16:51:20 OCA PAD AMENDMENT - PROJECT HEADER INFORMATION 07/27/90

Active

Project #: A-8669 Cost share #: Rev #: 1
Center # : 24-6-R8669-000 Center shr #: OCA file #:
Work type : RES
Contract#: AGREEMENT DATED 5/10/90 Mod #: 1 Document : CONT
Prime #: Contract entity: GTRC

Subprojects ? : N
Main project #:

Project unit: MSTL Unit code: 01.021.363
Project director(s):
GOOCH J W MSTL (404)894-8485

Sponsor/division names: SCHIPPMAN RESEARCH CORP. / BLAINE, WASHINGTON
Sponsor/division codes: 701 / 013

Award period: 900510 to 900801 (performance) 900801 (reports)

Sponsor amount	New this change	Total to date
Contract value	0.00	14,000.00
Funded	0.00	14,000.00
Cost sharing amount		0.00

Does subcontracting plan apply ?: N

Title: PREPARATION OF EMULSIONS FOR PROTECTION OF SKIN FROM IRRITANT MATERIALS

PROJECT ADMINISTRATION DATA

OCA contact: E. Faith Gleason 894-4820

Sponsor technical contact	Sponsor issuing office
KURT SCHIPPMANN (604)536-3149	KURT SCHIPPMANN (604)536-3149
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Security class (U,C,S,TS) : U ONR resident rep. is ACO (Y/N): N
Defense priority rating : N/A N/A supplemental sheet
Equipment title vests with: Sponsor X GIT
NONE PROPOSED.
Administrative comments -
PROJECT EXTENDED FOR 3 WEEKS AT NO ADDITIONAL COST TO SPONSOR.

GEOR[illegible] INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION

NOTICE OF PROJECT CLOSEOUT

Closeout Notice Date 08/28/90

Project No. A-8669 Center No. 24-6-R8669-000

Project Director GOOCH J W School/Lab MSTL

Sponsor SCHIPPMAN RESEARCH CORP./BLAINE, WASHINGTON

Contract/Grant No. AGREEMENT DATED 5/10/90 Contract Entity GTRC

Prime Contract No.

Title PREPARATION OF EMULSIONS FOR PROTECTION OF SKIN FROM IRRITANT MATERIALS

Effective Completion Date 900801 (Performance) 900801 (Reports)

Closeout Actions Required:	Y/N	Date Submitted
Final Invoice or Copy of Final Invoice	Y	
Final Report of Inventions and/or Subcontracts	N	
Government Property Inventory & Related Certificate	N	
Classified Material Certificate	N	
Release and Assignment	N	
Other	N	

Comments

Subproject Under Main Project No.

Continues Project No.

Distribution Required:

Project Director	Y
Administrative Network Representative	Y
GTRI Accounting/Grants and Contracts	Y
Procurement/Supply Services	Y
Research Property Managment	Y
Research Security Services	N
Reports Coordinator (OCA)	N
GTRC	Y
Project File	Y
Other	N
	N

FINAL REPORT

PREPARATION OF EMULSIONS FOR PROTECTION OF SKIN FROM IRRITANT MATERIALS

Prepared for

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Blaine, Washington 98230

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GTRI
GEORGIA TECH RESEARCH INSTITUTE

FINAL REPORT

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August 1, 1990

Table of Contents

List of Tables

1.0 INTRODUCTION

Schippmann Research Corporation manufactures a water soluble glycerine-based barrier cream which forms a protective shield on hands and skin applied before a person begins work. The cream forms a protective barrier and protects the skin from oils, greases, paints, inks, solvents, resins, adhesives, gasoline, tar which a worker would contact in the work place. After use, the worker may remove the cream with the above materials by rinsing his hands with tap water leaving hands clean for the next activity. The efficiency of the cream requires improvement, and there exists a growing number of materials in the work place. It is for these reasons that protection improvements and testing of the improvements are required.

2.0 TECHNICAL APPROACH

The technical approach for each objective and corresponding task is listed below.

A Kitchen-Aid Proline Mixer, 5.0 quart container, Model KSM5GR was utilized to mix the components. The 5.0 quart container was heated with a reaction vessel heating mantel with adjustable control. In each case, the Colega materials were first heated to 110^{o}C, and other components were added while mixing.

