

Arbutin

sc-221267



The Power is Question

Material Safety Data Sheet

Hazard Alert Code
Key:

EXTREME

HIGH

MODERATE

LOW

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

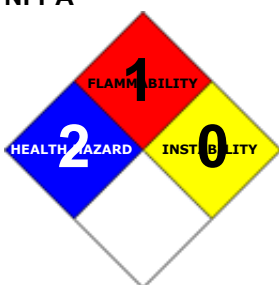
PRODUCT NAME

Arbutin

STATEMENT OF HAZARDOUS NATURE

CONSIDERED A HAZARDOUS SUBSTANCE ACCORDING TO OSHA 29 CFR 1910.1200.

NFPA



SUPPLIER

Company: Santa Cruz Biotechnology, Inc.

Address:

2145 Delaware Ave

Santa Cruz, CA 95060

Telephone: 800.457.3801 or 831.457.3800

Emergency Tel: CHEMWATCH: From within the US and
Canada: 877-715-9305

Emergency Tel: From outside the US and Canada: +800 2436
2255 (1-800-CHEMCALL) or call +613 9573 3112

PRODUCT USE

Glycoside isolated from the dried leaves of *Bergenia crassifolia* (L.) Fritsch, Saxifragaceae, from the leaves of the blueberry, cranberry, and pear trees (*Pyrus communis* L., rosaceae), from the leaves of cowberry (*Vaccinium vitis-idaea* L., Ericaceae) and bearberry (*Arctostaphylos uva-ursi* L., Ericaceae). Easily hydrolysed by dilute acids, or by emulsin yielding 1 mole D-glucose and 1 mole hydroquinone. Gallotannin inhibits enzymatic splitting of the substance and may explain why crude extracts are medicinally more effective than the pure substance. Used as a stabiliser for colour photographic images; as a diuretic and urinary tract antiseptic in therapy.

SYNONYMS

C12-H16-O7, "beta-D-glucopyranoside, 4-hydroxyphenyl-", "beta-D-glucopyranoside, 4-hydroxyphenyl-", 4-hydroxyphenyl-beta-D-glucopyranoside, 4-hydroxyphenyl-beta-D-glucopyranoside, hydroquinone-beta-D-glucopyranoside, hydroquinone-beta-D-glucopyranoside, "hydroquinone glucose", arbutoside, ursin, Uvasol, "constituent of: *Bergenia crassifolia* (L), Fritsch, Saxifragaceae/blueberry", "cranberry/*Pyrus communis* L., Rosaceae (pear tree)/*Vaccinium vitis-idaea* L., ", "Ericaceae (cowberry)/*Arctostaphylos uva-ursi* Spreng., Ericaceae (bearberry)"

Section 2 - HAZARDS IDENTIFICATION

CANADIAN WHMIS SYMBOLS



EMERGENCY OVERVIEW

RISK

Irritating to eyes.
May impair fertility.

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

■ The material has NOT been classified as "harmful by ingestion". This is because of the lack of corroborating animal or human evidence. The material may still be damaging to the health of the individual, following ingestion, especially where pre-existing organ (e.g. liver, kidney) damage is evident. Present definitions of harmful or toxic substances are generally based on doses producing mortality (death) rather than those producing morbidity (disease, ill-health). Gastrointestinal tract discomfort may produce nausea and vomiting. In an occupational setting however, unintentional ingestion is not thought to be cause for concern.

EYE

■ This material can cause eye irritation and damage in some persons.

SKIN

■ The material is not thought to produce adverse health effects or skin irritation following contact (as classified using animal models). Nevertheless, good hygiene practice requires that exposure be kept to a minimum and that suitable gloves be used in an occupational setting.

■ Open cuts, abraded or irritated skin should not be exposed to this material.

■ Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.

INHALED

■ The material is not thought to produce adverse health effects or irritation of the respiratory tract (as classified using animal models). Nevertheless, good hygiene practice requires that exposure be kept to a minimum and that suitable control measures be used in an occupational setting.

