treated animals were as follows: histamine, 0.22 ± 0.019 and 0.0098 ± 0.0012; oxotremorine, 0.16 ± 0.017 and 0.0062 ± 0.0004; nicotine, 1.08 ± 0.15 and 0.15 ± 0.038; and serotonin, 12.8 ± 0.29 and 0.12 ± 0.016. The toxicity of histamine was also increased by pretreatment with dichloroisoproterenol.

The resistance of the bronchiolar tree to Krebs-Henseleit perfusion in lungs excised after intravenous injection of lethal doses of bronchoconstrictors was much higher than that of lungs from control animals.

Doses of oxotremorine, serotonin, and histamine which did not change the resistance to perfusion, resulted in pronounced postmortem bronchoconstriction when the animals had received an intravenous dose of 10 mg./kg. of propranolol 15 min. before the bronchoconstrictor. A similar phenomenon was observed when 1.5 mg./kg. of nicotine was injected i.v. with propranolol.

The results indicate that in toxicity tests in control guinea pigs endogenous catecholamines exert a powerful antagonistic action against the bronchoconstrictor effect of histamine, serotonin, and oxotremorine. In the case of these three substances this protective mechanism can be overwhelmed by larger doses; the mechanism of death is bronchoconstriction. Nicotine, which is a bronchoconstrictor in the guinea pig pretreated with propranolol, does not kill untreated guinea pigs by producing bronchoconstriction.

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Keyphrases

Bronchoconstrictors—toxicity
β-Adrenergic blockade effect—bronchoconstrictor toxicity
Critical perfusion pressure—guinea pig lungs

Antimicrobial Activity of Dermatomucosal Agents

By LEO GREENBERG

Dermatomucosal agents act in a local manner on the skin and mucous membranes and are, in general, not regarded as materials which alter the microbial flora of the body. The present study was undertaken to determine whether they are, in fact, microbiologically inert. Nine categories of dermatomucosal agents were established and at least six commonly available products were investigated in each category. Products were evaluated for antimicrobial activity by the "small tube method" and by filter disk zone of inhibition method utilizing 12 organisms representative of the normal aerobic skin flora as substrates. Results indicate a wide range of antimicrobial activity among dermatomucosals with the distinct possibility that such products may, in actual conditions of use, alter normal human skin flora leading either to beneficial or deleterious results.

THERE IS, in modern pharmaceutical terminology, a large group of drugs which can collectively be identified as "dermatomucosal agents." These are compounded and dispensed in a multitude of different ways, but they all possess the property of acting in a local manner on the skin and mucous membranes. Some act purely in a physical or mechanical fashion (*e.g.*, demulcents, protectives) while others have a chemical mode of action (*e.g.*, astringents, anti-

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seborrheics). In general, they fall within the scope of cosmetic agents in that they enhance the esthetic properties of the skin in some way, but they are not normally considered as curative of dermatological infection. Thus specific antibacterial or antifungal ointments would fall outside of the scope of this definition and have not been considered in this study.

Antimicrobial activity on the part of a dermatomucosal agent or product arises as the result of (*a*) incorporation of a specific germicide into the formulation as a prophylactic measure, usually for the prevention of possible infection. It may be noted that this procedure has often been attacked as without scientific merit both as ineffective and indiscriminate (1). (*b*) incorporation of a germicide into the formulation for the inhibition or destruction of specific species of microorganisms such as those involved in ammonia dermatitis of infants. (*c*) incorporation into the formulation of a preservative agent. (*d*) antimicrobial activity by a chemical which is largely or entirely incidental to its intended activity.

Since the first three of these are procedures which constitute a routine part of pharmaceutical compounding of cosmetic products (2), it would appear likely that commercial dermatomucosal agents must exert an effect on the microbial flora of man which is either unintentional or exceeds the expected degree and range of response. Verification of this would have more than academic interest; changes in flora by cosmetic agents, whether intentional or unintentional, may conceivably result in serious health problems either from the development of resistant organisms or the accrual of virulent or undesirable species (3). Since some data on this problem are scattered in the literature and some are closely held in company files, the present study was undertaken to report on the antimicrobial spectrum of a large number of representative dermatomucosals.

PROCEDURES

Using standard reference sources (4), nine categories of dermatomucosal agents were identified for study. A tenth category, that of dusting powders was eliminated because of the extreme difficulty in preparing reliable dilutions. At least six common products in each category were purchased locally for evaluation.

