ORGANIC CHEMICALS DIVISION RESEARCH *Report*

REPORT NO. - P-1549 JOB NO. - 2-21-760.01-1113115

Tentative Process for

MCS 975 (Pydraul 625A)

DATE - December 30, 1969 WRITTEN BY - L. R. Stark

Monsanto

ST. LOUIS, MISSOURI

DSW 620133

STLCOPCB4094160

1) MCS 975 (Pydraul 625A) - a fire resistant air compressor lubricant and hydraulic fluid

2) Aroclor 1242 - used for blending MCS 975 instead of Aroclor 1260

3) Cresyl diphenyl phosphate used for blending MCS 975

SAFETY REVIEW COMMITTEE
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[signature] 2/9/70
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FILE: Hydraulic Fluid

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Organic Chemicals Division
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TENTATIVE PROCESS

FOR

MCS 975 (PYDRAUL 625A)

December 30, 1969

Written by: L. R. Stark

Work done by: P. D. Fowlkes
W. H. Calloway
L. F. Smith
P. F. Heinsch

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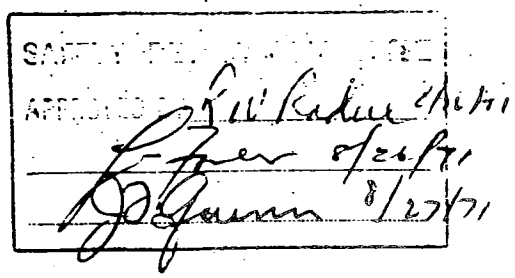
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TENTATIVE AMENDMENT B

TO THE

TENTATIVE PROCESS

FOR

MCS 975 (PYDRAUL 625A)

Report No. P-1549, dated Dec. 30, 1969

- -

Job. No. 2-21-760.01-1113115

Objective

Change of raw materials and additives used in blend.

Present Practice

The present tentative process enables the blending of Pydraul 625A, a fire resistant industrial hydraulic fluid.

Proposed Change

The revised formulation of Pydraul 625A is presented. The major change involves the replacement of Aroclor 5442 with Aroclor 5432. This change is intended to reduce or eliminate the tendency to form solids when 625A is used in air compressors. The revised blend also costs 11% less than the original and will be another step toward the elimination of Aroclor 5442

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from Pydraul blends. This will simplify inventory control for Central Drumming and also improve plant safety once 5432 can be handled at a lower temperature than 5442. This change supersedes Amendment A.

Bill of Materials

Basis: 100 lbs. of product

		Wt., lbs.
81113	Santicizer 140	39.5
82623	Aroclor 5432	60.0
51351	Santolube 70-A	0.25
46310	Paraplex G-62	0.20
60015	Tolyltriazole	0.05
31100	DC 200 Fluid 350 cs.	0.003
20640	DuPont Oil Blue A	0.003

Process in Detail

A suggested blending procedure would be to charge the Santicizer 140 to a clean dry tank. The 5432 is then added and the mixture stirred until homogeneous and the dye and tolyltriazole dissolves. The sensible heat of the 5432 should facilitate blending of the ingredients. The dye may be added either to the Santicizer 140 or to the blend as convenience dictates.

Discussion of Important Variables

The most important specification property of Pydraul 625A is viscosity. Adjustments should be made to keep the 100°F. viscosity within the required specification range.

If the 100°F. viscosity is low, add Aroclor 5432. One pound of Aroclor 5432 per 100 pounds of blend will increase the viscosity about 10 centistokes.

If the 100°F. viscosity is high, add Santicizer 140. One pound of Santicizer 140 per 100 pounds of blend will decrease the 100°F. viscosity about 6 centistokes.

