloride (KCl) from sea water

   Other names for these substances:

   - Sodium chloride: common salt, table salt, sea salt
   - Magnesium salts (containing magnesium chloride and magnesium sulfate): nigari, bittern
   - Magnesium sulfate: epsom salts, bitter salts
   - Magnesium chloride
   - Potassium chloride: muriate of potash

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2. Contact Information for Manufacture of Sea Salts

Salt Institute
700 North Fairfax Street
Fairfax Plaza Suite 600
Alexandria, VA 22314-2040
703 549 4648

Morton Salt
123 N. Wacker Dr.
Chicago, IL 60606
1 800 789 7258
Sodium chloride
Potassium chloride

Cargill Salt
P.O. Box 5621
Minneapolis, MN 55440-5621
888 385 7258
Sodium chloride
Potassium chloride

Vivion, Inc.
929 Bransten Road
San Carlos, CA 94070
650 595 3600
Sodium chloride
Potassium chloride
Magnesium chloride

Ako Kasei Co., Ltd.
329, Sakoshi, Ako-shi, Hyogo 678-0193, JAPAN
+81-791-48-1111
Sodium chloride
Magnesium chloride

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3. Manufacturing Procedures

   Sea water is filtered then concentrated through solar and/or vacuum evaporation. Salts are crystallized through a series of heating and cooling steps and then harvested using centrifugation. The physical changes that result in crystallization are the result of ionic bonds rather than covalent bonds. The attached process flow charts/process descriptions (Attachments 1 - 3) indicate the sea salts are derived from a natural source and extracted using accepted food processing techniques. There are some variations in procedures used by manufacturers but the resulting compounds are the same. While some synthetic chemicals may be used in the extraction process by some suppliers as noted in Attachment 2, these components do not remain in the final sea salt.

   The attached Decision Tree (Attachment 7) supports the classification of these sea salts as nonsynthetic.

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4. Historic and Intended Uses

   Sodium chloride is one of the oldest substances added to food in human history. It is used as a condiment to enhance flavor as well as a preservative to limit microbial growth. It can also change the functionality of components in a food.

   Magnesium chloride from sea water has been used as a coagulant of soy milk to make tofu. Used at a low level ($\leq$4% of dry soybeans), the magnesium combines with soy protein and causes it to coagulate and form a curd. Other coagulants used in tofu manufacture (calcium sulfate, calcium chloride, glucono-delta-lactone) result in tofu with significantly different texture. Of the coagulants, magnesium chloride from sea water has been considered the most compatible with organic principles.

   Potassium chloride is most commonly used as a salt substitute, either alone or in combination with other substances.

   All these salts are allowed for use in foods with the only limitation that they be used in accordance with good manufacturing practices (GMPs).

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5. OFPA

   Nonsynthetic, nonagricultural ingredient

6. Regulatory

   FDA: GRAS Status

   Sodium chloride 21CFR182.1
   Magnesium chloride 21 CFR 184.1426
   Magnesium sulfate 21 CFR 184.1443
   Potassium chloride 21 CFR 184.1622

   CAS Numbers

   Sodium chloride: #7647-14-5
   Magnesium chloride hexahydrate: #7791-18-6
   Magnesium sulfate heptahydrate: #10034-99-8
   Magnesium sulfate anhydrous: #7487-88-9
   Potassium chloride: #7447-40-7

   See Attachment 4 – Material Safety Data Sheets

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7. Current Status

   Sodium chloride: Not currently on the National List, however, it is commonly recognized as suitable for use in all categories of organic foods.

   Magnesium chloride: Already on the National List 205.605(b) as a synthetic although recognized as nonsynthetic in previous TAP reviews. See Attachments 5 – NOSB Final Recommendation #16, Addition of Synthetic Magnesium Chloride to National List, October 31, 1995 (TAP Review) and Attachment 6 –Magnesium Chloride, NOSB Materials Database, September 13, 1999 (TAP Review)

   Magnesium sulfate: Already on the National List 205.605(a) as "Magnesium sulfate, nonsynthetic sources only". Presumably, magnesium sources from sea water would be considered nonsynthetic.

   Potassium chloride: Already on the National List 205.605(a) but without the limitation "from sea water".

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8. Justification

At this time, magnesium sulfate and potassium chloride are listed as nonsynthetics in 205.605 (a). Most likely, sodium chloride (sea salt) was inadvertently left off the list of nonsynthetics because it is generally recognized as acceptable for use in any food. We believe that magnesium chloride from sea water was mistakenly classified as a synthetic and placed in 205.605 (b). The Harvey vs. Veneman decision to prohibit synthetic substances in foods labeled as "organic" requires that these nonsynthetic substances be listed in 205.605(a) in order to allow for their continued use in foods labeled as "Organic".

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ADDITION OF SEA WATER SALTS AS NONSYNTHETICS TO 205.605a

9. Additional References

- Salt Institute Website (www.saltinstitute.org)
- Kuntz, Lynn. "The Many Benefits of Salt". Food Product Design, October 1994.

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ADDITION OF SEA WATER SALTS AS NONSYNTHETICS TO 205.605a

Attachment 1: Manufacture of Salt - Details

Salt Institute (http://www.saltinstitute.org/11.html)

Solar salt is produced by the action of sun and wind on seawater or natural brine in lakes; both temperature and salinity are important. The water evaporates in successive ponds until the brine is fully concentrated and salt crystallizes on the floor of the crystallizing ponds. Solar salt plants must be located in areas of low rainfall and high evaporation rates, and where suitable low-cost is available. In the Mediterranean, for example, saltworks succeed because evaporation exceeds rainfall by a factor of 3:1; that advantage is even greater in Australia where it can reach 15:1.

Seawater contains about 3.5% (by weight) dissolved minerals. Sodium chloride is 77% of that amount, or about 2.7% of seawater. The other 0.8% consists chiefly of calcium, magnesium and sulfate ions. As seawater evaporates, its volume decreases and the concentration of sodium chloride in the resulting brine increases. Thus, saltworks generally extract as sodium chloride a bit over 2% of the weight of the influent seawater. This means that solar saltworks are often quite extensive in area. Often, the concentrating ponds will have distinct coloration, a pink or red, depending on the salt concentration and what species of plants and animals find it habitable. Salt crystals begin to form when the brine concentration reaches 25.8 % sodium chloride ($NaCl$). As evaporation proceeds, a layer of salt builds up on the earthen crystallizer floors to a thickness of 10 to 25 cm (4-10 in). Sometimes, a layer of salt remains in the crystallizers as "salt floors" to provide support for "harvesting" equipment and to lessen the chance of clay or soil contamination of the salt. A modern, properly operated solar salt plant can produce salt that is more than 99.7 % $NaCl$ (dry basis). In the Dead Sea, salt producers have to contend with "salt mushrooms."