Selection of test microorganisms was made on the basis of careful investigation of the resident and transient flora of the skin and mucous membranes. Thus bacteria, which constitute a preponderance of the normal population (5), were obviously of major interest as test substrates. Among the various groups, cocci are of primary importance, with Gram-positive species far outnumbering Gram-negatives. In the case of bacilli, the lipophilic, microaerophilic types are common, as are nonmotile forms of the *Neisseria*, *Mima*, or *Herella* type.

Yeasts are routinely cultured from normal skin and mucous membranes. Particular attention has been paid by clinicians and microbiologists to species of *Candida* because of their potential pathogenicity. However, *Saccharomyces*, *Torulopsis*, and *Pityrosporum* are commonly present. Molds are of course ubiquitous; many are environmental contaminants which are simply in transit from their normal habitat as saprophytes in the soil. Whether transient or resident, they do represent a major segment of the human skin ecology.

From these considerations, 12 microorganisms (seven bacteria, two yeasts, and three molds) representative of human flora were selected as test organisms and typical strains purchased from the American Type Culture Collection.

Tests for inhibitory concentrations of products were carried out by the "small tube method" (6) and by zone inhibition tests utilizing sterile S & S filter paper disks (7). Although these methods are not ideal, depending particularly upon both horizontal and vertical diffusion through the medium (8), they are entirely suitable for routine screening purposes.

Bacterial organisms were maintained on brain heart infusion agar and broth (Difco), while yeasts and molds were cultivated on Sabouraud dextrose agar and broth (Difco). Dilutions were made with sterile distilled water or suspended in sucrose solution if insoluble. Normally, 0.5 ml. of 18–24 hr. broth culture of the test organism was added to each 100 ml. of melted, cooled agar prior to pouring into sterile, plastic Petri dishes or tubes. Incubation in all experiments was at 35° for bacterial and yeast preparations and at 30° for molds. Bacteria and yeast plates and tubes were read after 48 hr. while molds were held for 7 days.

RESULTS AND DISCUSSION

For preliminary general screening, four representative organisms were chosen; these were a Gram-positive coccus, a Gram-negative enteric bacillus, a typical conidiospore-forming mold, and a pathogenic yeast. The activity or lack of activity of 63 commercial preparations against each of these four organisms was determined by filter paper disk method and is recorded qualitatively in Table I. The data indicate antimicrobial activity as follows: 41/63 against *M. citreus;* 31/63 against *E. coli;* 24/63 against *A. niger;* 10/63 against *C. albicans*. The minimum inhibitory concentration for each effective product against each test organism is given in Tables II–V, as well as the highest ineffective concentration tested. It may be noted that the number of effective products in Tables II–V exceeds the totals calculated from Table I. This results from the fact that inhibitory response judged to be "trace" in Table I was recorded as no activity, while being recorded as a minimum effective concentration in later tables.

From the results of these screening procedures, it is evident that antimicrobial activity is the rule among dermatomucosal agents rather than the exception. The sensitivity of micrococci to most