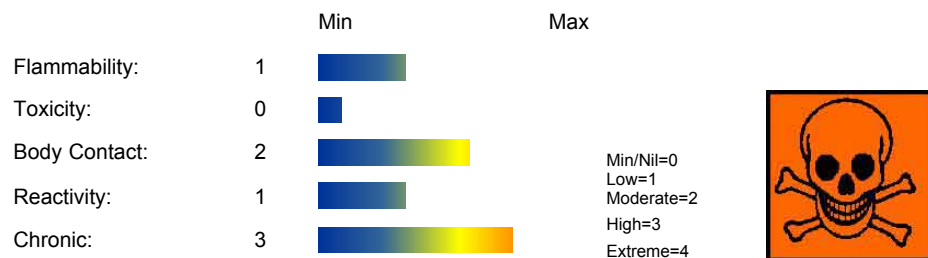
■ Persons with impaired respiratory function, airway diseases and conditions such as emphysema or chronic bronchitis, may incur further disability if excessive concentrations of particulate are inhaled.

CHRONIC HEALTH EFFECTS

■ Ample evidence exists from experimentation that reduced human fertility is directly caused by exposure to the material. Long term exposure to high dust concentrations may cause changes in lung function i.e. pneumoconiosis; caused by particles less than 0.5 micron penetrating and remaining in the lung. Prime symptom is breathlessness; lung shadows show on X-ray.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

HAZARD RATINGS



NAME	CAS RN	%
arbutin	497-76-7	>98
hydrolysis yields		
hydroquinone	123-31-9	

Section 4 - FIRST AID MEASURES

SWALLOWED

-
- Immediately give a glass of water.
- First aid is not generally required. If in doubt, contact a Poisons Information Center or a doctor.

EYE

- If this product comes in contact with the eyes:
 - Wash out immediately with fresh running water.
 - Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
 - If pain persists or recurs seek medical attention.
 - Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN

- If skin or hair contact occurs:
 - Flush skin and hair with running water (and soap if available).
 - Seek medical attention in event of irritation.

INHALED

-
- If dust is inhaled, remove from contaminated area.
- Encourage patient to blow nose to ensure clear passage of breathing.
- If irritation or discomfort persists seek medical attention.

NOTES TO PHYSICIAN

- Treat symptomatically.

Section 5 - FIRE FIGHTING MEASURES

Vapour Pressure (mmHG):	Negligible
Upper Explosive Limit (%):	Not available.
Specific Gravity (water=1):	Not available
Lower Explosive Limit (%):	Not available

EXTINGUISHING MEDIA

-
- Water spray or fog.
- Foam.
- Dry chemical powder.
- BCF (where regulations permit).
- Carbon dioxide.

FIRE FIGHTING

-
- Alert Emergency Responders and tell them location and nature of hazard.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or water course.
- Use water delivered as a fine spray to control fire and cool adjacent area.
- DO NOT approach containers suspected to be hot.
- Cool fire exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.
- Equipment should be thoroughly decontaminated after use.

GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS

-
- Combustible solid which burns but propagates flame with difficulty.
- Avoid generating dust, particularly clouds of dust in a confined or unventilated space as dusts may form an explosive mixture with air, and any source of ignition, i.e. flame or spark, will cause fire or explosion. Dust clouds generated by the fine grinding of the solid are a particular hazard; accumulations of fine dust may burn rapidly and fiercely if ignited.
- Dry dust can be charged electrostatically by turbulence, pneumatic transport, pouring, in exhaust ducts and during transport.
- Build-up of electrostatic charge may be prevented by bonding and grounding.
- Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.

Combustion products include: carbon monoxide (CO), carbon dioxide (CO₂), other pyrolysis products typical of burning organic material.

May emit poisonous fumes.

May emit corrosive fumes.

FIRE INCOMPATIBILITY

■ Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

PERSONAL PROTECTION

Glasses:

Chemical goggles.

Gloves:

Respirator:

Particulate

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS

-
- Clean up all spills immediately.
- Avoid breathing dust and contact with skin and eyes.
- Wear protective clothing, gloves, safety glasses and dust respirator.
- Use dry clean up procedures and avoid generating dust.
- Sweep up, shovel up or vacuum up (consider explosion-proof machines designed to be grounded during storage and use).
- Place spilled material in clean, dry, sealable, labeled container.

