524-40

Monsanto

SANTOPHEN® 1

GERMICIDE

ACTIVE INGREDIENT:

orthobenzylparachlorophenol 100%

WARNING!

CAUSES SKIN IRRITATION.

Avoid contact with skin, eyes or clothing.
Wear rubber gloves.
In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes; for eyes, get medical attention.

Melting point: approximately 49°C.

FOR MANUFACTURING USE ONLY.

Keep out of reach of children.

LOT NO. _____ PACKER

NET LEGAL	300 LBS.	136.08 KILOS	TARE	50 LBS.	22.68 KILOS
			GROSS	350 LBS.	158.76 KILOS

MONSANTO COMPANY, ST. LOUIS, MISSOURI, U.S.A. 810.88-010.07/53 (USDA Reg. No. 524-40)

Santobrite S

TECHNICAL SODIUM PENTACHLOROPHENATE BY **Monsanto**

ACCEPTED

NOV 14 1972

UNDER THE FEDERAL INSECTICIDE FUNGICIDE AND RODENTICIDE ACT FOR ECONOMIC POISON REGISTERED UNDER NO. 524-55 SUBJECT TO ATTACHED COMMENTS.

For manufacturing use only.

Keep out of reach of children.

WARNING!

HARMFUL IF INHALED OR SWALLOWED.

CAUSES SKIN IRRITATION.

INJURIOUS TO EYES.

ABSORBED THROUGH SKIN FROM SOLUTIONS.

Do not breathe dust or spray mist.

Do not get in eyes, on skin, or on clothing. Wear rubber gloves and goggles.

Wash thoroughly after handling.

In case of contact with dry material or its solution, wash skin at once with plenty of soap and warm water; for eyes, flush with plenty of water for at least 15 minutes and get medical attention. Remove and wash clothing before reuse.

If swallowed, induce vomiting. Call a physician.

NOTE TO PHYSICIAN: This product is a metabolic stimulant. causes hyperthermia. Treat symptomatically.

ACTIVE INGREDIENTS:	90%
Sodium Pentachlorophenate	79%
Sodium Salts of other chlorophenols	11%
INERT INGREDIENTS:	10%

Do not reuse container. Destroy when empty.

DIRECTIONS FOR USE

PAPER MILL FUNGAL SLIME CONTROL: Add 0.4 to 1.0 pound of this product to the beaters per ton of paper produced. Refer to our technical bulletin.

FOR CONTROL OF ALGAL AND FUNGAL SLIME IN INDUSTRIAL RECIRCULATING WATER COOLING TOWERS: Badly fouled systems must be cleaned before treatment is begun. The product should be applied when the system is in jeopardy of becoming affected or after cleaning systems whose efficiency is already impaired.

INITIAL DOSE: Apply ½ to 1 pound of this product per 1500 gallons of water in the system. Repeat until control is achieved.

SUBSEQUENT DOSE: When microbial control is evident, add ¼ to 1 pound of this product per 1500 gallons of water in the system every week or as needed to maintain control. Apply the product at a point in the system where it will be uniformly mixed.

FOR SAP STAIN AND MOLD CONTROL

When dipping, add sufficient alkali to maintain pH in excess of 7.5 at all times.

LUMBER: Dissolve 7 lbs. of this product in 100 gallons water. Dip or spray the fresh green lumber in this solution to thoroughly wet the boards. Avoid excessively alkaline solutions since they may cause discoloration of beech and other hardwoods.

LOGS: Spray ends and debarked areas of fresh logs with a solution of 14 lbs. of this product in 100 gallons water.

POLES, TIES AND TIMBERS: Dip or spray entire surface with a solution of 14 lbs. of this product in 100 gallons water. Spray again when seasoning checks develop.

LATH: Dip bundles of lath in a solution of 14 lbs. of this product in 100 gallons water. Pile in open layers using dry 2 x 4's for stickers and raise the piles well off the ground.

Wear protective clothing and rubber gloves when handling freshly treated wood.

This product is toxic to fish and wildlife. Keep out of lakes, ponds and streams. Treated effluent should not be discharged where it will drain into lakes, streams, ponds or public water. Do not contaminate water by cleaning of equipment or disposal of wastes.

LOT NO. _____ PACKER _____ NET/LEGAL _____ LB. _____ KG.

MONSANTO COMPANY, ST. LOUIS, MISSOURI 63166, U.S.A.