TABLE I—QUANTAL ACTIVITY OF FULL-STRENGTH DERMATOMUCOSAL AGENTS

	Product Active Against			
	Micrococcus citreus	*Escherichia coli*	*Aspergillus niger*	*Candida albicans*
Local anesthetics				
4% Butacaine sulfate	Yes	Yes	No	No
5% Cyclaine hydrochloride	Yes	Yes	No	No
4% Intracaine hydrochloride	Yes	Yes	No	No
4% Metycaine hydrochloride	Yes	Yes	No	No
4% Xylocaine hydrochloride	No	Yes	No	No
4% Procaine hydrochloride	No	No	No	No
Deodorants				
Arrid	Yes	Yes	Yes	No
Right Guard	Yes	Yes	Yes	No
Mennen Spray	Yes	Yes	No	No
Man Power	Yes	No	Yes	No
Ban	Yes	No	Yes	No
Mum Mist	Yes	No	No	No
Secret	Yes	No	No	No
Rubefacients and astringents				
Oil of Wintergreen	Yes	Yes	Yes	Yes
Pronto Gel	Yes	Yes	Yes	Yes
Sloan's Liniment	Yes	Yes	Yes	Yes
St. John's Bay Rum	Yes	Yes	Yes	Yes
Heet	Yes	Yes	Yes	No
Campho-Phenique	Yes	Yes	Yes	No
Omega Oil	Yes	Yes	Yes	No
Banalg	Yes	Yes	Yes	No
Camphorated Oil	No	No	No	No
St. John's After Shave	No	No	No	No
Face washes and cleansing creams				
Paradox Creme Cleanser	Yes	Yes	Yes	Yes
All Clear Face Wash	Yes	Yes	No	No
Du Barry Hand & Body Lotion	No	No	No	No
Nivea Skin Oil	No	No	No	No
Noxema Liquid	No	No	No	No
Water Lily Pore Lotion	No	No	No	No
Hair Tonics				
Trol	Yes	Yes	Yes	Yes
Heads Up	Yes	Yes	No	No
Fitches Ideal	Yes	Yes	No	No
Yardley	Yes	Yes	No	No
Hask	No	Yes	Yes	No
Jeris	Yes	No	No	No
Old Spice	No	No	No	No
St. John's Hair Groom	No	No	No	No
Vaseline Hair Tonic	No	No	No	No
Vitalis	No	No	No	No
Sunscreening agents				
St. John's Sun Tan	Yes	Yes	Yes	No
Tansation Plus	Yes	Yes	No	No
A-Fil	No	No	No	No
Bain de Soleil	No	No	No	No
Coppertone Cream	No	No	No	No
Sun Bath	No	No	No	No
Depilatories				
IMRA	Yes	Yes	Yes	Yes
Nair	Yes	No	Yes	No
Zip	Yes	No	No	No
Neet	No	No	No	No
Sleek	No	No	No	No
Shampoos				
All Clear	Yes	Yes	Yes	Yes
Rinse Away	Yes	Yes	Yes	Yes
Thylox	Yes	Yes	Yes	No
Kreml	Yes	Yes	Yes	No
Sebb	Yes	Yes	No	No
Capsebon	Yes	No	No	No

(Continued on next page.)

TABLE I (*Continued.*)

	Product Active Against			
	Micrococcus citreus	*Escherichia coli*	*Aspergillus niger*	*Candida albicans*
Protectives, demulcents, and emollients				
Paradox Moisturizing Lotion	Yes	No	Yes	No
Trushay	Yes	No	Yes	Yes
Edith Rehnborg Dermojeune Cream	Yes	No	No	No
Edith Rehnborg Moisture Cream	Yes	No	No	No
Jergens Lotion	No	No	No	No
Corn Huskers Lotion	No	No	No	No
Nosekote	No	No	No	No

TABLE II—INHIBITION OF GROWTH OF *Micrococcus Citreus* (BY GENERALLY DECLINING DEGREE OF ACTIVITY)

Item	Class	Effective Growth Inhibiting Concn.	Concn. Ineffectual for Inhibition
Butacaine sulfate	Local anesthetic	1/2500	1/3125
Rinse Away	Shampoo	1/2000	1/3000
Cyclaine hydrochloride	Local anesthetic	1/2000	1/2400
Intracaine hydrochloride	Local anesthetic	1/1875	1/2500
Metycaine hydrochloride	Local anesthetic	1/625	1/1250
Mum Mist	Deodorant	1/400	1/500
Mennen Spray	Deodorant	1/300	1/350
Secret	Deodorant	1/200	1/300
Right Guard	Deodorant	1/150	1/200
Fitches Ideal	Hair tonic	1/100	1/150
Heads Up	Hair tonic	1/100	1/150
Trol	Hair tonic	1/100	1/150
All Clear Face Wash	Cleanser	1/50	1/100
Man Power	Deodorant	1/50	1/100
Oil of Wintergreen	Rubefacient	1/50	1/100
Paradox Creme Cleanser	Cleanser	1/50	1/100
Paradox Moisturizer	Protective	1/50	1/100
Yardley	Hair tonic	1/50	1/100
All Clear	Shampoo	1/80	1/90
Edith Rehnborg Dermojeune Cream	Protective	1/50	1/60
Edith Rehnborg Moisture Cream	Protective	1/50	1/60
Trushay	Protective	1/40	1/50
Sebb	Shampoo	1/40	1/50
Thylox	Shampoo	1/40	1/50
Pronto Gel	Rubefacient	1/30	1/40
Campho-Phenique	Rubefacient	1/20	1/30
Ban	Deodorant	1/20	1/30
Capsebon	Shampoo	1/10	1/20
Kreml	Shampoo	1/10	1/20
Heet	Rubefacient	1/10	1/20
Sloan's Liniment	Rubefacient	1/10	1/20
Zip	Depilatory	1/10	1/20
Nair	Depilatory	1/4	1/10
IMRA	Depilatory	1/4	1/10
Arrid	Deodorant	1/4	1/10
Jeris	Hair tonic	1/4	1/10
St. John's Bay Rum	Astringent	1/4	1/10
Jergen's Lotion	Protective	Full strength	1/4
Banalg	Rubefacient	Full strength	1/4
Omega Oil	Rubefacient	Full strength	1/4
St. John's Sun Tan	Tanning agent	Full strength	1/4
Tansation Plus	Tanning agent	Full strength	1/4