MAJOR SPILLS

- Moderate hazard.
- CAUTION: Advise personnel in area.
- Alert Emergency Responders and tell them location and nature of hazard.
- Control personal contact by wearing protective clothing.
- Prevent, by any means available, spillage from entering drains or water courses.
- Recover product wherever possible.
- IF DRY: Use dry clean up procedures and avoid generating dust. Collect residues and place in sealed plastic bags or other containers for disposal. IF WET: Vacuum/shovel up and place in labelled containers for disposal.
- ALWAYS: Wash area down with large amounts of water and prevent runoff into drains.
- If contamination of drains or waterways occurs, advise emergency services.

ACUTE EXPOSURE GUIDELINE LEVELS (AEGL) (in ppm)

AEGL 1: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could

experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

AEGL 2: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

AEGL 3: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

-
- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.
- DO NOT enter confined spaces until atmosphere has been checked.
- DO NOT allow material to contact humans, exposed food or food utensils.
- Avoid contact with incompatible materials.
- When handling, DO NOT eat, drink or smoke.
- Keep containers securely sealed when not in use.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately.
- Launder contaminated clothing before re-use.
- Use good occupational work practice.
- Observe manufacturer's storing and handling recommendations.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

Empty containers may contain residual dust which has the potential to accumulate following settling. Such dusts may explode in the presence of an appropriate ignition source.

- Do NOT cut, drill, grind or weld such containers
- In addition ensure such activity is not performed near full, partially empty or empty containers without appropriate workplace safety authorisation or permit.

RECOMMENDED STORAGE METHODS

-
- Polyethylene or polypropylene container.
- Check all containers are clearly labelled and free from leaks.

STORAGE REQUIREMENTS

-
- Store in original containers.
- Keep containers securely sealed.
- Store in a cool, dry, well-ventilated area.
- Store away from incompatible materials and foodstuff containers.
- Protect containers against physical damage and check regularly for leaks.
- Observe manufacturer's storing and handling recommendations.

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS



X: Must not be stored together

O: May be stored together with specific preventions

+: May be stored together

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

Source	Material	TWA ppm	TWA mg/m ³	STEL ppm	STEL mg/m ³	Peak ppm	Peak mg/m ³	TWA F/CC	Notes
US - Oregon Permissible Exposure Limits (Z3)	arbutin (Inert or Nuisance Dust: (d) Total dust)		10						*
US OSHA Permissible Exposure Levels (PELs) - Table Z3	arbutin (Inert or Nuisance Dust: (d) Respirable fraction)		5						
US OSHA Permissible Exposure	arbutin (Inert or Nuisance		15						

Levels (PELs) - Table Z3	Dust: (d) Total dust)		10	
US - Hawaii Air Contaminant Limits	arbutin (Particulates not otherwise regulated - Total dust)		10	
US - Hawaii Air Contaminant Limits	arbutin (Particulates not otherwise regulated - Respirable fraction)		5	
US - Oregon Permissible Exposure Limits (Z3)	arbutin (Inert or Nuisance Dust: (d) Respirable fraction)		5	*
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	arbutin (Particulates not otherwise regulated Respirable fraction)		5	
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	arbutin (Particulates not otherwise regulated (PNOR)(f)- Respirable fraction)		5	
US - Michigan Exposure Limits for Air Contaminants	arbutin (Particulates not otherwise regulated, Respirable dust)		5	
Canada - Alberta Occupational Exposure Limits	hydroquinone (Dihydroxybenzene (Hydroquinone))		2	
Canada - British Columbia Occupational Exposure Limits	hydroquinone (Hydroquinone Revised 2008)		1	S
Canada - Ontario Occupational Exposure Limits	hydroquinone (1,4-Dihydroxybenzene)		2	
US OSHA Permissible Exposure Levels (PELs) - Table Z1	hydroquinone (Hydroquinone)		2	
US ACGIH Threshold Limit Values (TLV)	hydroquinone (Hydroquinone)		1	TLV Basis: eye irritation; eye damage
US NIOSH Recommended Exposure Limits (RELs)	hydroquinone (Hydroquinone)		2	
US - Minnesota Permissible Exposure Limits (PELs)	hydroquinone (Hydroquinone)		2	
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	hydroquinone (Hydroquinone)		2	
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	hydroquinone (Hydroquinone)		2	
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	hydroquinone (Hydroquinone)		2	
US - California Permissible Exposure Limits for Chemical Contaminants	hydroquinone (Hydroquinone; 1,4-benzenediol)		2	
US - Idaho - Limits for Air Contaminants	hydroquinone (Hydroquinone)		2	
US - Hawaii Air Contaminant Limits	hydroquinone (Hydroquinone)		2	4
US - Alaska Limits for Air Contaminants	hydroquinone (Hydroquinone)		2	
US - Michigan Exposure Limits for Air Contaminants	hydroquinone (Hydroquinone)		2	
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	hydroquinone (Dihydroxybenzene, see Hydroquinone)	-	2	- 3
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	hydroquinone (Hydroquinone)	-	2	- 3
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	hydroquinone (Hydroquinone)		2	4
US - Oregon Permissible Exposure Limits (Z1)	hydroquinone (Hydroquinone)		2	
Canada - Prince Edward Island Occupational Exposure Limits	hydroquinone (Hydroquinone)		1	TLV Basis: eye irritation;