(EPA Reg. No. 524-55)

SANTOBRITE®

sodium pentachlorophenate, technical

TECHNICAL BULLETIN No. Ø/PS-6
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Monsanto Company/Organic Chemical Division/800 N. Lindbergh Blvd./St. Louis, Mo. 63166

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Introduction

Many industrial products of organic origin are subject to microbiological attack at some stage in their preparation or use. Typical of these are wood, cellulosic materials, textiles, starches, adhesives, protein materials, leather, oils, paints, latex and rubber.

Santobrite,* Monsanto's sodium pentachlorophenate, technical, has a combination of properties that makes it particularly suitable for application in these fields and it has been used for many years with a demonstrated record of effectiveness and economy.

Other important fields of application for Santobrite are in termite control in wood and insulating board, and the control of slime.

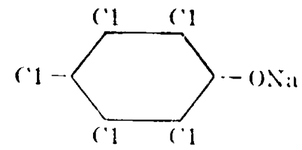
Santobrite is available in several forms and is easy to use and when properly handled creates no health hazards for persons working with it.

As a chlorophenolic material, Santobrite possesses an odor and taste that are typical of that class of compounds. It should not be used where odor and taste are matters of concern, particularly where food and food products are involved.

This bulletin includes physical, chemical and biological properties of Santobrite, together with information on handling and the preparation of solutions. Specific information relating to particular fields of application of Santobrite is available on request.

*Monsanto T M Reg U S. Pat. Off.

Physical and Chemical Properties of Santobrite

Trade Name	Santobrite (Reg. U. S. Pat. Off.)
Chemical Name	Sodium pentachlorophenate, technical
Formula	C_6Cl_5ONa 
Molecular Weight	288.34
Appearance	Light tan material available in several forms
Assay	90% Minimum Calculated as sodium pentachlorophenate determined by titration of hydroxyl groups.
Free Alkali	0.5%, 1.5%, Calculated as NaOH
Odor	Characteristically chlorophenolic
True Density	2.00 grams per cubic centimeter
Stability	Stable under ordinary atmospheric conditions when stored in a dry place.

SOLUBILITY

Solvent	*% Santobrite (On Weight of Solution)*
Water at 4.0°C. (39.2° F.)	15.0%
Water at 9.5°C. (49.0° F.)	20.0%

Solutions stronger than 20% tend to form crystalline precipitates which do not redissolve readily. Therefore, water base formulations should be kept to 20% Santobrite or less to insure stability unless co-solvents (e.g., methanol) are used. Information on co-solvent techniques is available.

95% Ethyl Alcohol — 25° C.	32-33%
Acetone — 25° C.	32-33%
Benzene — 25° C.	0.1%

pH

1% solution of pure sodium pentachlorophenate — about 9.0

1% solution of Santobrite — about 10.3

OTHER CHARACTERISTICS

1. Converted to the insoluble phenol form at pH below 6.8.
2. Does not undergo decomposition when heated for extended periods of time at temperatures up to 300° C.
3. Its chlorine does not split off readily.
4. Relatively inert; does not react readily with organic compounds.
5. Decomposed slowly by ultraviolet light.
6. Forms insoluble chlorophenates when added to solutions of most metal salts.
7. Can be decomposed by most but not all strong oxidizing agents. With nitric acid, chloroanil (tetrachloro-*para*-quinone) and tetrachloro-*ortho*-quinone are formed and this reaction is the basis of a method for the colorimetric determination of sodium pentachlorophenate. (See Monsanto Technical Bulletin SC-8: "Analytical Methods for Pentachlorophenal and Its Salts".)
8. Dry Santobrite powder is noncorrosive to iron, steel, copper or brass.

Biological Properties

TOXICITY TO FUNGI

Santobrite is effective against a broad range of fungi; some of which degrade wood, textiles, glues, cold water paints, etc.

TOXICITY OF SANTOBRITE TO FUNGI AS DETERMINED BY STANDARD MALT-AGAR-PETRI-DISH TEST

Organism	Type	Santobrite (I)	Santobrite (K)
Ceratostomella pilifera	Wood Stainer	0.008	0.008
Hormonema dematioides	"	0.006	0.008
Hormodendrum cladosporioides	"	0.006	0.040
Hormiscium gelatinosum	"	0.020	0.020
Alternaria tenius	"	0.020	0.020
Polystictus versicolor	Wood Rotter	0.008	0.010
Polystictus hirsutus	"	0.008	0.010
Fomes roseus	"	0.006	0.006
Fomes annosus (F.P.L. 517)	"	0.006	0.008
Lentinus lepideus	"	0.002	0.008
Poria incassata	"	0.002	0.002
Trametes serialis	"	0.001	0.002
Lenzites saepiaria	"	0.004	0.004
Lenzites trabea	"	0.002	0.006
Chaetomium globosum	Textile Rotter	0.006	0.010
Tricophyton rosaceum	Animal Pathogen	0.006	0.010
Tricophyton interdigitale	"	0.006	0.006
Epidermophyton inguinale	"	0.004	0.004
Fusarium vasinfectum	Plant Pathogen	0.010	0.030
Aspergillus niger	General Mold	0.008	0.1+
Pencillium chrysogenum	"	0.006	0.008
Penicillium digitatum	"	0.008	0.008
Alternaria radicini	"	0.006	0.006
Rhizopus nigricans	"	0.004	0.004