After the salt "crop" reaches the appropriate thickness, the salt is harvested (usually once a year) with mobile equipment, washed, and placed on stockpile to drain. The principal impurities in solar salt are small amounts of calcium and magnesium sulfate, and magnesium chloride. Clean brine, made by dissolving fine salt, is used to wash the salt to remove small amounts of impurities such as these. Seawater can also be used, but salt losses increase due to dissolution. Depending on the intended use, solar salt may be crushed, screened and dried in kiln or fluidized-bed dryers. Because of its high purity and large crystal size, solar salt is widely used to regenerate water softeners.

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Attachment 2: Manufacture of Salt - Details

Vacuum Pan Salt Refining

Salt Institute (http://www.saltinstitute.org/13.html)

Table salt is typical of the fine, granulated-evaporated salt produced in vacuum pan evaporators. Virtually all food grade salt sold or used in the United States is produced by vacuum evaporation of brine. Prior to mechanical evaporation, the brine may be treated to remove minerals that can cause scaling in the evaporators and adversely affect salt purity. Chemical treatment of the brine, followed by settling, reduces levels of dissolved calcium, magnesium and sulfate. Sulfuric acid treatment or chlorination may be used to remove hydrogen sulfide, and hydrochloric acid will neutralize brine used in diaphragm cell production of chlorine and caustic soda. Brine purification has become increasingly important to produce high purity salt for use in chlor-alkali production, particularly in Europe where dry salt is used extensively for this purpose.

Water is evaporated from purified brine using multiple-effect or vapor recompression evaporators. Multiple-effect (calandria) systems typically contain three or four forced circulation evaporating vessels connected together in series. Steam from boilers supplies the heat for evaporators and is fed from one evaporator to the next to increase energy efficiency in the multiple effect system. Vapor recompression forced-circulation evaporators (pictured below) consist of a crystallizer, compressor and vapor scrubber. Feed brine enters the crystallizer vessel where salt is precipitated. Vapor is withdrawn, scrubbed and compressed for reuse in the heater. Recompression evaporators are more energy efficient than multiple effect evaporators, but require higher cost electrical power for energy input. The development of single stage compressors has significantly reduced costs.

Ultimately, weak brine from either process is recycled to the solution mined cavern.

Crystallized salt is produced as slurry which is dewatered first by centrifuging or vacuum drying and then in kiln or fluidized-bed dryers where moisture content of the final product is reduced to 0.05% or less. During this century, salt producers have made significant advances in lowering energy consumption and in reducing salting and scaling in evaporators.

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Attachment 3: Manufacturing Process for Magnesium Chloride from Sea Water

Source: Vivion Inc. – Supplier of Magnesium Chloride

"Raw material" is sea (salt) water that has been concentrated then had the sodium chloride, potassium chloride and magnesium sulfate removed through a series of heating, cooling and filtering steps.

Magnesium Chloride (Crystalline) Production Process chart

Production Process chart	Process condition	Quality testing
Raw material		Test each time receiving products.
↓		
Dissolution		
↓		
Filtration	Filter press	
↓	Ventilation rate—350cc/minute •cm²	
Concentration		
↓		
Precipitation	—At this stage, settle foreign substance out and use skimming solution. Attach a 100 . of	
↓	mesh to a liquid connector.	
Cooling solidification		
↓		
Crush		
↓		
Provisional packing		
↓		
Grinding		
↓		
Measurement		
↓	20kg (−0, +100g)	Check if any foreign substance does not exist (by eye sight).
Packing		
↓		
Metal detector		Detection sensitivity Fe:Ø2.0mm, SUS304:Ø2.4mm
.		
Test		Product test / per lot
↓		
Product		

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Attachment 4: Material Safety Data Sheets

Source: Science Stuff, Inc.

3A Sodium Chloride

3B Potassium Chloride

3C Magnesium Chloride Hexahydrate

3D Magnesium Sulfate Heptahydrate

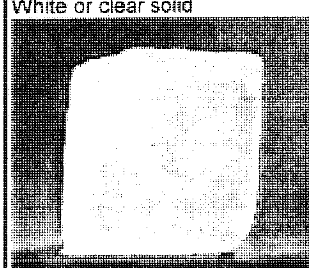
Encyclopedia: Sodium chloride

Updated 17 days 23 hours 23 minutes ago.

Other descriptions of Sodium chloride

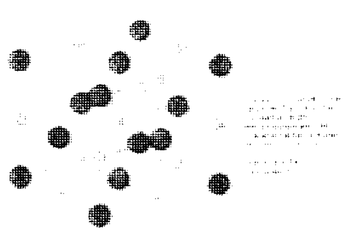
Sodium chloride, also known as **common salt**, **table salt**, or halite, is a chemical compound with formula NaCl. Sodium chloride is the salt most responsible for the salinity of the ocean and of the extracellular fluid of many multicellular organisms. It is commonly used as a condiment and food preservative.

Properties

General	
Name	Sodium chloride
Chemical formula	NaCl
Appearance	White or clear solid 
CAS-number	7647-14-5
Physical	
Formula weight	58.4 amu
Melting point	1074 K (801 °C)
Boiling point	1738 K (1465 °C)
Density	2.2×10^3 kg/m^3
Crystal structure	f.c.c.
Solubility	35.9 g/100 cm^3 water
Thermochemistry	
$\Delta_f H^0_{gas}$	-181.42 kJ/mol
$\Delta_f H^0_{liquid}$	-385.92 kJ/mol

Contents

Crystal structure



Sodium chloride crystal structure

Sodium chloride forms crystals with cubic symmetry. In these, the larger chloride ions are arranged in a cubic close-packing, while the smaller sodium ions fill the octahedral gaps between them. Each ion is surrounded by six of the other kind. This same basic structure is found in many other minerals, and is known as the halite structure.

$\Delta_f H^0_{solid}$	-411.12 kJ/mol
$S^0_{gas,\ 1\ bar}$	229.79 J/mol·K
$S^0_{liquid,\ 1\ bar}$	95.06 J/mol·K
S^0_{solid}	72.11 J/mol·K
Safety	
Ingestion	Dangerous in large quantities
Inhalation	May cause irritation
Skin	May cause irritation
Eyes	May cause irritation
More info	Hazardous Chemical Database (*http://ull.chemistry.uakron.edu/erd/chemicals/10/9918.html*)

SI units were used where possible. Unless otherwise stated, standard conditions were used.

Disclaimer and references

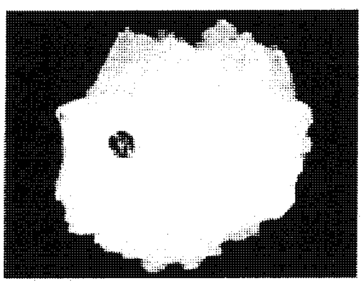
Biological importance

Sodium chloride is essential to life on Earth. Most biological tissues and body fluids contain a varying amount of salt. The concentration of sodium ions in the blood is directly related to the regulation of safe body-fluid levels. Propagation of nerve impulses by signal transduction is regulated by sodium ions.