eye
damage

US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	hydroquinone (Hydroquinone)	2		
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	hydroquinone (Hydroquinone)	2		
Canada - Northwest Territories Occupational Exposure Limits (English)	hydroquinone (Dihydroxybenzene (Hydroquinone))	2	4	
Canada - Northwest Territories Occupational Exposure Limits (English)	hydroquinone (Hydroquinone)	2	4	
Canada - Nova Scotia Occupational Exposure Limits	hydroquinone (Hydroquinone)	1		TLV Basis: eye irritation; eye damage
US - Washington Permissible exposure limits of air contaminants	hydroquinone (Dihydroxybenzene (Hydroquinone))	2	4	

EMERGENCY EXPOSURE LIMITS

Material	Revised IDLH Value (mg/m3)	Revised IDLH Value (ppm)
hydroquinone	50	

MATERIAL DATA

ARBUTIN:

HYDROQUINONE:

■ The recommended TLV-TWA for hydroquinone takes into account the toxicology of hydroquinone and experience of industrial exposures to benzenediols. Exposure at or below the limit is thought to minimise the risk to workers of eye injury, dermatitis and central nervous system effects. A short-term duration exposure value has not been recommended, because no quantitative data as to the levels of hydroquinone which produce eye irritation or more serious corneal changes has been identified.

PERSONAL PROTECTION



Consult your EHS staff for recommendations

EYE

-
- Safety glasses with side shields.
- Chemical goggles.
- Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. DO NOT wear contact lenses.

HANDS/FEET

- Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:
 - frequency and duration of contact,
 - chemical resistance of glove material,
 - glove thickness and
 - dexterity

Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739).

- When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374) is recommended.
- When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374) is recommended.
- Contaminated gloves should be replaced.

Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended.

Experience indicates that the following polymers are suitable as glove materials for protection against undissolved, dry solids, where abrasive particles are not present.

- polychloroprene
- nitrile rubber
- butyl rubber
- fluorocautchouc
- polyvinyl chloride

Gloves should be examined for wear and/ or degradation constantly.

OTHER

-

- Overalls.
- P.V.C. apron.
- Barrier cream.
- Skin cleansing cream.
- Eye wash unit.
-
- Respirators may be necessary when engineering and administrative controls do not adequately prevent exposures.
- The decision to use respiratory protection should be based on professional judgment that takes into account toxicity information, exposure measurement data, and frequency and likelihood of the worker's exposure - ensure users are not subject to high thermal loads which may result in heat stress or distress due to personal protective equipment (powered, positive flow, full face apparatus may be an option).
- Published occupational exposure limits, where they exist, will assist in determining the adequacy of the selected respiratory . These may be government mandated or vendor recommended.
- Certified respirators will be useful for protecting workers from inhalation of particulates when properly selected and fit tested as part of a complete respiratory protection program.
- Use approved positive flow mask if significant quantities of dust becomes airborne.
- Try to avoid creating dust conditions.

RESPIRATOR

Protection Factor	Half-Face Respirator	Full-Face Respirator	Powered Air Respirator
10 x PEL	P1	-	PAPR-P1
	Air-line*	-	-
50 x PEL	Air-line**	P2	PAPR-P2
100 x PEL	-	P3	-
	-	Air-line*	-
100+ x PEL	-	Air-line**	PAPR-P3

* - Negative pressure demand ** - Continuous flow

Explanation of Respirator Codes:

Class 1 low to medium absorption capacity filters.

