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MATERIALS EVALUATION FOR A PORTABLE ENCLOSURE

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WASHINGTON 12, D. C.

T. R. No. 6226*

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Director

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A B S T R A C T

Commercially available plastic films were obtained and tested qualitatively for properties that are desired in a surgical tent material.

I. Introduction

An enclosure for the purpose of separating the surgical patient from the general operating room environment and its personnel during the operation was desired.

In order to achieve such isolation of the patient, the Germ-Free Research Unit of the Walter Reed Army Institute of Research, under the supervision of Major Maria L. La Conte, ANC, has under development a plastic enclosure provided with access ports for the operating surgeons, anesthetist, and assistants.

The tent or enclosure is supported at points of a frame but its main support is achieved and maintained by inflation with circulating air under pressure from pumps.

In addition to the personnel directly concerned with the operation, other observers may be present. For this reason the tent is constructed of a transparent material through which the operation can be observed.

The tent is sterilized before and after the operation requiring that it be dismantled, folded and placed in the sterilizing chamber. At the present stage of development the tent is made from plasticized polyvinyl chloride film which is sterilized by means of ethylene oxide gas because the material cannot withstand the temperatures of the steam autoclave without blocking from the heat and without blanching from the moist steam. Hence one of the prime objects of the present investigation is to find a material that can be sterilized in the steam autoclave.

Another property of the plastic film that is important in this application is that the amount of noise given off by the film when manipulated be minimal since crackling noise could be most annoying to the patient and surgeons. Actually, only truly rubber-like materials could be said to qualify in this respect.

II. Test and Test Results

The manufacturers' data on general physical and chemical properties was accepted as received. Observations were made on each type

of film regarding ability to withstand autoclaving, optical clarity before and after the steam treatment, and other effects not found in the producers' lists of properties.

An additional item consisting of a model of a plastic cuff that is mounted in the wall of the tent is also presented. This cuff, which forms a part in the tent wall, supports the surgeons' glove provides the only means of outside communication with the patient. Lexan was selected for this application because it is easy to fabricate, is inexpensive and can also be steam autoclaved.

III. Results

The films tested are summarized in the appended table.

In general, it was found that thin films of inherently rigid materials illustrated good steam autoclaving characteristics but poor noise attributes. The noise obtained was of the crinkling and crackling variety. The inherently soft materials, on the other hand, did not present any noise problem but showed very poor autoclaving characteristics.

Of all the films tested, no one film appeared to have a balance of properties suitable for the application.

IV. Recommendations

It is recommended that some exploratory experimental work be initiated to determine whether it is feasible to reduce the noise characteristics of those films showing excellent resistance to steam autoclaving.

FILM	KODAR	TEDLAR	KEL-F 81	KEL-F-A
Manufacturer	Eastman Kodak Co.	Du Pont	Minnesota Mining Co. (3M)	3M
Type	Polyester	Polyvinilidene fluoride	Monochlorotri-fluoroethylene	Monochlorotri-fluoroethylene
Clarity (initial)	Excellent	Fair (hazy)	Excellent	Good
(after steam auto-claving)		Not affected	Not affected	
Film Surface	Excellent (both sides)	Irregular, one side machine marked.	Machine markings (striations, one surface)	Straited
Dimensional stability (post treated)	Excellent	Excellent	Poor, (severe distortion due to heat)	Poor, severe distortion
Elongation, (post treated)	< Original, (stiffened)	No apparent change	< Original (stiffened)	< Original
Blocking	None	None	None	None
Tear Resistance	Good edge strength but tear propagates easily	Good edge strength but tears propagate	Good edge strength fair resistance to propagation	Good resistance to propagation
Noise characteristic	Very high (post treated)	High and annoying (post treated)	Duller than most but higher than plasticized poly-vinyl chloride	> Plasticized poly-vinyl chloride

FILM	KEL-F-B	SCOTCHPAK	POLYPROPYLENE	PLASTICIZED CA
Manufacturer	3M	Minnesota Mining Co. (3M)	Avisun Corporation	DuPont
Type	Monochlorotri-fluoroethylene	Polyethylene laminated to polyester	Polypropylene	Celulose Acetate
Clarity (initial)	Fair (hazy)	Initial hazy	Good (initial) - slight haze after autoclaving machine marked (striated) surface besmudged	Excellent
after steam auto-claving				
Film Surface				
Dimensional stability (post treated)	Good, very little distortion	Poor	Good	Poor, distorted and fused
Elongation, (post treated)	<Original	<Original	Unchanged - Good	Poor
Blocking	None	Severe	None	Severe
Tear Resistance	Notched specimen, easily propagated tear	Poor	Film elongates before tear begins but tear propagates easily	Poor
Noise Characteristic	>Plasticized polyvinyl chloride	Loud	Loud, particularly after autoclaving	Very loud

FILM	ESTANE	ACLAR	TEFLON FEP	LEXAN
Manufacturer	B.F. Goodrich Co.	Allied Chemical Corp.	Du Pont	Plastex Process Co.
Type	Polyurethane	Fluorohalocarbon	Fluorocarbon	Polycarbonate
Clarity (initial)	Fair, slightly yellow initially more color from autoclaving. Good, some machine straitions.	Good (slightly haze) not effected by autoclaving. Straited one side.	Excellent	Excellent
(after steam autoclaving)				
Film Surface				
Dimensional stability (post treated)	Excellent	Excellent	Excellent	Excellent
Elongation,(post treated)	No change	No apparent change	No apparent change	Original stiffening
Blocking	Severe	None	None	None
Tear Resistance	Excellent	Good, good resistance to propagation of tear	Good	Fair
Noise Characteristic	Very low	Dull but plasticized polyvinyl chloride	Dull but plasticized polyvinyl chloride	Very loud

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WRAMC FORM 0183 (ONE TIME)
15 MAY 1961

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