

GIVAUDAN®

GIVAUDAN CORPORATION • 125 DELAWANNA AVENUE, CLIFTON, N. J. 07014

G-4-40® TECHNICAL

Aqueous Solution of Sodium
Salt of Dichlorophene Technical

Active Ingredient:

Sodium Salt of 2,2'-methylenebis (4-chlorophenol) 39.0%

Inert Ingredients: 61.0%

G-4-40® Technical is a Fungicide/Bactericide to be used as directed in Givaudan Corporation's Technical Bulletin D-1a.

WARNING: Keep out of reach of children.

May cause eye damage. Do not get in eyes. Avoid skin contact. In case of eye contact, flush immediately with plenty of water, and obtain medical attention. Harmful if swallowed. Avoid contamination of food. Rinse empty container thoroughly with water and discard it.

Our recommendations for use of this product are based on tests believed to be reliable. The use of this product, being beyond the control of the manufacturer, no guarantee, expressed or implied, is made as to the effects of such or the results to be obtained if not used in accordance with directions and established safe practice. The buyer must assume all responsibility, including injury or damage, resulting from its misuse as such, or in combination with other materials.

EPA REG. NO. 824-1

Net: Lbs. Gal. Lot No.

FOR MANUFACTURING USE ONLY

PRINTED IN USA

GIVAUDAN

chemical
division

TECHNICAL BULLETIN D-1A

G-4® Technical

(Brand of Dichlorophene Technical)

As a Fungicide and Bactericide

ACCEPTED

Feb 9, 1973

824-1

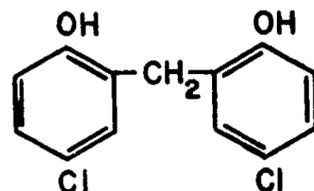
I. Introduction

G-4® is a potent fungicide and bactericide which is used to preserve cotton and woolen textiles and other materials. Mold, mildew, rot, mustiness and some types of rancidity are common expressions for the various types of deterioration caused by fungi and bacteria. G-4 is particularly effective against such deterioration.

II. Chemical and Physical Properties

Name: 2,2'-dihydroxy-5,5'-dichlorodiphenylmethane or 2,2'-methylenebis (4-chlorophenol) or bis (5-chloro-2-hydroxy phenyl) methane.

Structure:



Melting point: 164° C. minimum
Appearance: Light tan, free-flowing powder
Odor: Weak phenolic
Vapor pressure: 10⁻⁷ mm. of mercury at 100° C.; about 10⁻¹⁰ mm. at 25° C. (extrapolated value)
Solubility: Water 0.003 (grams in 100 ml. Ethyl alcohol 53 of solvent at 25° C.) Isopropyl alcohol 54 n-Butyl alcohol 43

t-Butyl alcohol 60
Propylene glycol 45
Acetone 80
Methyl ethyl ketone 75
Benzene 1.6
Toluene 1.7
Xylene 1.5
Stoddard solvent 0.2
Mineral Spirits 0.1
Soluble, with heat, in fatty acids and vegetable oils.

To obtain completely clear solutions of the technical grade of G-4, it may be necessary to filter the solutions.

III. Toxicity

Using the rabbit skin irritation technique, a petroleum jelly containing 5% of G-4 was applied twice daily for 10 days. This high concentration was selected to increase the severity of the test and the margin of safety for the interpretation of the results. It was concluded from this work that G-4 was not a primary irritant.

Patch tests were also conducted on 194 humans using G-4 at a concentration of 4% in a petrolatum base ointment. The patches were applied to the inside of the forearm and were removed after 48 hours.

Out of the 194 persons tested, 191 gave negative reactions and 3 were positive.

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The acute oral toxicity in animals has been determined to be as follows:

LD₅₀ - Guinea Pigs 1.25 gms/Kg
LD₅₀ - Dogs 2.0 gms/Kg

In chronic toxicity studies on rats, 0.2% of G-4 was added to the food for a period of ninety days; this dosage corresponds to a daily intake of approximately 400 mg/Kg of body weight. The animals were autopsied and histopathological studies were made on various tissues. There was no evidence of toxicity after 90 days. At a concentration of 0.5% daily in the diet, there was evidence of kidney changes at the end of ninety days.

