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PACKAGING MATERIAL

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The invention described herein, if patented, may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to an improved packaging material and more particularly to a halogen vapor resistant packaging material.

For many years the Armed Forces have utilized a chlorine releasing substance such as chlormelamine to produce germicidal and bactericidal solutions for emergency use in disinfecting food service equipment and fresh fruits and vegetables in the field. The disinfectant, in powder form, is packaged in flexible heat-sealed pouches in quantity sufficient to make a predetermined amount of disinfecting solution of the appropriate strength. In common with a great many other items used by the military, supplies of the disinfectant must be kept on hand and available for immediate use as the occasion may arise. This requires that the product must be kept in storage for periods varying from a few weeks to two or more years.

The active ingredient of the disinfectant, chlormelamine, for example, gradually deteriorates in effectiveness over an extended period through the release of chlorine vapors. This deterioration which results in a decrease in the amount of available chlorine with its disinfectant potential, is accelerated by the presence of moisture and is, of course, undesirable. In fact, since the disinfectant may often constitute the sole health protection of the users in the food service area, loss of its effectiveness may result in wide spread exposure to disabling disease which would obviously be intolerable in a military combat situation.

A number of packaging materials have been utilized in the packaging of the dry disinfectant, generally, with unsatisfactory results in so far as storage stability of the product is concerned. The liberated chlorine vapors are believed to cause deterioration of packaging material with the results that the moisture impenetrability of the package is compromised. The entry of moisture into the package accelerates the release of still more chlorine vapor and the attendant loss of germicidal and bactericidal potential of the disinfectant. Of course, even in the absence of chlorine deterioration of the packaging material, any weakness or inherent moisture permeability in the packaging material will only contribute to the rate at which the dry disinfectant loses its potential effectiveness. The packaging material presently in use for the disinfectant, a polyethylene-foil-polyethylene-paper laminate coated with lacquer and heat sealed to form a pouch, deteriorates to the extent that the activity of the disinfectant is seriously impaired after storage for only six months in temperate climate.

More recently an improved food service disinfectant including both chlorine and iodine liberating compounds has become available. This product requires a packaging material which is resistant and impenetrable to both chlo-

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rine and iodine vapors in addition to moisture impenetrability.

It is therefore an object of the present invention to provide an improved packaging material for halogen liberating compounds. A further object of the invention is to provide a packaging material which will maintain the effectiveness of a halogen liberating disinfectant during extended periods of storage. A still further object is to provide a packaging material which may be heat sealed to form a pouch. A still further object is to provide a packaging material for halogen releasing compounds which can be readily produced on conventional equipment from noncritical materials and at reasonable cost. Still further objects and advantages of the present invention will become apparent from the following detailed description of the invention and examples of its performance.

The flexible packaging material of the present invention comprises paper having a polyethylene terephthalate film laminated to one side thereof and a coating of a mixture of microcrystalline wax and polyisobutylene on the other side. The polyisobutylene serves to improve the flexibility, strength, moisture and halogen vapor resistance of the protective coating formed by the microcrystalline wax polyisobutylene mixture. The polyethylene terephthalate film is laminated to the paper by conventional means utilizing a suitable latex base adhesive. The unlaminated side of the paper-polyethylene terephthalate laminate is then coated with the microcrystalline wax and polyisobutylene mixture by the conventional hot melt dip process. The material may be utilized to form a pouch by placing the polyethylene terephthalate side of two pieces in opposed face-to-face relation and adhesive or heat sealing the edges of the material in a conventional manner as will be more fully described in the following specific examples of the present invention.

Example 1.—A forty pound (40#) base weight kraft paper is laminated on one side to a polyethylene terephthalate film 0.5 to 1.0 mil in thickness. The unlaminated side of the kraft paper is then coated to a thickness of 3 to 4 mils with a mixture comprising 92–95% microcrystalline wax and 5–8% polyisobutylene. The resulting mixture has a melting point of 162–166° F. The coating was carried out at 200–210° F. in a conventional hot melt dip. A suitable pouch may be formed of this material by heat sealing the edges of two pieces thereof, using a Model 24-C Sentinel heat sealer with Model 100 control, both manufactured by Packaging Industries, Montclair, New Jersey. On this model a temperature control setting of 45 for 2.5 seconds and a pressure control setting of 30 lb./sq. in. for 6 seconds has been found to produce a satisfactory seal.