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Material Specifications

Property	Tentative Specification	Typical Value	JFQ Method
Appearance	Clear blue liquid		16-B
Viscosity, Cs. at 100°F.	125-145 cs.	132.0	126-A
at 210°F.	6.2-6.7	6.50	
Acidity, mg. KOH/g.	0.30 max.	0.21	80-B
Specific Gravity, 25/25°C.	1.26-1.30	1.283	116-A
Moisture, KF	0.15 max.	0.04	78-B

Justification for Change

The change of raw materials will alleviate a potentially serious customer problem with air compressor lubricator blockage. The change also lowers the COGS of the product and is a step toward simplifying Central Drumming procedures.

Precautions

No additional precautions are required due to this amendment to the Tentative Process.

P. D. Fowlkes

P. D. Fowlkes

L. R. Stark

L. R. Stark

File copy approved by:

U R Richard — Manager, R&D — 8/23/71 (date)

Manager of Manufacturing — (date)

Manager of Process Technology — (date)

/is
8/12/71

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MONSANTO COMPANY
Organic Chemicals Division
St. Louis Research Department
April 23, 1970

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TENTATIVE AMENDMENT NO. A

TO THE

TENTATIVE PROCESS

FOR

MCS 975 (PYDRAUL 625A)

Report No. P-1549, dated Dec. 30, 1969

Job No. 2-21-760.01-1113115

Objective: Incorporation of additives into blend

DSW 620139

1. Brief Description of Present Practice

The present tentative process enables the blending of MCS 975 (Pydraul 625A), a fire resistant industrial hydraulic fluid.

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2. Description of Proposed Change

The revised composition of MCS 975 is presented. The additives improve the functional properties of the fluid. The material specifications which are changed are described, and modifications to the blending process delineated. The same format as used in the tentative process is followed.

BILL OF MATERIALS

Basis: 100 lbs of product

Raw Material		Weight, lbs.
82621	Aroclor 5442	49.1
80077	Cresyl diphenyl phosphate	50.1
61326	Unox 221	0.5
82113	Santolube 70-A	0.3
*	tolyltriazole	0.1
*	FC-98	0.02
20640	Dye, Dupont Oil Blue A	.003
31100	Dow Corning 200 fluid, 350 cs	.002

* See P.D. Fowlkes-Research for raw material sources

PROCESS IN DETAIL

All of these additives dissolve readily in the CDP and a suggested procedure is to add all of them to the CDP before the 5442 is added. 1/2 to 1 hour at 125-150°F (50-65°C) should be sufficient mixing time.

The tolyltriazole and FC-98 should be measured carefully on a suitable balance as they will affect the acidity and appearance specifications of the blend. These materials are also very expensive.

DISCUSSION OF IMPORTANT VARIABLES

The procedures for viscosity adjustment are unchanged.

MATERIAL SPECIFICATIONS

Property	Tentative Specification	Typical Value
Appearance	Cloudy blue liquid	--
Viscosity, cs		
at 100°F	125-145	140.1
at 210°F	6.7-7.2	7.13
Acidity, mgKOH/g	0.30 to 0.60	0.46
Sp. Gr.	1.30-1.34	1.322
Moisture, KF	0.15 max.	0.03
Pour Point (each 10th lot)	+5°F	-5°F

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3. Justification for Change

The additive package developed for MCS 975 improves hydraulic pump performance dramatically at a very slight increase in cost.

4. Precautions

The only additional precaution relates to the handling of FC-98. It is an extremely fine, light powder and disperses in the air quite easily. Breathing of this dust should be avoided and precautions taken to avoid creating dust.