products is not unexpected, but the relative resistance of *Candida albicans* lends support to current fears among some clinicians of an upsurge of yeast overgrowth in areas of the body where the resident bacterial flora has been reduced or eliminated by drug therapy.

To establish a picture of the range of germicidal activity involved, the two most active products in each of the nine categories were tested against eight additional organisms, and the data summarized in Table VI. The reader can determine by inspection the degree of activity of any given

TABLE III—INHIBITION OF GROWTH OF *E. Coli* (BY GENERALLY DECLINING DEGREE OF ACTIVITY)

Item	Class	Effective Growth Inhibiting Concn.	Concn. Ineffectual for Inhibition
Cyclaine hydrochloride	Local anesthetic	1/2500	1/3000
Butacaine sulfate	Local anesthetic	1/1875	1/2500
Xylocaine hydrochloride	Local anesthetic	1/1875	1/2500
Intracaine hydrochloride	Local anesthetic	1/1250	1/1875
Metycaine hydrochloride	Local anesthetic	1/1250	1/1875
Rinse Away	Shampoo	1/250	1/1000
All Clear	Shampoo	1/150	1/200
Oil of Wintergreen	Rubefacient	1/50	1/100
Thylox	Shampoo	1/30	1/40
Heads Up	Hair tonic	1/30	1/40
Yardley	Hair tonic	1/20	1/30
St. John's Bay Rum	Astringent	1/20	1/30
Mennen Spray	Deodorant	1/20	1/30
Arrid	Deodorant	1/10	1/20
Campho-Phenique	Rubefacient	1/10	1/20
Pronto Gel	Rubefacient	1/10	1/20
Sloan's Liniment	Rubefacient	1/10	1/20
Paradox Creme Cleanser	Cleanser	1/10	1/20
All Clear Face Wash	Cleanser	1/10	1/20
Fitches Ideal	Hair tonic	1/10	1/20
Hask	Hair tonic	1/10	1/20
St. John's Sun Tan	Tanning agent	1/10	1/20
IMRA	Depilatory	1/10	1/20
Sebb	Shampoo	1/10	1/20
Tansation Plus	Tanning agent	1/8	1/10
Trol	Hair tonic	1/4	1/6
Right Guard	Deodorant	1/2	1/4
Banalg	Rubefacient	1/2	1/4
Kreml	Shampoo	1/2	1/4
Ban	Deodorant	Full strength	1/10
Mum Mist	Deodorant	Full strength	1/10
Man Power	Deodorant	Full strength	1/10
Nair	Depilatory	Full strength	1/10
Heet	Rubefacient	Full strength	1/2
Omega Oil	Rubefacient	Full strength	1/2

TABLE IV—INHIBITION OF GROWTH OF *A. Niger* (BY GENERALLY DECLINING DEGREE OF ACTIVITY)

Item	Class	Effective Growth Inhibiting Concn.	Concn. Ineffectual for Inhibition
Oil of Wintergreen	Rubefacient	1/50	1/100
All Clear	Shampoo	1/40	1/50
Rinse Away	Shampoo	1/40	1/50
Paradox Creme Cleanser	Cleanser	1/40	1/50
Trol	Hair tonic	1/30	1/40
Paradox Moisturizer	Protective	1/20	1/30
Pronto Gel	Rubefacient	1/20	1/30
Sloan's Liniment	Rubefacient	1/20	1/30
Omega Oil	Rubefacient	1/20	1/30
Thylox	Shampoo	1/20	1/30
St. John's Bay Rum	Astringent	1/10	1/20
Heet	Rubefacient	1/10	1/20
Campho-Phenique	Rubefacient	1/10	1/20
Man Power	Deodorant	1/10	1/20
Right Guard	Deodorant	1/10	1/20
St. John's Sun Tan	Tanning agent	1/10	1/20
Hask	Hair tonic	1/10	1/20
Kreml	Shampoo	1/10	1/20
Trushay	Protective	1/10	1/20
Ban	Deodorant	1/4	1/10
IMRA	Depilatory	1/4	1/20
Nair	Depilatory	1/4	1/10
Capsebon	Shampoo	Full strength	1/10
Jeris	Hair tonic	Full strength	1/10
Mennen Spray	Deodorant	Full strength	1/10
Secret	Deodorant	Full strength	1/10
Old Spice	Hair tonic	Full strength	1/10
Arrid	Deodorant	Full strength	1/4
Banalg	Rubefacient	Full strength	1/4