0.9% sodium chloride in water is called a *physiological solution* because it is isosmotic with blood plasma. It is known medically as normal saline. Physiological solution is the mainstay of fluid replacement therapy that is widely used in medicine in prevention or treatment of dehydration, or as an intravenous therapy to prevent hypovolemic shock.

Humans are unusual among primates in secreting large amounts of salt by sweating.

Salt throughout history



Salt crystal

Salt's preservative ability was a foundation of civilization. It eliminated dependency on the seasonal availability of food and allowed travel over long distances. By the Middle Ages, caravans consisting of as many as forty thousand camels traversed four hundred miles of the Sahara bearing salt, sometimes trading it for slaves.

Until the 1900s, salt was one of the prime movers of national economies and wars. Salt has played a prominent role in determining the power and location of the world's great cities. Timbuktu was once a huge salt market. Liverpool rose from just a small English port to become the prime exporting port for the salt dug in the great Cheshire salt mines and thus became the source of the world's salt in the 1800s.

Salt created and destroyed empires. The salt mines of Poland led to a vast kingdom in the 1500s, only to be destroyed when Germans brought sea salt (often, to most of the world, considered 'superior' to rock salt). Venice fought and won a war with Genoa over salt. Genoa, however, had the last laugh. Genovites Christopher Columbus and Giovanni Caboto destroyed the Mediterranean trade by introducing the new world to the market.

Salt was once one of the most valuable commodities known to man. Salt was taxed, from as far back as the 20th century BC in China. In the Roman Empire, salt was sometimes even used as a currency, giving us the term salary. The Roman Republic and Empire controlled the price of salt, increasing it to raise money for wars, or lowering it to be sure that the poorest citizens could easily afford this important part of the diet. Throughout much of history, it influenced the conduct of wars, the fiscal policies of governments, and even the inception of revolutions.

In the empire of Mali, merchants in 12th-century Timbuktu—the gateway to the Sahara Desert and the seat of scholars—valued salt enough to buy it for its weight in gold; this trade led to the legends of the incredibly wealthy city of Timbuktu, and fueled inflation in Europe, which was exporting the salt.

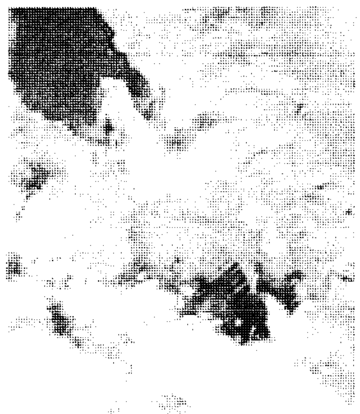
In later times, for instance during the British colonial period, salt production and transport were controlled in India as a means of generating enormous tax revenues. This ultimately led to the Salt March to Dandi, led by Mahatma Gandhi in 1930 in which thousands of Indians went to the sea to illegally produce their own salt in protest of the British tax on salt.

The salt trade was based on one fact — it is more profitable to sell salted foodstuffs than to sell just salt. Thus sources of food to salt went hand in hand with salt making. Before the salt mines of Cheshire were discovered, a huge trade in British fish for French salt existed. This was not a happy accord, for each nation did not want to be dependent on each other. The search for fish and salt led to the Seven Years War between the two. With the British in control of saltworks in the Bahamas and North American cod, their sphere of influence quickly covered the world. The search for oil in the late 1800s and early 1900s used the technology and methods pioneered by salt miners, even to the degree that they looked where salt domes were located for oil.

In religion

There are thirty-two references to salt in the Bible, the most familiar probably being the story of Lot's wife, who was turned into a pillar of salt when she disobeyed the angels and looked back at the wicked city of Sodom (Genesis 19:26). Jesus also referred to his followers as the "salt of the earth" (Matthew Matthew 5:13), a reference to salt's great value in the ancient world.

Production and use



Jordanian and Israeli salt evaporation ponds at the south end of the Dead Sea

Nowadays, salt is produced by evaporation of seawater or brine from other sources, such as brine wells and salt lakes, and by mining **rock salt**, called halite.

While most people are familiar with the many uses of salt in cooking, they might be unaware that salt is used in a plethora of applications, from manufacturing pulp and paper to setting dyes in textiles and fabric, to producing soaps and detergents. In the northern USA, large quantities of rock salt are used to help clear highways of ice during winter.

Salt is also the raw material used to produce chlorine which itself is required for the production of many modern materials including PVC, pesticides, fire retardents and disinfectants.

Flavor enhancer

Salt is commonly used as a flavor enhancer for food and has been identified as one of the basic tastes. Ironically, given its history, this has resulted in large sections of the developed world ingesting salt massively in excess of the required intake, particularly in colder climates where the required intake is much lower. This causes elevated levels of blood pressure in some, which in turn is associated with increased risks of heart attack and stroke.

Biological uses

Many microorganisms cannot live in an overly salty environment: water is drawn out of their cells by osmosis. For this reason salt is used to preserve some foods, such as smoked bacon or fish. It has also been used to disinfect wounds.

Mounds of salt

De-icing

While salt was a scarce commodity in history, industrialised production has now made salt plentiful. About 51% of world output is now used by cold countries to de-ice roads in winter, see Grit bin. This works because salt and water form a eutectic mixture that has about a 10°C lower freezing point than pure water: the ions prevent regular ice crystals from forming (below -10°C salt will not prevent water from freezing). Concerns are arising that this use may be harmful to the environment though, and, in Canada, norms were developed to minimise the use of salt in de-icing.

Additives

The salt one buys for consumption today is not purely sodium chloride as most people assume. In 1911 Magnesium carbonate was first added to salt to make it flow more freely. In 1924 trace amounts of iodine in form of sodium iodide, potassium iodide or potassium iodate were first added, creating iodized salt to reduce the incidence of simple goiter.

Etymology

Rock salt mine near Mount Morris, New York

Salt has also had influence on the English language. Many of its effects can still be seen today. Words and expressions related to salt mostly come from the Roman and Greek civilizations when salt was still a valuable commodity.

The Latin word for salt, *sal*, the French words *solde* (meaning "pay") and *soldier*, are all related. In the Italian language *soldi* means "money", *soldato* is "a soldier".

Roman soldiers were given a particular allowance to purchase salt (Latin: *sal*), salarium argentum, from which we take our English word *salary*. The Romans also preferred salting of their greens, which led to the Latin word for salt being integrated in the word *salad* (in Vulgar Latin *salata* literally meant "salted").

Also the expression "He is not worth his salt" can be traced back to ancient Greece where salt was traded for slaves.

It is worth noting that apparently, the English word doesn't come from the Latin word, but they both derive from a common ancestral PIE root-word *sal, which meant 'salt' in the Proto-Indo-European language, which is estimated to have been spoken over eight thousand years ago.