(I) — Inhibiting concentration (% by weight)
(K) — Killing concentration (% by weight)

COMPARATIVE FUNGICIDAL VALUE

COMPARATIVE FUNGICIDAL VALUE OF SODIUM PENTACHLOROPHENATE AND OTHER CHEMICALS (Malt-Agar Petri Dish Method)

Chemical	Killing Concentration (% by weight) for *Fomes annosus*
Arsenic trioxide	0.025
Borax	0.13
Boric acid	0.25
Copper sulfate	0.04-0.05
Mercuric chloride	0.005-0.006
Sodium arsenite	0.044
Sodium chromate	0.031
Sodium dichromate	0.03
Sodium fluoride	0.25
Zinc chloride	0.35
Zinc metaarsenite	0.10
Beechwood creosote	0.12-0.21
Wood tar creosote	0.025-0.05
Beta naphthol	0.15
2,6-Dinitrophenol	0.023
2,4,5-Trichlorophenol	0.001-0.002
Sodium pentachlorophenate	0.002

[1] Hunt, G. M. and Garratt, G. A. Wood Preservation (1938 pp. 94-95. McGraw Hill Pub. Co., Inc. N.Y. N.Y.

TOXICITY TO ALGAE

Generally toxic to a wide range of algae which develop in industrial recirculating water cooling tower systems. The pattern of use for slime control must be in the form of slug doses repeated weekly, or as needed. Experimental data indicate the following ranges may be suitable under continuous addition:

Organisms	Part-Per Million Santobrite To Kill (Temp. 25-35° C., pH about 7.0)
Diatoms (siliceous algae)	5 to 10
Chlorophyceae (green algae)	5 to 15
Cyanophyceae (blue-green algae)	10 to 20

TOXICITY TO PROTOZOA

Most forms are killed by concentrations of 3 to 5 parts per million.

TOXICITY TO YEASTS

"Wild" yeasts cause serious damage in fermentation industries and on painted surfaces. Most yeasts are controlled by Santobrite in concentrations of 75 to 100 parts per million.

Instructions for Handling Santobrite

Care should be exercised in handling Santobrite. Like other products which are toxic to micro-organisms and insects, it IS harmful to human beings when not properly handled. However, experimental toxicological work on test animals and experience in the manufacture and use of Santobrite over a period of many years, has shown that Santobrite may be handled when the following precautions are followed.

Santobrite must not be taken internally. If it is swallowed, either as the solid or in solution, vomiting should be induced by administe[illegible]stard and water, or other emetic, and a p[illegible] should be called.

Santobrite dust is irritating to the mucous membranes of the eyes, nose and th[illegible]oat and may provoke sneezing and coughing if inhaled. Both the solid material and water solutions (1% or stronger) are irritating to the skin

if contact is prolonged or if there are repeated short-period contacts.

Prolonged contact should be avoided.

The safety of persons handling Santobrite will be assured by following such precautionary measures as are necessary in particular instances. These measures will vary from the simple washing of the hands with soap and water at the completion of handling operations to the wearing of protective garments and equipment.

Protective garments and equipment may include any combination of rubber gloves, rubber aprons, and rubber shoes for general protection of the body. Goggles and respirators will provide protection for the mucous membranes from splashing or irritation from dust.

approved

If ordinary clothing is used during the application of Santobrite solutions, such clothing must be changed promptly if it becomes wetted with the solutions. This is to avoid contact of the solutions with the skin. If the skin has been wetted also, it should be cleansed with soap and water at the time the clothes are changed.

Washing with soap and water should be routine practice before eating, drinking or smoking at the close of the working period. It may be advisable at other times, under particular conditions, and should always be practiced in cases of accidental contact.

For detailed handling precautions, see Monsanto Technical Bulletin O PS-3 "Handling Precautions for Penta and Santobrite."