Class 2 medium absorption capacity filters.

Class 3 high absorption capacity filters.

PAPR Powered Air Purifying Respirator (positive pressure) cartridge.

Type A for use against certain organic gases and vapors.

Type AX for use against low boiling point organic compounds (less than 65°C).

Type B for use against certain inorganic gases and other acid gases and vapors.

Type E for use against sulfur dioxide and other acid gases and vapors.

Type K for use against ammonia and organic ammonia derivatives

Class P1 intended for use against mechanically generated particulates of sizes most commonly encountered in industry, e.g. asbestos, silica.

Class P2 intended for use against both mechanically and thermally generated particulates, e.g. metal fume.

Class P3 intended for use against all particulates containing highly toxic materials, e.g. beryllium.

The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required.

Use appropriate NIOSH-certified respirator based on informed professional judgement. In conditions where no reasonable estimate of exposure can be made, assume the exposure is in a concentration IDLH and use NIOSH-certified full face pressure demand SCBA with a minimum service life of 30 minutes, or a combination full facepiece pressure demand SAR with auxiliary self-contained air supply. Respirators provided only for escape from IDLH atmospheres shall be NIOSH-certified for escape from the atmosphere in which they will be used.

ENGINEERING CONTROLS

-
- Local exhaust ventilation is required where solids are handled as powders or crystals; even when particulates are relatively large, a certain proportion will be powdered by mutual friction.
- Exhaust ventilation should be designed to prevent accumulation and recirculation of particulates in the workplace.
- If in spite of local exhaust an adverse concentration of the substance in air could occur, respiratory protection should be considered. Such protection might consist of:

(a): particle dust respirators, if necessary, combined with an absorption cartridge;

(b): filter respirators with absorption cartridge or canister of the right type;

(c): fresh-air hoods or masks

- Build-up of electrostatic charge on the dust particle, may be prevented by bonding and grounding.

Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.

Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to efficiently remove the contaminant.

Type of Contaminant:	Air Speed:
direct spray, spray painting in shallow booths, drum filling, conveyer loading, crusher dusts, gas discharge (active generation into zone of rapid air motion)	1-2.5 m/s (200-500 f/min.)
grinding, abrasive blasting, tumbling, high speed wheel generated dusts (released at high initial velocity into zone of very high rapid air motion).	2.5-10 m/s (500-2000 f/min.)

Within each range the appropriate value depends on:

Lower end of the range	Upper end of the range
1: Room air currents minimal or favorable to capture	1: Disturbing room air currents
2: Contaminants of low toxicity or of nuisance value only	2: Contaminants of high toxicity
3: Intermittent, low production.	3: High production, heavy use
4: Large hood or large air mass in motion	4: Small hood-local control only

Simple theory shows that air velocity falls rapidly with distance away from the opening of a simple extraction pipe. Velocity generally decreases with the square of distance from the extraction point (in simple cases). Therefore the air speed at the

extraction point should be adjusted, accordingly, after reference to distance from the contaminating source. The air velocity at the extraction fan, for example, should be a minimum of 4-10 m/s (800-2000 f/min) for extraction of crusher dusts generated 2 meters distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL PROPERTIES

Solid.

Mixes with water.

State	Divided solid	Molecular Weight	272.25
Melting Range (°F)	390.2.5- 392	Viscosity	Not Applicable
Boiling Range (°F)	Not available	Solubility in water (g/L)	Miscible
Flash Point (°F)	Not Available	pH (1% solution)	Not available
Decomposition Temp (°F)	Not available	pH (as supplied)	Not applicable
Autoignition Temp (°F)	Not available	Vapour Pressure (mmHG)	Negligible
Upper Explosive Limit (%)	Not available.	Specific Gravity (water=1)	Not available
Lower Explosive Limit (%)	Not available	Relative Vapor Density (air=1)	Not applicable
Volatile Component (%vol)	Negligible	Evaporation Rate	Not applicable

APPEARANCE

Light yellow strongly hygroscopic crystalline powder; mixes with water. Occurs initially as an unstable form which appears to be converted to the stable form by melting. Forms complexes with hexamethylenetetramine which is used to separate it from methylarbutin with which it commonly occurs.

Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY

-
- Presence of incompatible materials.
- Product is considered stable.
- Hazardous polymerization will not occur.