Task 1 - Improvement of Package and Operating Temperatures

The use of the cream in tropical areas creates a problem. Perspiration through the skin increases at elevated temperatures. Also, the components comprising the formulation separate. Materials which are moisture permeable, but less water soluble were selected for this application. Aeration of the mixture of components provided a creamy and comfortable method of application, however, the air bubbles have a tendency to escape and decrease the package stability. The relative amount of aeration was quantified by measuring density or lbs./gal. which was reported for each formulation.

Task 2 - Improved Protection of Fingernails against Printers Ink

Protecting fingernails and areas between nail and skin were addressed. The improved barrier films were tested by the Sponsor. Improvements included higher molecular weight olefinic polymers dispersed within the cream.

Task 3 - Protection of Skin from Irritating Fluids

This task required concentrating on fluids used in a specific

industry such as the coatings industry. Paint and fluid resistance was addressed within this task. GTRI evaluated the creams for fluid resistance, and the Sponsor evaluated them for paint resistance. Developing creams with resistance to these materials included a careful selection of emulsified/dispersed materials such as olefinic waxes with a wide range of molecular weights. Protection against solvents required a wide range of incompatibility of cream with solvents (i.e., the cream must not be dissolved by the solvents). There exists a wide range of solvents in the coatings industry, and the selection of materials for formulating the creams were chosen on the basis of each solvent and combinations of solvents.

Task 4 - Improved Feel on Hands and Faster Rub-In

Working with tools is difficult if hands are creamy or possess a lubricity property. Therefore, formulations were prepared which provide a "gripping" property to the hands while providing a protective barrier. Tackiness was reduced, and the rub-in property was improved.

Tests were performed on all formulations. Gum rubber panels were coated with the cream and immersed in a swirling test fluid at 37^{o}C (body temperature) to determine the efficacy of the cream. Testing of creams using toxic substances on human subjects were not conducted at GTRI.

Samples of each formulation together with results of testing were forwarded to the Sponsor for approval.

3.0 RESULTS

The results of testing the formulations are listed in Tables 3 and 4 which are referred to in the following discussion.

3.1 Improvement of Packaging and Operating Temperature

Decreasing the entrained air volume improved the package stability to 8.0 hours as shown in formulation no. 4 due to the addition of polyethylene wax. However, the further addition of acrylamide/N-methylolacrylamide greatly increased the stability to 72.0 hours.

3.2 Improved Protection of Fingernails against Printer's Ink

The Sponsor tested the formulations no. 7, 8 and 9 for potection against ink and paint and reported to GTRI that it provided acceptable protection from Boston Printer's Ink and a blue tinter paint for 2-4 hours. These materials provided protection and could be washed off with water. The period of protection is decreased by heat and abrasion. More practical laboratory study

is needed to determine the effective period of performance verus conditions. In any event, formulation no. 9 provided protection of hands from ink and paint.

3.3 Protection of Skin from Irritating Fluids

Gum rubber panels (1 in. x 6 in. x 1/8 in.) were covered with a layer of each formulation in Table 3 followed by immersing in the fluids which were used to test the protection of the formulations in Table 3. If the protective layer of cream was permeated, the rubber swelled within ten minutes. An uncoated control panel was used in each series of tests. All formulations were effective up to hours in hydraulic fluid 5608, but failed in other fluids. It is thought that momentary exposure to the fluids would not destroy the protection of the leading formulations.

3.4 Improved Feel on Hands and Faster Rub-In

Formulation no. 9 provided an acceptable rub-in time and a comfortable dry feel on the hands. This effect was due to the addition of polyacrylamide and polyethylene wax.