Other facts

- Salty soil is generally unfit for agriculture, hence the practice of salting the earth.
- The superstition that spilling salt brings bad luck is said to have originated with the overturned salt cellar in front of Judas Iscariot at the Last Supper, immortalised in Leonardo Da Vinci's famous painting.
- Due to its high concentration of salt, the Dead Sea has such a high density that some objects which are not normally buoyant can float on its surface. Humans float easily, having a density slightly less than that of pure water. (But only 8% of the salt in the Dead Sea is sodium chloride, 53% is magnesium chloride, 37% potassium chloride).
- The cities of Cincinnati and Detroit are on top of active salt mines.
- The Third Reich stored vast amounts of money, paintings and artworks in salt mines and many important documents and items continue to be stored in former salt mines to this day. They are also used to store nuclear waste.

See also

- black salt
- edible salt
- soap
- salinity
- biosalinity

Wikibooks Cookbook has more about this subject:
Salt

External links

- Salt Institute (*http://www.saltinstitute.org*) website
- Salt Archive (*http://salt.org.il/news_arch.htm*) website

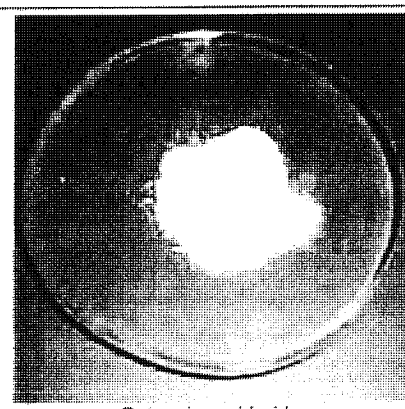
- Click for **other authoritative sources** for this topic (summarised at Factbites.com).

Encyclopedia: Potassium chloride

Updated 6 days 20 hours 32 minutes ago.

Other descriptions of Potassium chloride

The chemical compound **potassium chloride** (KCl) is a metal halide composed of potassium and chlorine. In its pure state it is odourless. It has a white to colourless vitreous crystal, with a face-centred cubic structure that cleaves easily in three directions. KCl is used in medicine, scientific applications, food processing and in judicial execution through lethal injection. It occurs naturally as the mineral sylvite and in combination with sodium chloride as sylvinite.



Potassium chloride

IUPAC name potassium chloride	
General	
Molecular formula	KCl
Molecular weight	74.55 amu
Appearance	white crystalline solid
CAS number	[7447-40-7]
MSDS	Potassium chloride MSDS
Other names	
sylvite (mineral form) **muriate of potash**	
Bulk Properties	
Density	1.987 g/cm^3
Solubility	water: 34.4 g/100 cm^3 (cold) ethanol: 0.4 g/ cm^3 acetone: insoluble
Melting point	776 °C (1049 K)
boiling (sublimation) point	1500 °C (1770 K)
Hazards:	see text
Structure	
Crystal structure	Face-centred cubic
Hydrates	none believed known
Related Compounds	
potassium fluoride potassium bromide potassium iodide	sodium chloride rubidium chloride

Contents

Chemical properties

Potassium chloride can react as a source of chloride ion. As with any other soluble ionic chloride, it will precipitate insoluble chlorides when added to a solution of an appropriate metal salt such as silver nitrate:

$KCl(aq) + Ag(NO_3)(aq) \longrightarrow AgCl(s) + KNO_3(aq)$

Although potassium is more electropositive than sodium, KCl can be reduced to the metal by reaction with metallic sodium if the potassium is removed by distillation, due to Le Chatelier's principle:

$$KCl(l) + Na(l) \xrightarrow{850\ ^\circ C} NaCl(l) + K(g)$$

This method is the main method for producing metallic potassium. Electrolysis (used for sodium) fails because of the high solubility of potassium in molten KCl.

Manufacture/Extraction

Potassium chloride occurs naturally as sylvite, and it can be extracted from sylvinite. It is also extracted from salt water and can be manufactured by crystallization from solution, flotation or electrostatic separation from suitable minerals. It is a by-product of the making of nitric acid from potassium nitrate and hydrochloric acid.

Uses

The majority of the **potassium chloride** produced is used for making fertilizer[2], since the growth of many plants is limited by their potassium intake. As a chemical feedstock it is used for the manufacture of potassium hydroxide and potassium metal. It is also used in medicine, scientific applications, food processing and in judicial execution through lethal injection.

Biological/Medical properties

Potassium is vital in the human body and oral potassium chloride is the common means to replenish it, although it can also be diluted and given intravenously. It can be used as a salt substitute for food, but due to its weak, bitter, unsalty flavor, it is usually mixed with regular salt, sodium chloride, for this purpose to improve the taste. Medically it is used in the treatment of hypokalemia and associated conditions, for digitalis poisoning, and as an electrolyte replenisher. Side effects can include gastrointestinal discomfort including nausea and vomiting, diarrhea and bleeding of the gut. Overdoses cause hyperkalemia which can lead to paresthesia, cardiac conduction blocks, fibrillation and arrhythmias, also sclerotic effects.

Precautions

Orally it is toxic in excess; the LD_{50} is around 2500 mg/kg (meaning that a 150-lb person would have to consume about six ounces; regular salt is about as toxic). Intravenously this is reduced to just over 100 mg/kg but of more concern are its severe effects on cardiac muscles; high doses can cause cardiac arrest and rapid death.

Suppliers/Manufacturers

- Sigma Aldrich (*http://www.sigmaaldrich.com*)
- Alfa Aesar (*http://www.alfa.com/alf/index.htm*)
- VWR International (*http://www.vwr.com/index.htm*)
- Fisher Scientific (*https://www1.fishersci.com/index.jsp*)

References

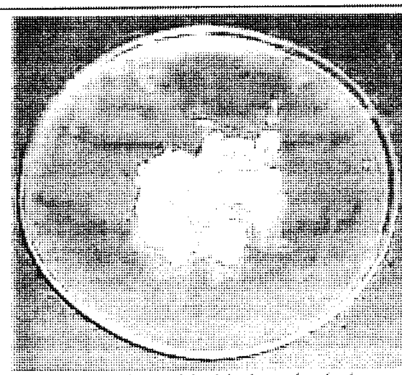
- *Handbook of Chemistry and Physics*, 71st edition, CRC Press, Ann Arbor, Michigan, 1990.
- N. N. Greenwood, A. Earnshaw, *Chemistry of the Elements*, Pergamon Press, 1984.

- Click for **other authoritative sources** for this topic (summarised at Factbites.com).

Encyclopedia: Magnesium chloride

Updated 7 days 19 hours 39 minutes ago.