STORAGE INCOMPATIBILITY

- Avoid reaction with oxidizing agents.

For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

arbutin

TOXICITY AND IRRITATION

- No significant acute toxicological data identified in literature search.
- Reproductive effector in rats.

CARCINOGEN

Hydroquinone	International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs	Group	3
Hydroquinone	US ACGIH Threshold Limit Values (TLV) - Carcinogens	Carcinogen Category	A3
HYDROQUINONE	US Environmental Defense Scorecard Suspected Carcinogens	Reference(s)	CPDB

Section 12 - ECOLOGICAL INFORMATION

Refer to data for ingredients, which follows:

ARBUTIN:

- DO NOT discharge into sewer or waterways.

HYDROQUINONE:

- Very toxic to aquatic organisms.
- Do NOT allow product to come in contact with surface waters or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment wash-waters.

Wastes resulting from use of the product must be disposed of on site or at approved waste sites.

■ Hydroquinone is a naturally occurring substance found in several foods (e.g., wheat products, fruits) and beverages (e.g., brewed coffee, some teas, beer, red wine). Hydroquinone is formed as a byproduct of metabolism in several bacteria and marine species. It is estimated that approximately 5 x 10⁴ kg of hydroquinone is generated per year during cigarette smoking. Hydroquinone is considered to be readily biodegradable and photodegradable.

The aquatic toxicity of hydroquinone to fresh water fish, Daphnia, and algae was between 0.050-0.335 mg/l; the predicted chronic values for these fresh water taxa were calculated to be < 0.100.

The 84 hr LC50 for the salt water shrimp, *C. septemspinosa*, was selected as the only salt water species for analysis. Based

on these data and on the predicted aquatic toxicity values, the USEPA identified concern concentrations or predicted no effect concentrations (PNECs) at 1.0 ug/l for fresh water species and 8.0 ug/l for salt water species. Alternatively, a PNEC can be derived using the assessment factors recommended in the SIDS Manual. As only acute effect data for fish and daphnids are available, an assessment factor of 100-1000 would be appropriate. Due to the large available database, a factor of 100 would be acceptable. Applied to the lowest experimental value of 0.044 mg/l (fathead minnow), a PNEC of 0.44 ug/l can be derived.

Physicochemical parameters:

Water solubility: 73 g/l (25 C)

log Kow: 0.50-0.61

Vapour pressure: 2.34×10^{-3} Pa (25 C)

BOD5: 1.0 g O2/g

COD5: 1.83 gO2/g

BOD5/COD5: 0.55

Degradation: Hydroquinone degrades by both biotic and abiotic mechanisms. Biodegradation is affected by pH, temperature, aerobic/anaerobic conditions, and acclimation of the microorganisms involved. Under aerobic conditions 74% of the radioactivity from the incubation of activated sludge and 14C- hydroquinone was recovered as carbon dioxide in 5-10 days. Small amounts of 1,4-benzoquinone, 2-hydroxy-1,4-benzoquinone, and beta-ketoadipic acid are formed as metabolites of hydroquinone. A maximum concentration of 0.11% (1.05 mg/L) 1,4-benzoquinone was detected at 2 hr during incubation of 950 mg/L hydroquinone by yeast cultures. At later time points 1,4-benzoquinone levels were lower and benzoquinone was not detected in the effluent from the activated sludge unit. In another study 82% of hydroquinone was converted to CO2 in a 28-day Sturm test ; 97% of the dissolved organic carbon was removed in 28 days. Thus hydroquinone is primarily converted to CO2 or mineralised during aerobic degradation.

Under anaerobic conditions, hydroquinone is metabolized through phenol, instead of 1,4-benzoquinone, prior to mineralisation.

As the organisms which biodegrade hydroquinone are widely distributed in the environment in sludges, soils, sediments, and composts, hydroquinone is expected to readily biodegrade in soils and water.

Photolysis: Due to its intrinsic properties, hydroquinone is relatively rapidly photodegraded; phototransformations may occur from direct excitation or from induced or photocatalytic reactions.

Bioaccumulation: With measured partition coefficients log Pow = 0.50-0.61, hydroquinone is not considered to undergo bioaccumulation. Bioaccumulation factors of 40 have been determined for algae and fish .