Example 2.—A bleached chemical wood pulp paper 25# base weight is laminated to a 1.0 mil polyethylene terephthalate film by conventional means and the resulting laminate coated on the unlaminated side of the paper with the same wax polyisobutylene mixture to the same thickness and in the same manner as in Example 1. Pouches may be formed of this material in the same manner as in Example 1.

Example 3.—A 28–29# base weight kraft paper is laminated to a 1.0 mil polyethylene terephthalate film and the resulting laminate coated on the unlaminated side of the paper with the same wax-polyisobutylene mixture to the same thickness and in the same manner as in Example 1. Pouches may be formed of this material in the same manner as in Example 1.

The following table summarizes the results of tests of the various embodiments of the present invention for impenetrability by halogen vapors and water vapor. These data represent an average of a minimum of three

tests. The reference material is a pouch material which has been normally used in packaging chlorine liberating disinfectant in the past and comprises a laminate of, starting from the inside, 25# polyethylene, 0.35 mil foil, 15# polyethylene, and 25# pouch paper with a lacquer coating. The impenetrability to halogen vapors was determined by placing the packaging material between a halogen vapor liberating source and a starch-potassium iodide indicator which turns blue when either chlorine or iodine comes in contact with the indicator. The test results are stated in terms of the number of days expiring from the start of the test to the color indication of halogen vapor penetration of the material. The tests in each instance were conducted under conditions of 100% relative humidity and 99° F. temperature.

Since the amount of halogen released from a packaged disinfectant is somewhat proportional to the amount of moisture gaining entrance to the package, water vapor transmission rates were determined for the various embodiments of the present invention. The water vapor transmission rates were run according to ASTM designation E96-53T, Procedure B, Part 7, 1955, except that relative humidity was controlled at 53% instead of 50 plus or minus 2%. Also no attempt was made to control the circulation of air at 500 feet per minute. The water vapor transmission data are presented in grams per 100 square meters per hour at 23° C.

	Ex. 1	Ex. 2	Ex. 3	Ref.
Resistance to Cl ₂ vapor as a sheet (days).....	119	10	21	5
Resistance to Cl ₂ vapor as a pouch (days).....	41	62	81	10
Resistance to I ₂ vapor as a sheet (days).....	159	151	41	7
Resistance to I ₂ vapor as a pouch (days).....	68	10	42	15
Water vapor transmission (grams).....	1.8	0.9	0.9	0.5

In comparing the results of a single sheet and of a pouch of the material under test considerable variation can be noted. These differences are most likely due to the fact that all applications of the wax-polyisobutylene coating and the heat seals used on the pouches were performed under limited laboratory facilities which were in several instances inadequate, particularly with respect to maintaining a uniform thickness of the wax-polyisobutylene coating.

An analysis of the data present in the table clearly reveals that the present invention affords a substantial increase in halogen vapor impenetrability when compared with the best previously available product for this application. The maximum storage life of the halogen releasing disinfectant packaged in the polyethylene-foil-polyethylene-pouch paper laminate coated with lacquer has been established at six months. Based on the comparative results shown in the above table, it is anticipated that the use of the packaging material of the present invention will increase this storage life at least four-fold to a period of two years. The advantages of this improvement, particularly for Armed Forces use, cannot be overstated. Further, while materials were not available for sufficient replications of the tests, it is fairly indicated from the results obtained that the increase in storage life of the disinfectant through the use of the present invention may be expected to approach ten-fold.