The most significant improvements are related to the addition of polyacrylamide and acrylamide/N-methylolacrylamide into the Colega base formulation. The density is directly related to the package stability which is inversely related to the amount of entrained air. A density of 6.7 lbs./gal. and above is preferable for an acceptable package stability. There is no direct relationship between package stability (ASTM D1847) at 51.7°C (125°F) and actual conditions, however, improved stability at 125°C is an indication of longer shelf life. The in situ polymerization of acrylamide/N-methylolacrylamide initiated with ammonium persulfate produced the most stable protective material when blended with 10 percent polyethylene wax (see formulation 11 in Table 3). The acrylamide/N-methylolacrylamide monomers polymerized and crosslinked while continously being flowed into the base material. This formulation formed a continuous film when spread over skin unlike the powdery dispersion in the Colega base material. However, it was reported by the Sponsor that an objectionable odor emanated from the cream which GTRI believes can be eliminated with post-heating.

4.0 RECOMMENDATIONS

4.1 Optimize Properties

It is recommended that the Sponsor reformulate the creams in Tables 3 and 5 to optimize the above the package stability and

ink/paint resistance properties. It is anticipated this could be done within 30 days.

4.2 Field Test Leading Candidates

It is recommended that the leading candidates from this project be thoroughly field tested to determine their usefullness, and that the data be shared with GTRI to aid the Sponsor in optimizing the product. GTRI recommends approaching the aircraft painting industries to test the effectives of the formulations against urethane based coating materials which are irritants to the skin.

4.3 New Uses

Formulations 1-12 in Table 3 were used to coat vapor deposition bell jars in the GTRI laboratories to prevent build-up of metals on the glass surfaces. Cleaning these jars has been difficult, but precoating with formulation No. 9 allowed quick and efficient cleaning with a moist cloth. It is recommended that the product be evaluated for other uses where temporary protective films are required.

Table 1. Formulation of Colega Hand Cream[1]

	Component	Percent by weight
1.	Water	23.24
2.	Glycerine	42.90
3.	Silicate N	21.40
4.	Coconut Oil Soap	5.40
5.	Methyl-Parabens Wax	0.10
6.	Propyl-Parabens Wax	0.10
7.	Wax, paraffin based (MP=52^{o}C)	6.50
8.	BASF Creamaphor A-25	0.26
9.	Benzaldehyde	0.10

1 - The viscosity of the mixture is 20 cps at 25^{o}C and pH=10.8

Table 2. Materials for Formulating Purposes

Material	Source
Acrylamide	American Cyanamide Corporation
N-Methylol Acrylamide	" " "
Polyacrylamide	" " "
Ammonium Persulfate	Aldrich Chemical Company
MP-12 Micronized Wax	MicroPowders Company

Table 3. Composition of Hand Cream Formulations

Formulation	Components, Percent Weight			
	Colega Material	Polyethylene Wax MP-12 MP=106°C	Polyacrylamide	Acrylamide/ N-Methylol- Acrylamide
1	100	0	0	0
2	95	5	0	0
3	90	10	0	0
4	80	20	0	0
5	95	0	5	0
6	90	0	10	0
7	85	0	15	0
8	80	0	20	0
9	70	10	20	0
10	95	0	0	5
11	85	10	0	5
12	95	0	0	5

Table 4. Results of Testing Hand Cream Formulations

Formulation	Density lbs/gal	Drying Time, Secs.	ASTM D1847 Package Stability, Hrs.	Fluid Resistance, Hrs.		
				Hydraulic Fluid 5608	Unleaded Fuel	JP-4 Fuel
				Pass/Fail (+/-)		
				8/24	8/24	8/24
1	5.5	35	6	+/-	-/-	-/-
2	4.5	32	6	+/-	-/-	-/-
3	3.3	30	6	+/-	-/-	-/-
4	6.7	33	8	+/-	-/-	-/-
5	2.4	30	3	+/-	-/-	-/-
6	2.8	31	3	+/-	-/-	-/-
7	4.0	34	2	+/-	-/-	-/-
8	3.3	30	3	+/-	-/-	-/-
9	3.1	32	3	+/-	-/-	-/-
10	4.2	20	6	+/-	-/-	-/-
11	3.6	22	72	+/-	-/-	-/-
12	2.2	20	6	+/-	-/-	-/-

Table 5. Results of Ink and Paint Resistance

Formulation	Protection, Hours	
	Ink on Finger Nail	Paint
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	5	5
7	5	5
8	5	5
9	15	15
10	0	0
11	0	0
12	1	1