P. D. Fowlkes

ms

4/23/70

Recommended Review Date: Jan. 1, 1970

Approved by:

W. R. Richard — 4/29/70

W. R. Richard (Date)
Manager of Research

DSW 620141

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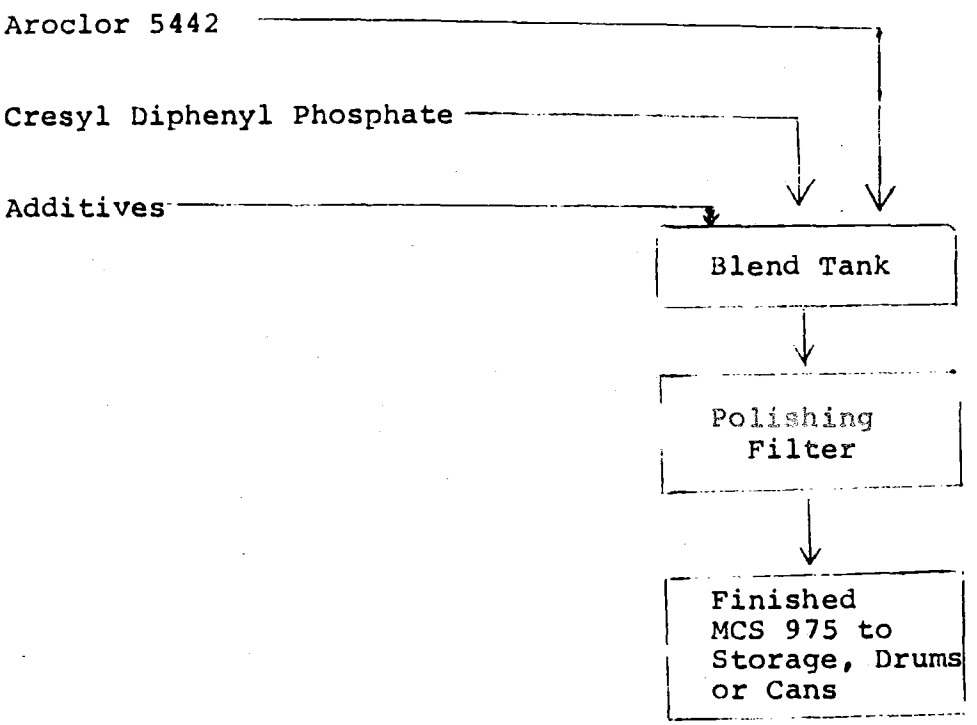
INTRODUCTION

MCS 975 (Pydraul 625A) is a fire resistant air compressor lubricant and hydraulic fluid. This formulation was developed to eliminate Aroclor 1260 from the blend and to use cresyl diphenyl phosphate to replace tricresyl phosphate.

SYNOPSIS OF PROCESS

MCS 975 is prepared by blending Aroclor 5442 with cresyl diphenyl phosphate and additives. The blended product is filtered through a simple filter to remove any stray debris from raw materials or blending and is transferred to containers or storage.

FLOW SHEET



BILL OF MATERIALS

Basis, 100 lb of product

Raw Material	Weight, lb
82621 - Aroclor 5442	51.0
80077 - Cresyl diphenyl phosphate	48.7
82113 - Santolube 70-A	0.3
20640 - Dye, DuPont Oil Blue A	0.003
31100 - Dow Corning 200 Fluid, 350 cs	0.002

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PROCESS IN DETAIL

The blending operation may be carried out in any suitable metal or glass lined vessel. The materials are not corrosive and carbon steel equipment is suitable. An agitator should be provided.

To the clean, dry vessel charge the cresyl diphenyl phosphate (CDP). Addition of the Aroclor 5442 will depend on local preference for handling. The Aroclor can be added as a crushed solid or in the molten liquid state.

Aroclor 5442 is a resinous, glassy solid at room temperature. In this state it is friable and can be crushed to small chunks for addition to the heel of CDP. If addition is made in the molten state, Aroclor 5442 should be heated to 180 to 200F (82 to 93C). At 180F viscosity is 300 to 500 centistokes and at 200F, 80 to 120 cs.

The dye should be carefully measured on a suitable scale or balance and added as a solid to the batch. Note: relatively small changes in dye concentration or incomplete mixing can cause batch-to-batch color variations.