Other descriptions of Magnesium chloride



Magnesium chloride hexahydrate

IUPAC name Magnesium chloride	
General	
Molecular formula	$MgCl_2$
Molecular weight	95.22 amu (anhydrous) 203.31 amu (hexahydrate)
Appearance	white or colourless crystalline solid
CAS number	[7786-30-3] (anhydrous) [7791-18-6] (hexahydrate)
MSDS	Magnesium chloride MSDS
Other names	
■ **Magnesium(II) chloride**	
Bulk Properties	
Density	2.32 g/cm^3 (anhydrous) 1.56 g/cm^3 (hexahydrate)
	water: 54.2 g/100 cm^3 (20 °C)

Magnesium chloride is composed of magnesium and chlorine and is a typical ionic halide, being highly polar and soluble in water. It is a weak Lewis acid, so not surprisingly the hexahydrate can undergo partial hydrolysis when heated. Magnesium chloride can be extracted from brine or sea water, and is a commonly used source of magnesium metal, which can be extracted from $MgCl_2$ using electrolysis.

Contents

Chemical Properties

Magnesium chloride can serve as a source of magnesium compounds, for example by precipitation:

$MgCl_2(aq) + Ca(OH)_2(aq) \rightarrow Mg(OH)_2(s) + CaCl_2(aq)$

It can be electrolysed to give magnesium metal:

$MgCl_2(l) \rightarrow Mg(l) + Cl_2(g)$

Both of these reactions are used in the Dow process for production of metallic magnesium.[3]

Magnesium chloride can also act as a weak Lewis acid, and salts containing the $MgCl_4^{2-}$ are known, though rare. [2]

Preparation

In the Dow process, magnesium chloride is regenerated from magnesium hydroxide using hydrochloric acid:

$Mg(OH)_2(s) + 2\ HCl \rightarrow MgCl_2(aq) + 2\ H_2O(l)$

Solubility	ethanol: 7.4 g/100 cm^3 (30 °C)
Melting point	714 °C (987 K)
Boiling point	1412 °C (1685 K)
Hazards:	Irritant
Structure	
Coordination geometry	(octahedral, 6-coordinate?)
Crystal structure	$CdCl_2$
Hydrates	hexahydrate
Related Compounds	
magnesium fluoride magnesium bromide magnesium iodide	beryllium chloride calcium chloride

It may also be prepared from magnesium carbonate by a similar reaction.

Uses

Magnesium chloride is used for a variety of applications, besides the manufacture of magnesium via the Dow process discussed above. It is used in the manufacture of textiles, paper, fireproofing agents, cements and refrigeration brine.[3]

Magnesium chloride is also the foremost soy milk coagulant for the preparation of tofu.

A number of state highway departments throughout the United States have decreased the use of rock salt and sand on roadways and have increased the use of liquid magnesium chloride as a de-icer or anti-icer. The liquid magnesium chloride is sprayed on dry pavement (tarmac) prior to precipitation or wet pavement prior to freezing temperatures in the winter months to prevent snow and ice from adhering and bonding to the roadway. The application of anti-icers is utilized in an effort to improve highway safety. The use of this product seems to show an improvement in driving conditions during and after freezing precipitation yet it seems to be negatively affecting electric utilities.

Two main issues have been raised regarding the anti-icer magnesium chloride as it relates to electric utilities: contamination of insulators causing tracking and arcing across them, and corrosion of steel and aluminium poles and pole hardware.

Precautions

Irritant. Wear gloves and goggles. For more details see a Baker MSDS (*http://www.jtbaker.com/msds/englishhtml/m0156.htm*).

Suppliers/Manufacturers

Aldrich: http://www.sigmaaldrich.com Alfa: http://www.alfa.com/alf/index.htm VWR: http://www.vwr.com/index.htm or Fisher: https://www1.fishersci.com/index.jsp

External links

- Magnesium Chloride as a De-Icing Agent (*http://www.usda.gov/rus/electric/engineering/2001/magnesium_chloride.htm*)

References

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3. Hill, Petrucci, McCreary, Perry, "General Chemistry", 4th ed., Pearson/Prentice Hall, Upper Saddle River, New Jersey, USA.

- Click for **other authoritative sources** for this topic (summarised at Factbites.com).

Encyclopedia: Magnesium sulfate

Updated 4 days 18 hours 50 minutes ago.

Other descriptions of Magnesium sulfate

Magnesium sulfate (commonly called **Epsom salts** or **bitter salts** in hydrated form) is a chemical compound with the formula $MgSO_4 \cdot 7H_2O$.

Origin

Epsom salt was originally prepared by boiling down mineral waters at Epsom, England and afterwards prepared from sea water. In more recent times, these salts are obtained from certain minerals such as siliceous hydrate of magnesia. It is used as a therapeutic bath.

Medical use

It is taken orally as a laxative, and to treat heartburn or constipation.

Intravenous use is broadening, as magnesium sulfate reduces striated muscle contractions and blocks peripheral neuromuscular transmission by reducing acetylcholine release at the myoneural junction. Indications for its use are:

- Prevention and treatment of seizures (especially in eclampsia, for which it is the most effective therapy).
- As a bronchodilator after beta-agonist and anticholinergic agents have been tried, e.g. in severe exacerbations of asthma.
- In some cardiac arrhythmias:
  - Atrial fibrillation
  - Torsades de pointes tachycardia

- Click for **other authoritative sources** for this topic (summarised at Factbites.com).

PETITION

ADDITION OF SEA WATER SALTS AS NONSYNTHETICS TO 205.605a

Attachment 5: NOSB Final Recommendation #16, Addition of Synthetic Magnesium Chloride to National List, October 31, 1995 (TAP Review)

NATIONAL ORGANIC STANDARDS BOARD
FINAL RECOMMENDATION ADDENDUM NUMBER 16

ADDITION OF SYNTHETIC MAGNESIUM CHLORIDE TO NATIONAL LIST

Date adopted: October 31, 1995
Location: Austin, Texas

Introduction:

Included within the discussion of the materials review of magnesium sulfate, considerable concern was raised about "nigari" or magnesium chloride, a substance used to coagulate soymilk in the production of tofu, specifically if it was currently being mislabeled as to the actual source used. Accordingly, the Processing, Handling, and Labeling Committee was charged to research nigari as well as natural and synthetic forms of magnesium chloride to report the group's recommendations as to whether these should or should not be included on the National List. Our research includes the following:

In general, the confusion originates on the correct definition of "nigari", the traditional name used for the tofu coagulant made from salt water. Natural extracted nigari is the most traditional and one of the most natural coagulants for tofu. Extracted from sea water by removing most or all of the sodium chloride and water, it contains primarily magnesium chloride plus all the other salts and trace minerals naturally found in sea water, as well as twigs, sand, plankton, organic matter, etc. if not properly filtered. As most tofu shops have found natural nigari of questionable purity and sanitation, most prefer the refined form.

Japanese production of **refined** nigari continues to be extraction from sea water, available via two different extraction methods: 1) the ion-exchange process or 2) a method in which sea water is concentrated, filtered, bleached, and cooked to yield magnesium and natural salt. Most tofu producers in the U.S. use refined nigari processed according to the second method. Although from sea water, refined nigari must be classified as a synesthetic due to the bleaching process in its manufacture.