These results are quite surprising when it is considered that tests of the impenetrability of 1.0 mil polyethylene terephthalate sheets to chlorine and iodine vapors conducted in the same manner and under the same conditions as the above tests reveal that impenetrability was limited to two days in each instance while similar tests of unbleached kraft paper sheets coated on one side to a thickness of 3.0-4.0 mils with the previously described microcrystalline wax and polyisobutylene mixture showed impenetrability to chlorine vapors for only

ten days and to iodine vapors for only sixteen days. Similar tests conducted with 28-29# kraft paper adhesively laminated to 1.0 mil polyethylene terephthalate sheet showed impenetrability to chlorine vapor for a maximum of five days. From this data it would be anticipated that the present invention which combines these materials in a single laminate might afford impenetrability to halogen vapors which is merely additive of these results, i.e., twelve days impenetrability to chlorine vapors and eighteen days impenetrability to iodine vapors. Reference to the above table reveals, however, that the present invention affords up to about ten times the resistance to chlorine vapors and up to about eight times the resistance to iodine vapors when compared with the combined resistance of the individual components.

From the foregoing, it will be seen that we have disclosed an improved packaging material which fills a long felt need, at least of the Armed Forces, for the packaging of halogen liberating substances. While we have disclosed a number of specific embodiment of our invention, it will be apparent to those skilled in the art that numerous modifications thereof may be used. Pouches may be formed of the paper-polyethylene terephthalate laminate filled with the product and sealed thereafter coated with the microcrystalline wax-polyisobutylene mixture. This variation affords the additional advantage of providing a wax-polyisobutylene seal over the edges of the pouch in addition to the heat seal. Paper or fabric laminated with polyethylene terephthalate film on one side can be made into bags either before or after coating with the wax-polyisobutylene mixture to produce a halogen vaporproof bag which may be used alone or as a liner for another bag. While the specific embodiments described utilize paper as a base material, any type of web or fabric susceptible to lamination to a polyethylene terephthalate film and coating with the wax-polyisobutylene mixture will serve as a base material. Various other modifications will be apparent to those skilled in the art.

While the invention has been described with reference to various examples, procedures, and products, it will be apparent to those skilled in the art that various modifications may be made, equivalents substituted therefor, or other procedural methods employed to attain the objectives, without departing from the spirit of the present invention or the scope of the subjoined claims.

We claim:

1. A laminated packaging material for halogen vapor liberating substances characterized by superior impenetrability to halogen vapors, comprising paper laminated on one side to a film of polyethylene terephthalate and coated on the other side with a mixture of microcrystalline wax and polyisobutylene.

2. A laminated packaging material for halogen vapor liberating substances characterized by superior impenetrability to halogen vapors, comprising paper coated on one side with a film of polyethylene terephthalate and on the other side with a mixture of about 92 to about 95 parts of microcrystalline wax and about 5 to about 8 parts of polyisobutylene.

3. A laminated packaging material characterized by superior impenetrability to halogen vapors, comprising paper coated on one side with a film of polyethylene terephthalate of a thickness of about .0005 inch to about .001 inch, and on the other side with a layer of a thickness of about .003 inch to about .004 inch, said layer being a mixture of about 92 to about 95 parts of microcrystalline wax and about 5 to about 8 parts of polyisobutylene.

4. A sealed pouch characterized by superior impenetrability to halogen vapors, comprising two sheets of paper, each sheet being paper coated on one side with a film of polyethylene terephthalate and on the other side with a mixture of microcrystalline wax and polyiso-

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butylene, said sheets being heat-sealed together at their edges.

5. A sealed pouch characterized by superior impenetrability to halogen vapors, comprising two sheets of paper, each sheet being of paper coated on one side with a mixture of about 92 to about 95 parts of microcrystalline wax and about 5 to about 8 parts of polyisobutylene, said sheets being heat-sealed together at their edges.

6. A laminated packaging material for halogen liberating substances characterized by superior impenetrability to halogen vapors, comprising a flexible base material laminated on one side to a film of polyethylene, terephthalate and coated on the other side with a mixture of microcrystalline wax and polyisobutylene.

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7. A laminated packaging material as in claim 6 wherein said base material is a fabric.

8. A sealed pouch characterized by superior impenetrability to halogen vapors, comprising two sheets of flexible base material, each sheet being laminated on its inner side to a film of polyethylene terephthalate, said sheets being heat-sealed together at their edges, and the outer surfaces of the pouch being coated with a mixture of microcrystalline wax and polyisobutylene.

No references cited.