IV. Biological Activity

G-4 exhibits both fungicidal and bactericidal properties which is an important advantage since both fungi and bacteria may be contributing factors to deterioration. The effectiveness of G-4 has been well-established by the Armed Forces who consume large quantities for the protection of their equipment.

Fungicidal Properties:

The literature on the fungicidal properties of G-4 is so voluminous that only a few examples can be cited here to illustrate its activity.

Various laboratories have tested G-4 against fungi in nutrient agar medium. In these tests, the center of the agar plate was inoculated with a drop of a spore suspension of the test organism and periodic measurements of the size of this colony were made for several days. The ratio of these measurements to those of a control plate which did not contain G-4 was recorded as percentage inhibition. (See Table 1—page 3).

Using *Trichophyton interdigitale* in a standard agar plate method, a zone of 6 mm. was obtained with filter paper impregnated with a 2% solution of G-4 in alcohol; at a solution strength of 0.2% only a trace of a zone was noted.

The results of laboratory tests on cotton duck treated with G-4 are given in Table II (Page 3). Since certain of these tests are not standardized procedures, fabric samples treated with copper naphthenate were used for control purposes. These samples were tested without the beneficial effects of a water repellent treatment.

A concentration of 0.25% of G-4 in a fabric has been found to be the minimum concentration which will pass the *Aspergillus niger* and *Chaetomium globosum* tests.

Bactericidal Properties:

Table III (page 3) shows the dilution of G-4 which will kill the various micro-organisms in 10 minutes, but not in 5.

The AOAC method of test was used with modifications necessary for growing the different bacteria. Since G-4 is not soluble in water, the following test solution, containing 0.1% G-4,

was employed. 0.1 g of G-4 was dissolved in 1 ml. of 95% alcohol and 0.75 ml. of 0.5 N-alcoholic potassium hydroxide and, to this solution, water was added to make a total volume of 100 ml.

The data in Table III may also be expressed as phenol co-efficients as follows:

	20° C 10 min.	37° C 10 min.
<i>Salmonella typhosa</i>	75	100
<i>Micrococcus pyogenes</i>		
var. <i>aureus</i>	42	100

Note: When G-4 Technical is incorporated into substrates other than water, bactericidal efficacy tests must be conducted to prove claims for bactericidal activity. If bacteriostatic activity claims are to be made for the treated product, other appropriate tests must be conducted.

V. Methods of Application to Textiles

Recommended Concentrations:

For outdoor use, it is recommended that G-4 be applied with a water-repellent finish to obtain maximum effectiveness.

The following concentrations of G-4 are suggested:

- 0.25-0.5% for textiles not used out-of-doors.
- 0.8-1.0% for textiles subject to weathering.

Most government specifications on mildew-proofing with G-4 require that the treated fabric contain about 1% G-4 based on the dry weight of the goods.

From Alkaline Solution:

While G-4 is quite insoluble in water, an aqueous solution of its sodium salt can be readily prepared. Such a solution, at a concentration of 40% of the mono-sodium salt, is called G-4-40 and can be prepared as follows:

G-4	100 lbs.
Caustic soda flakes 70% min.	18 lbs.
Water	18 gals.

The G-4 and caustic soda are mixed together and put into the water under stirring until solution is complete. The heat of solution of the caustic soda is usually sufficient to get the G-4 into solution; additional heating may be desirable to speed the process. This stock solution is then diluted with water to the desired strength. To eliminate the cloudy appearance of this solution, filter with an aid such as Saper-Cel® (Johns-Manville Corp.).

Knowing the percentage pickup of the pad liquor by the fabric and the percentage of G-4 that should be deposited in the fabric, one can determine from Table IV (page 3), the dilution of the stock solution (G-4-40) that is required.

The diluted solution should be padded on at a temperature of 140-150° F. The material must then be passed through a cold 5-5% acetic acid