Food grade magnesium chloride made in the U.S. is produced from the reaction between hydrochloric acid and magnesium. It, too, is a synthetic process, albeit very pure, sanitary, and safe to use. However, since the Japanese source is extracted from sea water, it appears that it remains "more natural" than U.S. food grade magnesium chloride.

While other types of coagulants can be used to produce tofu, such as calcium chloride, calcium sulfate, magnesium sulfate, and glucono delta-lactone, most manufacturers use magnesium chloride (or refined nigari) as at least the primary coagulant (often a blend of coagulants is used) to achieve the flavor and texture that is typically preferred.

Recommendation:

The Processing, Handling, and Labeling Committee recommends that synthetic magnesium chloride extracted from sea water (often referred to as "refined nigari") be added to the National List as an allowed synthetic for use as an ingredient in organic foods. Natural (unrefined) nigari should be listed as a prohibited natural on the National List.

TAP REVIEWER COMMENT FORM for USDA/NOSB

Use this page or an equivalent to write down comments and summarize your evaluation regarding the data presented in the file of this potential National List material. Complete both sides of page. Attach additional sheets if you wish.

This file is due back to us by: August 29, 1995

Name of Material: Magnesium chloride

Reviewer Name: R THEUER

Is this substance Synthetic or non-synthetic? Explain (if appropriate)

SYNTHETIC (OR) NON-SYNTHETIC (FROM BRINE)

If synthetic, how is the material made? (please answer here if our database form is blank)

This material should be added to the National List as:

____ Synthetic Allowed ____ Prohibited Natural

or, ✓ Non-synthetic (Allowed as an ingredient in organic food)

✓ Non-synthetic (Allowed as a processing aid for organic food)

or, ____ this material should not be on the National List

Are there any use restrictions or limitations that should be placed on this material on the National List?

FROM NATURAL SOURCE (NON-SYNTHETIC)

Please comment on the accuracy of the information in the file:

GOOD

Any additional comments? (attachments welcomed)

Do you have a commercial interest in this material? ____ Yes; ✓ No

Signature [signature] **Date** 8/28/95

Please address the 7 criteria in the Organic Foods Production Act:
(comment in those areas you feel are applicable)

(1) the potential of such substances for detrimental chemical interactions with other materials used in organic farming systems;

(2) 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;

(3) the probability of environmental contamination during manufacture, use, misuse or disposal of such substance;

(4) the effect of the substance on human health;

(5) the effects of the substance 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;

(6) the alternatives to using the substance in terms of practices or other available materials; and

(7) its compatibility with a system of sustainable agriculture.

TAP REVIEWER COMMENT FORM for USDA/NOSB

Use this page or an equivalent to write down comments and summarize your evaluation regarding the data presented in the file of this potential National List material. Complete both sides of page. Attach additional sheets if you wish.

This file is due back to us by: August 29, 1995

Name of Material: Magnesium chloride

Reviewer Name: DR. JOE MONTECALVO.

Is this substance Synthetic or non-synthetic? Explain (if appropriate)

Synthetic

If synthetic, how is the material made? (please answer here if our database form is blank)

This material should be added to the National List as:

✓ Synthetic Allowed ____ Prohibited Natural

or, _____ Non-synthetic (Allowed as an ingredient in organic food)

_____ Non-synthetic (Allowed as a processing aid for organic food)

or, ____ this material should not be on the National List

Are there any use restrictions or limitations that should be placed on this material on the National List?

Only for specified specific uses

Please comment on the accuracy of the information in the file:

Any additional comments? (attachments welcomed)

- Also it is used for fireproofing wood, in disinfectants, fire extinguishers, dressing cotton fibers/fabrics, carbonizing wool, artifical leather, in casein glues, as a reagent in ~~ana~~ analytical chemistry.

Do you have a commercial interest in this material? ____ Yes; ✓ No

Signature [signature] **Date** 7/31/95

Please address the 7 criteria in the Organic Foods Production Act:

(comment in those areas you feel are applicable)

(1) the potential of such substances for detrimental chemical interactions with other materials used in organic farming systems;

None.

(2) 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;

none known.

(3) the probability of environmental contamination during manufacture, use, misuse or disposal of such substance;

None.

(4) the effect of the substance on human health;

Mild as a cathartic

(5) the effects of the substance 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;

None.

(6) the alternatives to using the substance in terms of practices or other available materials; and

Not known.

(7) its compatibility with a system of sustainable agriculture.

~~[illegible]~~ Only for specific uses/Applications

PETITION
ADDITION OF SEA WATER SALTS AS NONSYNTHETICS TO 205.605a

Attachment 6: Magnesium Chloride, NOSB Materials Database, September 13, 1999 (TAP Review)

Magnesium chloride

Processing

Identification

Chemical Names Magnesium chloride
Other Names: Magnogene.
Double salt with magnesium sulfate: Nigari, Bittern

CAS Number: 7786-30-3
Other Codes: INS 511

Characterization

Composition $MgCl_2.6H_2O$

Properties:
A colorless, deliquescent, odorless material crystals or flakes. Very soluble in water and freely soluble in alcohol. Solubility at 20° C. is 54.6 g/100cc.

How Made:
Occurs naturally as the mineral bischofite. It is manufactured as a by-product of the potash industry, from natural brines, from seawater, and in the presence of an organic reducing agent. Recovery from brines and from potash manufacture is achieved by concentrating the liquor by solar evaporation and then fractional crystallization of other salts. The resulting mixture of magnesium chloride and magnesium sulfate (epsom salts) is traditionally called 'nigari.' Magnesium chloride can also be synthesized by reacting magnesium oxide, magnesium carbonate, magnesium ammonium chloride hexahydrate, or magnesium hydroxide with a solution of hydrochloric acid (Bryce-Smith, 1960 from Budavari, 1996), or as a by-product of potassium mining and fertilizer production (Tisdale et al., 1985).

Specific Uses:
Color retention and firming agent for canned vegetables; a coagulant of soy milk with magnesium sulfate (Epsom salts) to make tofu (bean curd); in infant formula; as a dressing agent in cotton fabrics. Used in sugar beet processing. Used as a disinfectant.

Action:
Coagulation of soymilk is a complex interaction of several variables (Hou et al., 1997). Combines with soluble proteins to denature and take them out of solution. Attacks fused silica when melted.

Combinations:
With magnesium sulfate (Epsom salts) in nigari. Also found in combination with potassium carbonate and magnesium sulfate as a potash magnesia double salt (Rose and Rose, 1979).

Status

OFPA
Non-synthetic, non-agricultural ingredient.

Regulatory
FDA-GRAS 21 CFR 184.1426.