Santolube 70-A and Dow Corning Fluid are added in the quantities indicated. These, too, should be measured carefully since variations will affect acidity specs, anti-rust performance, and foam.

It is suggested the blend be warmed to 125 to 150F (50 to 65C) and agitation continued for sufficient time to insure complete component mixing. Thirty minutes to one hour should be sufficient. Lower blending temperatures may be used if experience indicates satisfactory mixing. Heat from molten Aroclor 5442 may be sufficient to raise batch temperature. The low viscosity of Aroclor 5442 at 200°F will aid dispersion in phosphate ester. The batch is then circulated through a polishing filter. Samples are taken as required for analytical purposes. The batch may be held for possible viscosity adjustment or be sent to storage. After blending is complete, it is recommended that the temperature be reduced to 80 to 129F (26 to 49C). Prolonged exposure at higher temperatures may cause some product quality deterioration.

DISCUSSION OF IMPORTANT VARIABLES

The most important specification property of MCS 975 is viscosity. Adjustments in the blend should be made to keep the 100F viscosity within the required specification range.

If the 100F viscosity is low, add Aroclor 5442. One lb of Aroclor 5442 per 100 lb of blend will increase the 100F viscosity about 14 centistokes.

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If the 100F viscosity is high, add CDP. One lb of CDP per 100 lb of blend will decrease the 100F viscosity about 14 cs.

The quantity of dye, Santolube 70-A, and Dow Corning Fluid added should be carefully measured on a suitable small balance or scale. This is important to insure uniform color from batch-to-batch, acidity, antifoam, and antirust protection.

Another caution mentioned in the previous section concerned prolonged heating. It is suggested that maximum temperatures of 125 to 150F be limited to 2 or 3 hours. Also, manner of heating the batch should control film temperatures so there are no significant hot spots. Prolonged heating may cause gradual darkening of the product as well as gradual increase in acidity due to decomposition of the CDP.

MATERIAL SPECIFICATIONS

Raw Materials

Refer to raw material specification sheets included in the Appendix.

Finished MCS 975

Typical analyses and suggested specification limits follow:

Property	Tentative Specification	Typical Value
Appearance	Clear blue liquid	
Viscosity, cs		
At 100 F	125-145	132.
At 210 F	6.7-7.2	6.81
Acidity, mg KOH/gm	0.30 max.	0.07
Specific Gravity, 25/25C	1.30-1.34	1.322
Moisture, KF	0.15 max.	0.03
Pour point (each 10th lot)	+5°F	-5°F

ANALYTICAL METHODS

No new or special analytical procedures are required for this product. A cross reference table appears in the Appendix listing

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standard analytical procedures used at J. F. Queeny Plant, W. G. Krummrich Plant, and at the Anniston Plant. These procedures are currently used on similar products.

TOXICITY AND HAZARDS

No unusual toxicity or hazards are expected with the raw materials or finished blend. The process is a simple blending procedure and no hazardous reactions should occur between the various components.

Aroclor 5442 and CDP have been known materials produced by Monsanto for many years. CDP has been used in Pydraul fluid formulations. (Note: Current specific toxicity information is being obtained from the Medical Department on these materials and it is suggested these be included in the Appendix of this report.)

General Precautions include the following:

1. Goggles should be worn where splashing or spillage may occur.

2. Any material in contact with the skin should be removed by washing with soap and water.

3. Prolonged or repeated exposure to the skin may cause irritation due to removal of skin oils with resulting dryness and chapping.

4. Material may be irritating to sensitive skin areas and eyes. In case of contact with eye tissue, flush copiously with water and then get medical attention.

5. In case of internal ingestion get immediate medical attention.

6. Avoid inhaling volation material or mists.

POLLUTION CONTROL

No waste by-products are generated by this process. Used filtering material, flushings from the system during cleaning, as well as any spoiled product should be disposed of as dictated by local regulations.