TOXICITY TO FISH

The toxicity to fish is of interest when through their use pentachlorophenol or sodium pentachlorophenate can in some direct or indirect way get into fish-bearing streams or lakes. Dr. C. J. Goodnight (University of Illinois) conducted extensive research studies to evaluate the possible hazard to fish life arising from such pollution. His work was published*. Following are quotations from the summary.

"Pentachlorophenol and sodium pentachlorophenate are fatal to the more sensitive species of fish in concentrations above 0.2 p.p.m. although hardier species will survive at 0.4 or 0.6 p.p.m. In lethal concentrations they increased the metabolism of fish as evidenced by increased respiratory movements; bleeding results from capillary rupture. Silver-mouthed minnows are the most sensitive of the fish used in the experiments.

"The toxicity of pentachlorophenol and sodium pentachlorophenate to fish is increased by lowering the pH of the water. Within reasonable limits the size of the fish, the temperature of the water, and its character do not greatly affect the toxicity of the compounds. The number of fish in a solution of given volume does not affect their survival time. Above 10 p.p.m. fish can detect the presence of sodium pentachlorophenate but not below 5.0 p.p.m.

"Eggs of lake trout are very resistant to these compounds. Lake trout are most sensitive to pentachlorophenol in the yolk sac stage immediately after hatching.

"Invertebrates such as are used by fish as food are relatively insensitive to pentachlorophenol and sodium pentachlorophenate. The most sensitive invertebrates will live at concentrations at which fish will survive."

*Goodnight, C. J. Toxicity of Sodium Pentachlorophenate and Pentachlorophenol to Fish. Ind. Eng. Chem. 31, 807 (1939).

Preparation of Solutions

RECOMMENDED STRENGTH OF SOLUTION

Santobrite solutions should be made with clean, fresh water. A solution containing one pound of Santobrite per gallon of solution will be found convenient for most applications, but stronger or weaker solutions may be used if desired. A half-pint of the suggested strength (one pound per gallon) contains one ounce of Santobrite.

The maximum strength of solution which can be prepared at a temperature of 77° F. (25° C.) contains about 2¼ pounds per gallon.

DISSOLVING SANTOBRITE FINES OR PELLETS

If stock solutions are prepared, the necessary amount of Santobrite may be transferred directly from shipping containers to the dissolving water. Each of these forms will dissolve readily. The solution should be stirred when dissolving is complete in order to insure uniformity.

If a continuous dissolving procedure is employed, due consideration should be given to the rate of solution or proportioning — that is the amount of Santobrite dissolved and the rate or quantity of water flow. A suitable method for this is to place a convenient and measured amount of Santobrite in a muslin bag and submerge the bag in the dissolving water.

DISSOLVING BRIQUETTES

Santobrite briquettes are made from the powder and have the same toxic value per unit of weight as either the powder or pellet forms. However, because of their hardness, higher density and freedom from dust, the briquettes may be found more convenient for certain uses. This is often true where only small amounts of Santobrite are required.

STOCK SOLUTION

Because of their hardness and toughness, the briquettes dissolve slowly in cold water, even with agitation. The practical preparation of a stock solution requires the use of hot water (140°-160° F.) and agitation. Concentrations should be limited to no more than 20% unless co-solvents such as methanol are used. Information on using co-solvents to make stronger solutions is available.

If a mechanical agitator of the propeller or revolving paddle type is available, charge the required amount of hot water into the dissolving tank, start the agitator and then charge the necessary quantity of briquettes. The time for solution will depend upon the temperature of the water, the quantity of briquettes and the type of agitation. For solutions of the recommended concentration, the time probably will not exceed a half-hour.

Agitation may also be accomplished by circulating the dissolving water, if there are facilities for that, or by hand stirring with a suitable paddle.

Where live steam is available, another good method of dissolving Santobrite briquettes is to place them in cold water and heat by admitting steam at the bottom of the dissolving tank. The agitation provided by the steam is usually sufficient to effect solution by the time the temperature of the water has been raised to 140°-160° F.

DIRECT FEEDING WITHOUT PREPARING STOCK SOLUTION

The physical form and characteristics of Santobrite briquettes make them especially adaptable to continuous, direct feeding without the preparation of solutions.

To do this, suspend the briquettes at some point in the system where the flow of water is sufficient to dissolve them at the desired rate. This may frequently be accomplished by suspending the briquettes in a suitable wire basket under a [illegible] water from a shower spray.

Shipping Information

Shipping classification (in U.S.A.)

- Sodium Pentachlorophenate.

Shipping Regulations -- None

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