Distribution between environmental compartments and occurrence in the environment: The environmental transport of hydroquinone can be partially predicted based on its physicochemical properties. With a melting point of 169 C, a vapor pressure of 2.34×10^{-3} Pa at 25 C and a relative vapor density of 3.81 (air=1), it is not expected to transport into the atmosphere. A calculation of fugacity using Mackay's model I indicates that hydroquinone will be distributed to the water compartment (99.6%) when released into the environment.

Air: Hydroquinone is essentially non-volatile in its solid form. Its solubility in water (which increases with temperature), low vapor pressure, and high relative vapor density, and low Henry's law constant (3.84×10^{-11} atm-m³/mole) indicate that hydroquinone will not evaporate from water into the atmosphere. The half-life of hydroquinone in the air is 14 hr (U.S.E.P.A., 1990).

In its dry solid form, hydroquinone is stable and darkens only slowly if exposed to the air. In the presence of moisture and ambient levels of oxygen, hydroquinone can undergo oxidation to 1,4-benzoquinone which is more likely to volatilise because of its higher vapor pressure. As this potential reaction is well recognised, manufacturing plants do not let hydroquinone powders stand in open environments prior to bagging or drumming operations. For the same reason, hydroquinone-containing products such as photographic developers contain stabilizers such as sodium sulfite to prevent or retard oxidation.

Water: Due to its physical chemical properties, hydroquinone can be expected to partition to the water compartment. As its melting point is 169 C, vapor pressure is low, Henry's law constant is relatively low, and its solubility in water increases with temperature, hydroquinone is not likely to be volatilised to the air compartment from water. In waste water, hydroquinone would be expected to be readily biodegradable. If hydroquinone were present in an open body of water, it would be expected to both biodegrade and photodegrade. Hydroquinone half-life in surface water is 20 hr. While 1,4-benzoquinone would be expected to be one of the degradation products of hydroquinone, its ready degradation would not be expected to impact the toxicity of a hydroquinone release.

Soil: Hydroquinone released to the soil would be expected to mineralize as organisms which can degrade hydroquinone are commonly found in soils and compost. Half-life in soil is 2-14 days and depends on photo-oxidation and bacterial degradation. Hydroquinone present in soil could be expected to partition to water in the soil and be mobile. Half-life values in ground water are 4-14 days (aerobic conditions) and up to a month (anaerobic conditions). However, hydroquinone and its immediate degradation product, 1,4-benzoquinone may also be absorbed to the soil. Since hydroquinone and 1,4-benzoquinone are electron donor and electron acceptor molecules respectively, they could form charge transfer complexes with soil particles. Hydroquinone and its biodegradation products may contribute to the formation of humic acids which are polymerisation products of polyphenols commonly formed during the biodegradation of plants. Much of the naturally occurring hydroquinone in plants may be reincorporated into soils in this manner.

Effects on the Environment

Aquatic effects

Fish LC50 (96 h): Pimephales promelas 0.044 mg/l

Daphnia magna LC50 (48 h): 0.096 mg/l (interpolated results from several researchers)

Salt water shrimp (Crangon septemspinosa) LC50 (84 h):0.833 mg/l

Algal EC50 (3 d): S. capricornutum 0.355 mg/l

Based on these numbers hydroquinone has a high acute toxicity for aquatic organisms.

■ The material is classified as an ecotoxin* because the Fish LC50 (96 hours) is less than or equal to 0.1 mg/l

* Classification of Substances as Ecotoxic (Dangerous to the Environment)

Appendix 8, Table 1

Compiler's Guide for the Preparation of International Chemical Safety Cards: 1993 Commission of the European Communities.

Koc: 9-50

ThOD: 1.89

BCF: 40-65

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
arbutin	LOW		LOW	HIGH
hydroquinone	LOW		LOW	MED

Section 13 - DISPOSAL CONSIDERATIONS

Disposal Instructions

All waste must be handled in accordance with local, state and federal regulations.

! Puncture containers to prevent re-use and bury at an authorized landfill.

Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws

operating in their area. In some areas, certain wastes must be tracked.
A Hierarchy of Controls seems to be common - the user should investigate:

- Reduction
- Reuse
- Recycling
- Disposal (if all else fails)

This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate.