Status among Certifiers
Many certifiers have adopted the NOSB's annotation in their recommendation to add magnesium chloride to the National List, but were confused about how to adopt and implement the NOSB's recommendation. That recommendation is that magnesium chloride, unrefined is considered non-synthetic and prohibited for use in processing organic food. Magnesium chloride, refined is considered synthetic and allowed to process organic food. Some certifiers are considering seawater extracted nigari to be 'refined' magnesium chloride in the absence of a clear standard and others are not.

Historic Use
The material has long been used in organic tofu production.

International
INS 511--Allowed for soy processing under IFOAM.

OFPA 2119(m) Criteria

(1) The potential of such substances for detrimental chemical interactions with other materials used in organic farming systems. As this is a processing material, the substance is not used in organic farming systems.
(2) 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. See processor criteria 3 below.
(3) The probability of environmental contamination during manufacture, use, misuse or disposal of such substance. This is considered below under item (2).
(4) The effect of the substance on human health. This is considered in the context of the effect on nutrition (3) below as well as the and the consideration of GRAS and residues (5) below.
(5) The effects of the substance 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. As this is not released into the agroecosystem, there is no direct effect.
(6) The alternatives to using the substance in terms of practices or other available materials. See discussion of alternatives in (1) below.
(7) Its compatibility with a system of sustainable agriculture. This is considered more specifically below in the context of organic handling in (6) below.

NOSB Processing Criteria

A SYNTHETIC PROCESSING AID OR ADJUVANT may be used if;

1. An equivalent substance cannot be produced from a natural source and has no substitutes that are organic ingredients.
   Some coagulant must be used to make tofu. The qualify of tofu products is significantly influenced by the type of coagulant used (Tsai, et al., 1981). Magnesium chloride is available from non-synthetic and synthetic sources--see a description of various sources above in the 'How Made' section. Other tofu coagulants include calcium chloride, calcium sulfate and delta gluco lactone (Shurtleff and Aoyogi, 1990). The NOSB did not recommend that either calcium sulfate or delta gluco lactone be added to the National List of non-organic ingredients. Calcium chloride has been recommended, but all three of these coagulants produce a tofu with different textural qualities from nigari. Nigari and calcium sulfate are considered as the only two coagulants suitable for Chinese-style tofu. Of these two, calcium sulfate tofu is both harder and more brittle than nigari tofu (Hou, et al., 1997).

2. Its manufacture, use and disposal does not contaminate the environment.
   Seawater extraction involves minimal impact on the environment. It is usually performed by solar evaporation. Synthesis from magnesium oxide made from magnesium carbonate involves the use of fossil fuels and hydrochloric acid. Manufacture from fertilizer by-products also involve the use of synthetic chemicals an reactions, principally the reaction of magnesium sulfate with hydrochloric acid or potassium chloride.

3. If the nutritional quality of the food is maintained and the material itself or its breakdown products do not have any adverse effect on human health.
   Magnesium is beneficial to human health in the amounts used. The amount of chloride used in processing would fall below the levels that would be considered a health risk.

4. Is not a preservative or used only to recreate/improve flavors, colors, textures, or nutritive value lost during processing except in the latter case as required by law.
   Magnesium chloride is not used as a preservative. Use of magnesium chloride as a firming agent helps foods to retain texture. While magnesium chloride creates other sensory effects, that is not is sole or primary purpose. Finally, magnesium chloride can serve as a supplemental source of magnesium.

5. Is Generally Recognized as Safe (GRAS) by FDA when used in accordance with Good Manufacturing Practices (GMP), and contains no residues of heavy metals or other contaminants in excess of the tolerances established by FDA.
   Rat LD50 is 8.1 g/kg (Smyth, 1969 cited in Merck). There is no distinction between refined and unrefined magnesium chloride, only magnesium chloride that meets the standard of identity set in the Food Chemicals Codex. Because the NOSB raised concerns about the possible contamination of the seawater used to extract the brine, suppliers to organic processors may need to be required to implement strict quality assurance measures. The standard of identity for magnesium chloride sets a maximum contaminant level for ammonium (NH_4) at not more than 0.005%, arsenic (As) at not more than 3 ppm, heavy metals as lead at not more than 10 ppm, and sulfate at not more than 0.02%. Therefore, because nigari contains with it approximately 4% magnesium sulfate, its sulfate level prevents nigari from meeting the magnesium chloride standard of identity. The investigator contacted two basic producers and one distributor for data on heavy metal levels in their product, but was unable to obtain any test results.

6. Is compatible with the principles of organic handling.
   Magnesium chloride is currently used as an ingredient in organic processed food products. Organic processors surveyed in 1991 rated nigari as 4.2 (5=highly compatible, 1=highly incompatible) (Raj, 1992); mined minerals rated 3.6 and acidic solutions rated 2.4. Therefore, nigari appeared in that survey at that time to be the coagulant most compatible with organic principles.

7. There is no other way to produce a similar product without its use and it is used in the minimum quantity required to achieve the process.
   If magnesium chloride is not allowed by the NOSB tofu producers would have to label their tofu as being "made from organic soybeans" rather than "organic tofu." Under current NOSB recommendations, many if not most existing organic tofu makers would be put in a position of having to relabel their tofu as "tofu made from organic soybeans" rather than as "organic tofu."

Discussion

Condensed Reviewer Comments

Reviewer 1:
The NOSB should not prohibit the use of non-synthetic magnesium chloride for tofu production. It should consider restricting the use to non-synthetic, refined magnesium chloride to eliminate unacceptable levels of arsenic and lead which may be present in the unrefined material

Magnesium chloride seems to be less compatible with the philosophy of organic production for processed foods other than tofu. It is not integral to the production of canned foods and is used to preserve color and texture. These qualities could be better addressed by labeling the product with a date to indicate time best used by. The use of magnesium chloride should be restricted to those products such as tofu for which it is integral to the manufacture of the product.

Reviewer 2:
In summary, nigari would be the most preferable choice of material for use in organic systems, providing that it can be shown to contain levels of harmful components which are below those delineated by the Food Chemicals Codex for magnesium chloride. Next in order of preference would be refined magnesium chloride from other natural sources.

SUMMARY AND RECOMMENDATION (from Reviewer 2)
List magnesium chloride under 3 separate headings, as follows:

nigari - non-synthetic, regulated - Annotation: As a coagulant in soy processing only. Must be shown not to contain heavy metals or other contaminants (magnesium sulfate excluded) at levels comparable to those allowed for refined magnesium chloride used as a food additive.

magnesium chloride - non-synthetic, regulated - Annotation: As a coagulant in soy processing only, and only when nigari is not an available alternative. Must be refined to a degree which meets the Food Chemicals Codex requirements for maximum levels of allowable contaminants.

magnesium chloride - synthetic - prohibited

Reviewer 3:
I feel that if magnesium chloride/Nigari is prepared from a potash operation which separates, concentrates and crystallizes a potash magnesia double salt, then it is compatible with organic production and handling and should be classified as non-synthetic.

