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DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
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ANTI-DIMMING PREPARATIONS FOR GLASS SURFACES

In response to numerous requests for formulas for preparations to prevent the "dimming" or "fogging" by rain and condensed moisture of automobile windshields and the "sweating" of windows by condensed moisture, the following data have been collected.

Numerous patents have been granted covering such preparations and abstracts of such patents will be found in the various volumes of Chemical Abstracts, published by the American Chemical Society. Most of these preparations are designed to lower the surface tension of the droplets of water on the glass, causing them to coalesce and spread into a thin, continuous film.

Tests at the Bureau

Tests made at the National Bureau of Standards have been limited to the following materials: (1) Straight U.S.P. glycerine; (2) a mixture of equal volumes of U.S.P. glycerine and ethanol (ethyl alcohol); (3) a paste made up from 35 parts by weight of soft soap, 37 parts of precipitated chalk (calcium carbonate), 12 parts of U.S.P. glycerine, and 16 parts of water; (4) a mixture of U.S.P. glycerine and precipitated chalk; (5) a mixture of U.S.P. Glycerine, precipitated chalk and ordinary soap; (6) a mixture of U.S.P. glycerine, precipitated chalk, and soda soap (white floating soap).

The glass surface was cleaned and dried, the anti-dimming preparation applied with a cloth to one-half of the surface, and rubbed thoroughly; the glass was then wiped with clean absorbent cotton to a polished clear surface. The glass was placed vertically and water in a stream of drops from an atomizer was directed horizontally against the treated and untreated surfaces. Several tests were run with each material under varying conditions, the untreated half of the surface serving as a comparison.

Results.- In every case the untreated portion of the glass was "fogged". All of the materials showed a marked effect. The drops spread out the instant they hit the treated surface

and coalesced into a continuous film that impaired the vision very little, while vision was seriously impaired through the untreated portion. The kind of glass (blown or plate) was immaterial. No particular precautions seemed necessary with any of the materials. None of the materials tested was effective on a surface containing dry oil, but all except the mixture containing the ordinary soap were effective in the case of oil and water. The tests indicated that the treated surfaces would keep clear many hours if continuously exposed to a rain. But if at any time the surface becomes dry, the film is broken and it is no longer effective.

Straight glycerine seemed just as effective (as far as could be judged from the tests) as any of the materials tested. The only advantage noted in the preparations containing precipitated chalk was ease of polishing. This was very marked, in contrast with the straight glycerine which required more polishing to give a clear film. All of the mixtures containing precipitated chalk seemed about the same in this regard. Applied to a surface already wet, the glycerine possessed marked advantages over the other materials tested.

Work of the Chemical Warfare Service

Subsequent to the above tests the Chemical Warfare Service conducted considerable research on anti-dimming preparations for gas mask eyepieces. This work was based on previous investigations by Harry N. Holmes and his assistants. Experiments were carried out with preparations containing the sodium salts of sulphonated rapeseed oil, cottonseed oil, corn oil, castor oil, coconut oil, peanut oil, raw linseed oil, cod oil and fish oil. As a result of this work, the following formula was developed as giving the most satisfactory preparation:

Sodium salt of sulphonated rape oil . .	100	parts	by	weight
Sodium hydroxide, "C.P." powdered . . .	20	"	"	"
Sodium silicate, syrup	5	"	"	"
Glycerine, U.S.P.	3	"	"	"
Commercial engine oil	3	"	"	"

Place the ingredients in a casserole in the order given and mix; then let stand with occasional stirring until the mixture is of such a consistency that it can be pressed into cakes. To ten grams of this soap in a casserole add 90 milliliters of distilled water, stir, and heat until the soap is dissolved. Place in this solution 30 loosely knit cotton cloths (size 1 3/4 inches by 2 1/4 inches) and let soak until thoroughly impregnated with

the hot solution. Then remove the cloths, let drain, and dry on racks over a radiator at about 60°C (140°F). Each cloth can be used for a large number of applications to a glass surface.

The following procedure is given for sulphonating the oil and preparing the sodium salt:

To 200 milliliters (ml) of the oil in a 500-ml flask add slowly 20 ml of sulphuric acid (sp. gr. 1.84), keeping the flask and contents at a temperature below 35°C (95°F) by constant whirling in cold water. Now add 40 ml of cold distilled water to the mixture (still keeping it cool), and mix thoroughly. Pour the mixture into a separatory funnel, let the dilute acid settle out, and then draw it off. Wash the sulphonated oil (remaining in the funnel) twice with 50 ml of saturated sodium sulphate solution, and then with sodium hydroxide solution until the washings are neutral or slightly alkaline. The sodium salt of the sulphonated oil is then separated from the wash liquids and used for the preparation of the anti-dimming compound.

The cottonseed oil soaps are fairly satisfactory for anti-dimming preparations, although less efficient than the rape oil soaps for this purpose. The following formula is used:

Sodium salt of sulphonated cottonseed oil	100 parts by weight
Sodium hydroxide, "C.P.", powdered	15 " " "
Glycerine, U.S.P.	3 " " "
Commercial engine oil	3 " " "
Distilled water	25 " " "

Place the ingredients in a casserole in the order given, mix to a smooth paste, and heat on a steam-bath for one hour. To ten grams of this soap in a casserole add 50 ml of distilled water and heat to boiling. Impregnate cloths with the hot solution, as outlined above. This solution is sufficient to impregnate 18 cloths 1 3/4 inches by 2 1/4 inches. The cottonseed oil is sulphonated and the sodium salt of the sulphonated oil prepared as described for rape oil.

A sulphonated castor oil preparation made up by the following formula was not quite equal to the preparations made from sulphonated rape oil and sulphonated cottonseed oil:

Sodium salt of sulphonated castor oil	100 parts by weight
Sodium hydroxide, "C.P.", powdered	15 parts by weight
Sodium silicate, syrup	5 " " "
Glycerine, U.S.P.	3 " " "
Commercial Engine Oil	3 " " "

These ingredients are mixed and the resulting soap applied to cloths, as described above under sulphonated rape oil. The castor oil is sulphonated and the sodium salt of the sulphonated oil prepared as described for rape oil.

These preparations may also be molded into sticks or other forms. They have been used on windows of pilot houses and port holes, lenses, etc.

Commercial testing laboratories will, no doubt, sulphonate the oils and prepare the sodium salts, if furnished with a copy of the above procedure. Sulphonated oils suitable for the preparation of the neutral or slightly alkaline sodium salt by treatment with sodium hydroxide (as described under rape oil) might be obtained from the following firms:

National Oil Products Co., Harrison, N. J.

Kali Manufacturing Co., 1408 N. Front St., Philadelphia, Pa.

Hart Products Corporation, New York, N. Y.

L. Sonneborn Sons, Inc., New York, N. Y.

Richards Chemical Works, Jersey City, N. J.

John Campbell & Company, New York, N. Y.

Jacques-Wolf Co., Passaic, N. J.

To prevent the "sweating" and "frosting" of store windows and other windows, the preparations listed above should be helpful. Perfect ventilation would be effective, but in cold weather would under ordinary conditions cause too great a lowering of the inside temperature.

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