TABLE V—INHIBITION OF GROWTH OF *Candida Albicans* (BY GENERALLY DECLINING DEGREE OF ACTIVITY)

Item	Class	Effective Growth Inhibiting Concn.	Concn. Ineffectual for Inhibition
Rinse Away	Shampoo	1/200	1/250
Oil of Wintergreen	Rubefacient	1/50	1/100
Paradox Creme Cleanser	Cleanser	1/30	1/40
Trol	Hair tonic	1/30	1/40
All Clear	Shampoo	1/20	1/30
Paradox Moisturizer	Protective	1/10	1/20
Trushay	Protective	1/10	1/20
Sloan's Liniment	Rubefacient	1/10	1/20
Pronto Gel	Rubefacient	1/10	1/20
IMRA	Depilatory	1/10	1/20
Nair	Depilatory	Full strength	1/10
Arrid	Deodorant	Full strength	1/10
Mennen Spray	Deodorant	Full strength	1/10
Heet	Rubefacient	Full strength	1/10
Thylox	Shampoo	Full strength	1/10
St. John's Bay Rum	Astringent	Full strength	1/4

TABLE VI—COMPARATIVE ANTIMICROBIAL ACTIVITY OF FULL-STRENGTH DERMATOMUCOSAL AGENTS[a]

Product	Test Organisms[b] A	B	C	D	E	F	G	H	I	J	K	L
All Clear shampoo	1+	1+	1+	1+	0	1+	1+	0.8	1+	1+	0.9	0
Trol hair tonic	0.9	1+	1+	1+	0.9	1	0.7	0.4	0.9	0.7	0.8	1+
Paradox Creme Cleanser	1+	1+	1+	1+	0	1+	0.8	0.4	0.9	0.8	0.7	1+
Trushay lotion	0.7	1+	1	0.9	1+	0.7	0.6	0	0.6	0.8	0.6	0.4
Rinse Away shampoo	1+	1+	1+	0.9	0	0	0.7	0.7	0.6	0.6	1	0.6
Oil of Wintergreen	0.8	0	1+	1+	0.6	0	0.5	1+	1+	0	1+	0
Mennen Spray deodorant	0.7	1	1+	1+	0.5	0.9	0.5	0.6	T	0	T	0.6
Sloan's Liniment	1	0.6	0.4	0.8	0.8	0.5	0.3	0.5	0.6	0.7	0.5	0.3
St. John's Sun Tan	1+	0.8	0.3	0	1+	0.7	0.5	0.4	0.5	0.6	0	0
Mum Mist deodorant	0.7	0.9	0.5	0.5	0.5	0.8	0.4	T	T	0.9	0	0.6
Paradox Moisturizer	0.3	0.8	0.8	0.7	0.5	0.5	0.3	0	0.7	0.3	0.6	0.7
Heads Up hair tonic	0.5	1	0.9	0.3	1	0.5	0.5	0.5	0	0.5	0	0.3
Butacaine sulfate	0.9	0.7	1	0.7	0	0	0.6	0.8	0	0.3	0	0
All Clear Face Wash	0.7	0.8	0.6	0	0.8	0.6	0.4	0.4	0	0.4	0	0.5
Cyclaine hydrochloride	0.8	0.8	0.6	0	0.3	0	0.7	1	0	0	0	0.3
Tansation Plus	1+	0.3	0.3	0	0.6	0.5	0.4	0.4	0	0	0	0.5
Nair depilatory	0.4	0.3	0.3	0	1+	0.6	0.4	T	0.4	0.3	T	0.3
IMRA depilatory	0.4	0.4	0.3	0	0.3	0.4	0.4	1.4	0.4	0	0.4	0.4

