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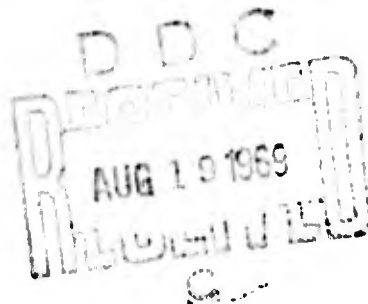
TECHNICAL REPORT 6909

EVALUATION OF 2-CYANOACRYLATE ESTER MONOMERS AS A  
QUICK-SETTING ADHESIVE FOR WET DIALYSIS

Reported by:

Joshua Nelson

May 1969



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WALTER REED ARMY MEDICAL CENTER  
Washington, D.C. 20012

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Project 3A061101A91C 010

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## INTRODUCTION

Attempts to adhere moist regenerated cellulose membranes to each other have met with limited success. Because alkyl 2-cyanoacrylates polymerize and form strong bonds on moist substrates it was decided to test these monomers for their ability to adhere to regenerated cellulose membranes.

The results of the investigation are reported herein.

## EXPERIMENTAL

Cuprophane membranes, kindly supplied by Dr. W. J. Kolff, University of Utah, were cut into strips using a metal die of dimensions 1" in width and 6" in length. The strips were conditioned overnight by immersing in Ringer's solution. After conditioning, two strips were removed and the surface patted lightly with a hand paper towel to remove excess water. Approximately 6-8 drops of the 2-cyanoacrylate monomer undergoing evaluation were placed on a 2" long end portion of one strip and spread over this area with a piece of dacron felt. The end of the other strip was then placed over the end of the first strip so that a 2" overlap was formed. The overlap was then smoothed by hand until the monomer polymerized. Three samples for each monomer were fabricated in this manner and allowed to dry for one hour before testing. Shear strengths and peel strength of the bonds were determined using the Instron Testing Machine at a strain rate of 5 inches per minute.

The 2-cyanoacrylic acid esters which were evaluated as adhesives for wet cuprophane membranes were methyl, ethyl, n propyl, n butyl, n amyl, isopropyl, isobutyl and isoamyl.

## RESULTS AND DISCUSSION

The results obtained for both shear strengths and peel strength are summarized in Table I.

The results obtained indicate that the ethyl, propyl, isopropyl and isoamyl monomers produce bonds which were equal to or superior to the tensile strength of the membrane material itself.

The peel strengths obtained were rather low in value ranging from 0.5 to 1.2 pounds per inch of width. However, the peel test consisted in pulling the specimen at an angle of 180° so as to induce peeling, and in practically all the tests, failure was initiated by a tear at a small spot usually in the middle of the test specimen. As pulling continued, the failure noted resulted from tearing of the material in localized areas leaving most of the adhered material intact.

From the viewpoint of quick adherence and good quantitative results, isopropyl 2-cyanoacrylate monomer appears to be the monomer of choice.

#### SUMMARY

Ethyl, propyl and isopropyl 2-cyanoacrylate monomers appear to be a possible candidate as quick-setting adhesives for the adhesion of wet regenerated cellulose dialysis membranes. Of these, isopropyl or isoamyl 2-cyanoacrylate seem to warrant further investigation.

TABLE I

Monomer	Shear Strength (lbs)	Type* of Failure	Peel* Strength (lbs)	Type of Failure
Methyl	9	A	0.15	A
	11	A	0.0	B
	12.5	A		
Ethyl	13	B	0.7	A
	10	A	0.5	A
	9	A		
Propyl	12.5	A	0.6	A
	12.5	A	0.6	A
	9.5	A		
Butyl	11.5	B	0.45	A
	11.5	A	0.25	B
	9.5	A		
Amyl	12	B	0.15	B
	9	A	0.25	B
	7			
Isopropyl	13	B	1.2	A
	12.5	A	0.6	A
	12	A		
Isobutyl	10	B	0	B
	12	A	0.2	B
	9	A		
Isoamyl	12.5	B	0.72	A
	13	A	0.40	B
	11.5	A		

As a control, a 1" wide strip of the dialysis membrane yielded a tensile strength of 12.5 pounds.

\*A - Substrate Failure

B - Adhesive

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13. ABSTRACT Ethyl, propyl and isopropyl 2-cyanoacrylate monomers appear to be a possible candidate as quick-setting adhesives for the adhesion of wet regenerated cellulose dialysis membranes. Of these, isopropyl or isoamyl 2-cyanoacrylate seem to warrant further investigation.			

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