DO NOT allow wash water from cleaning equipment to enter drains. Collect all wash water for treatment before disposal.

- Recycle wherever possible.
- Consult manufacturer for recycling options or consult Waste Management Authority for disposal if no suitable treatment or disposal facility can be identified.
- Dispose of by: Burial in a licensed land-fill or Incineration in a licensed apparatus (after admixture with suitable combustible material)
- Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

Section 14 - TRANSPORTATION INFORMATION

NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS: DOT, IATA, IMDG

Section 15 - REGULATORY INFORMATION

arbutin (CAS: 497-76-7) is found on the following regulatory lists;

"US - Hawaii Air Contaminant Limits", "US - Oregon Permissible Exposure Limits (Z3)", "US OSHA Permissible Exposure Levels (PELs) - Table Z3"

Regulations for ingredients

hydroquinone (CAS: 123-31-9) is found on the following regulatory lists;

"Canada - Alberta Occupational Exposure Limits", "Canada - British Columbia Occupational Exposure Limits", "Canada - Northwest Territories Occupational Exposure Limits (English)", "Canada - Nova Scotia Occupational Exposure Limits", "Canada - Ontario Occupational Exposure Limits", "Canada - Prince Edward Island Occupational Exposure Limits", "Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)", "Canada - Saskatchewan Industrial Hazardous Substances", "Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits", "Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances", "Canada Domestic Substances List (DSL)", "Canada Ingredient Disclosure List (SOR/88-64)", "Canada National Pollutant Release Inventory (NPRI)", "Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (English)", "Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (French)", "International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs", "OECD Representative List of High Production Volume (HPV) Chemicals", "US - Alaska Limits for Air Contaminants", "US - California Air Toxics ""Hot Spots"" List (Assembly Bill 2588) Substances for which emissions must be quantified", "US - California Occupational Safety and Health Regulations (CAL/OSHA) - Hazardous Substances List", "US - California Permissible Exposure Limits for Chemical Contaminants", "US - California Toxic Air Contaminant List Category IV", "US - Connecticut Hazardous Air Pollutants", "US - Hawaii Air Contaminant Limits", "US - Idaho - Limits for Air Contaminants", "US - Massachusetts Oil & Hazardous Material List", "US - Michigan Exposure Limits for Air Contaminants", "US - Minnesota Hazardous Substance List", "US - Minnesota Permissible Exposure Limits (PELs)", "US - New Jersey Right to Know Hazardous Substances", "US - Oregon Permissible Exposure Limits (Z1)", "US - Pennsylvania - Hazardous Substance List", "US - Rhode Island Hazardous Substance List", "US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants", "US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants", "US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants", "US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants", "US ACGIH Threshold Limit Values (TLV)", "US ACGIH Threshold Limit Values (TLV) - Carcinogens", "US CAA (Clean Air Act) - HON Rule - Organic HAPs (Hazardous Air Pollutants)", "US Clean Air Act - Hazardous Air Pollutants", "US Cosmetic Ingredient Review (CIR) Cosmetic ingredients found safe, with qualifications", "US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides", "US DOE Temporary Emergency Exposure Limits (TEELs)", "US EPA High Production Volume Program Chemical List", "US EPA Master Testing List - Index I Chemicals Listed", "US EPCRA Section 313 Chemical List", "US FDA Indirect Food Additives: Adhesives and Components of Coatings - Substances for Use Only as Components of Adhesives - Adhesives", "US List of Lists - Consolidated List of Chemicals Subject to the Emergency Planning and Community Right-to-Know Act (EPCRA) and Section 112(r) of the Clean Air Act", "US NIOSH Recommended Exposure Limits (RELs)", "US OSHA Permissible Exposure Levels (PELs) - Table Z1", "US SARA Section 302 Extremely Hazardous Substances", "US Toxic Substances Control Act (TSCA) - Inventory", "US TSCA Section 4/12 (b) - Sunset Date/Status", "US TSCA Section 8 (d) - Health and Safety Data Reporting"

Section 16 - OTHER INFORMATION

Denmark Advisory list for selfclassification of dangerous substances

Substance CAS Suggested codes hydroquinone 123- 31- 9 Xn Mut3; R68

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■ Classification of the mixture and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

A list of reference resources used to assist the committee may be found at:

www.chemwatch.net/references.

- The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

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