I would also like to propose that an annotation be developed which clearly states that magnesium chloride/Nigari must be derived from potash operations and its manufacture involve separation, concentration and drying (crystallization). All forms of magnesium chloride/Nigari clearly derived by synthesis with hydrochloric acid would be classified synthetic and possible prohibited.

Conclusion

The NOSB made separate decisions for "Refined" and "Unrefined" sources. Many organic processors and certifiers are unable to interpret the NOSB's recommendation because neither 21 CFR 184.1426 nor the Food Chemicals Codex distinguishes magnesium chloride in this way. Food grade sources can be obtained from either seawater or bischofite, both of which appear to be non-synthetic. If the NOSB is concerned that the Food Chemicals Codex tolerances for contaminants are too high, these can be adjusted accordingly. The recommendation of one of the reviewers--that use be limited only to tofu--may merit discussion. Use in textiles and processed products labeled as made with organic ingredients need not meet as rigorous a standard as magnesium chloride used in food labeled 'organic.'

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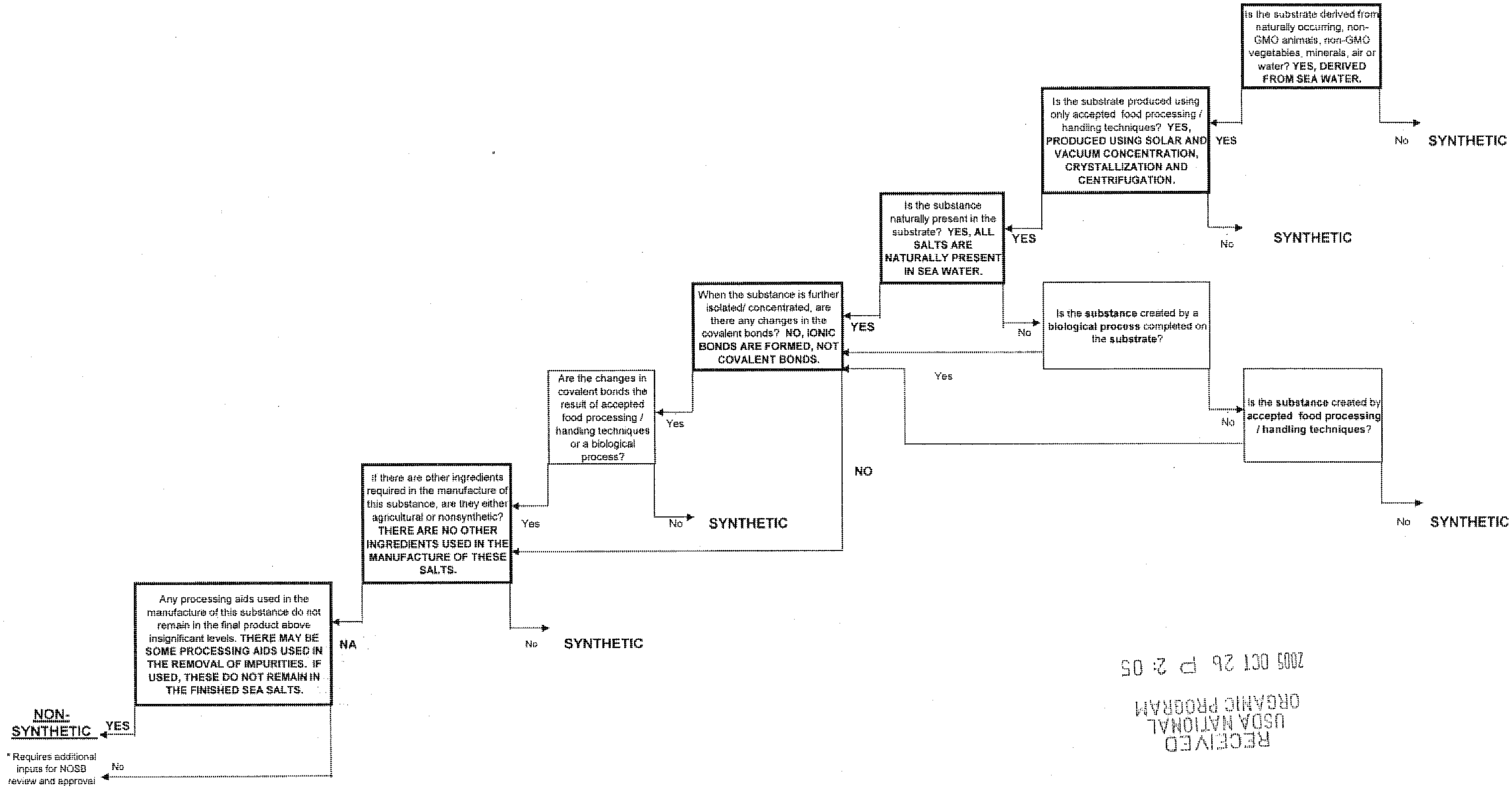
PETITION
ADDITION OF SEA WATER SALTS AS NONSYNTHETICS TO 205.605a

Attachment 7: Sea Salts Decision Tree – Nonsynthetic or Synthetic

DECISION TREE FOR SEA SALTS: NONSYNTHETIC OR SYNTHETIC



8/3/05

DECISION TREE FOR SEA SALTS: NONSYNTHETIC OR SYNTHETIC

Definitions

NONSYNTHETIC INGREDIENT	A substance that has been derived from nature using biological and/or accepted food processing/handling techniques
SYNTHETIC INGREDIENT	A substance which has had non-biological changes in one or more covalent bonds during manufacture with the exclusion of changes which occur as the result of accepted food processing/handling techniques

Accepted food processing / handling techniques	Traditional food processing / handling methods: baking, heating, drying, mixing, separating, extracting, cutting, fermenting, evaporating, freezing, etc.
Biological process	A chemical change to a substance which occurs naturally as a result of living cells or the components of living cells, typically enzymes.
Covalent bonds	A strong chemical bond in which a pair of electrons is shared equally by two adjacent atoms with each atom contributing one electron to the bond. When a covalent bond is added, removed or changed in a molecule, an entirely new compound is formed.
Ingredients	Components used in the manufacture of the substance which have **some** functional effect in the eventual use of the substance and are generally included in the ingredient declaration.
Nonagricultural ingredient (current NOP defined term)	A substance that is not a product of agriculture, such as a mineral or a bacterial culture, that is used as an ingredient in an agricultural product.....A nonagricultural ingredient also includes any substance, such as gums, citric acid, or pectin, that is extracted from, isolated from, or a fraction of an agricultural product so that the identity of the agricultural product is unrecognizable in the extract, isolate or fraction.
Processing aids	Minor components used in the manufacture of the substance which have **no** functional effect in the eventual use of the substance **and** are either absent in the finished substance or present in very low levels; these are generally not labeled in the ingredient declaration.
Substance	Finished food ingredient under evaluation consisting of one primary component and possibly one or more minor ingredients and/or processing aids used in the manufacturing process.
Substrate	Material(s) from which substance is derived.

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