[a] Zone of inhibition of 25-mm. diameter = 1; zone of inhibition greater than 25-mm. diameter = 1+; trace activity = T; and lack of activity = 0. [b] Test organisms: A, *Streptomyces griseus;* B, *Sarcina lutea;* C, *Micrococcus citreus;* D, *Saccharomyces ellipsoides;* E, *Spirillum rubrum;* F, *Neisseria catarrhalis;* G, *Bacillus cereus mycoides;* H, *Escherichia coli;* I, *Aspergillus niger;* J, *Mucor mucedo;* K, *Candida albicans;* L, *Streptococcus faecalis.*

product against any given organism. He can also rank any product in comparison to 17 others and can estimate the general sensitivity of any test organism to chemical agents. From the data, it is clear that all categories participate in the antimicrobial phenomenon (seven different categories are represented among the 10 most active products), and as is to be expected, there is a wide range of activity within each category. It is likewise evident that different species of microorganisms display quite different susceptibilities to chemical agents. However, the marked sensitivity of *Streptomyces griseus* to all types of dermatomucosals was unexpected, and it is noteworthy that the test species of *Streptococcus* and *Neisseria*, genera associated with a high degree of pathogenicity, show a relatively high degree of resistance to chemical agents.

Finally, mention must be made of the fact that in some cases, the response of the test organism to certain concentrations of the dermatomucosal agent was unpredictable. Increase in colony size, enhancement of growth, and induction of sporulation were among the observations recorded, and further studies have been undertaken to determine if these represent consistent, reproducible responses or merely local idiosyncracies.

CONCLUSIONS

1. Evidence is presented that dermatomucosal products, normally intended to serve a cosmetic-type function, possess powerful abilities to affect microbial organisms typical of those normally associated with skin and mucous membranes.

2. Although no specific clinical implications can be drawn from this kind of laboratory investigation, the possibility that dermatomucosal products may significantly alter normal human skin flora leading to either beneficial or deleterious changes (in either case, neither predictable nor expected) cannot be discounted.

3. The data would appear to justify the recommendation that in dermatomucosal formulations, unless specific evidence of beneficial activity has been reported, antimicrobial activity should be kept to the most practical minimum.

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Keyphrases

Dermatomucosal agents—antimicrobial activity

Antimicrobial activity—small tube, disk methods

Cosmetic products—antimicrobial activity

Effects of Heat and Ultraviolet Radiation on the Stability of a Polypropylene–Polyisobutylene Alloy

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Polypropylene and blends of polypropylene are or may be utilized in medical items of equipment, containers, and various devices. Changes in properties of the material may negate its value when used for these purposes. This paper deals with the assessment of the stability of a polypropylene–polyisobutylene alloy when exposed to heat and ultraviolet radiation. Evaluation of stability was based upon (*a*) differential thermal analysis, (*b*) tensile properties, and (*c*) infrared spectroscopy. Results of the study revealed that considerable degradation of the material had occurred when exposed to a combination of heat and radiation, but relatively little degradation when the plastic was exposed to heat only.

PRESENTLY, polypropylene is enjoying widespread use in many applications in pharmacy, dentistry, and medicine as such items as disposable syringes, various types of containers, protective sheets, and a host of other devices. Addition of relatively small concentrations of a second polymer, polyisobutylene, gives added advantages for certain applications, the chief of which is a reduction in water vapor transmission.

Polypropylene is generally less stable to heat than polyethylene, for the most part due to the methyl side groups attached to every other carbon in the polymer (1). These tertiary carbons serve as active sites for oxidative degradations leading to chain scission and embrittlement. Incorporation of small quantities of antioxidants or combinations of antioxidants with other agents into the polymer increases the long-term stability of the final item.

In recent years, the authors have become interested in various man-made polymeric materials as protective barriers against harmful chemicals. It has become clear, however, that depending upon the inherent properties of the polymeric material and the types of stabilizers employed, the shelf-life of the plastic will be a function of time and the environmental conditions imposed upon the item. A protective coating which is initially found to prevent the penetration or permeation of a chemical poison might become, depending upon its storage conditions, sufficiently altered to permit the passage of the contaminating agent.

To gain some knowledge as to the stability of polymeric materials which might be used in medical items, containers, and various devices, a study was initiated to evaluate the properties of a specific material, polypropylene-polyisobutylene alloy, when exposed to heat and ultraviolet radiation.

EXPERIMENTAL

Materials and Apparatus—Polypropylene–polyisobutylene alloy[1] (Pro-Fax N400), 10 mil thick-

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[1] Five percent polyisobutylene.