APPENDIX

L. R. STARK

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Manager of Research

Feb 2, 1970
Date of Approval

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IN 610

APPENDIX

PHYSICAL CONSTANTS DATA

SUBSTANCE	STRUCTURAL FORMULA
MCS 975 (Pydraul 625A)	Blend: 51% wt. Aroclor 5442 48.7% Cresyl diphenyl phosphate Additives
COMPILED BY / DATE	

NAME		SOURCE & DATE
Formula	Blend	
Molecular Weight		
Appearance	Clear, blue oily liquid	
Boiling Point at 760 mm	770°F	
Boiling Point at 1.4 mm	200C	
Boiling Point at ~~mm~~ 0.55x10^{-2}mm	100C	
Boiling Point at mm		
Crystallizing Point	None	
Melting Point	None	
Solution Point		
Specific Gravity @ 25/25C	1.30-1.34	
Specific Gravity @		
Pounds per Gal. @ 25 °C	11.0	
Coefficient of Expansion	.00048	
Refractive Index @ n_D		
Infra Red Spectrum *(Reference)*		
Ultra Violet Spectrum *(Reference)*		
Viscosity @ 100F	125-145 cs	
Viscosity @ 210F	6.7-7.2 cs	
Surface Tension		
Solubility in Water	Nil	
Solubility in		
Solubility in		
Pour Point	-5°F typical (+5F max)	
Moisture (Karl Fisher)	0.03 (typical)	
Thermal Cond. (BTU/hr/ft/°F)	0.0623 (est)	
Flash Point °F *(Method)* ASTM D-92	435F	
Fire Point °C ASTM D-92	760F	
Heat of Combustion		
Heat of Formation		
Thermal Stability (cal. kg. min.)		
Latent Heat of Fusion		
Latent Heat of Vap.		
Specific Heat BTU/°F/lb	0.300 (est)	
Critical Temperature		
Critical Pressure		
Dissociation Constant		
Acidity, mg KOH/gm	0.07 (0.3 max)	
Foam ASTM D-972 @ 75F 5ml	0 sec.	

the Constants

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Analytical Procedures

Property	WGK	JMC	Anniston	ASTM
Appearance	12809	16-B	G-1	-
Viscosity	12837	126-A	049	D-445
Flash & Fire Point	12803	50-A	114	D-92
Specific Gravity	12804	116-B	052	-
Pour Point	13005	100-A	053	D-97
Cloud Point	-	36-A	-	D-2500
Acidity	12794	80-B	050	D-664/D-974
Moisture	12810	78-B	047	D-1744
Foam	12803	54-A	-	D-892
Refractive Index	13123	104-A	048	D-1218
Distillation Range	10117	-	054	Modified D-20

* Approximate equivalent ASTM method.

DSW 620148

Monsanto
ORGANIC CHEMICALS DIVISION

FINISHED PRODUCT SPECIFICATION

PRODUCT		DEPT.
Aroclor 5442		27-S
PLANT	PRODUCT CODE	USE
Anniston	826.21	Sales
DATE EFFECTIVE	SALES CODE	
3-15-66	1040-470-04-009	

APPROVALS

PRODUCTION	RESEARCH
R. G. Moody /s/ 12-29-65	L. R. Stark /s/ 3-11-66
SALES	QUALITY CONTROL (Chief Chemist)
W. E. Ault /s/ 3-2-66	O. E. Dolin /s/ 12-29-65

GENERAL DESCRIPTION

Mixture

CHEMICAL FORMULA

MOL WT.

SUPERSEDES SPECS. OF	SAMPLE FOR ANALYSIS	ISSUED BY
4-25-61	1 x 16 oz. Can or W.M. Bottle	J. A. Liddle 11-30-65

CHARACTERISTIC	LIMITS	METHOD
UNRESTRICTED INFORMATION		
(R) Appearance and Color	Clear, yellow sticky resin	G-1
(R) Color, NPA, Molten	2 Max.	G-4
(R) Softening Point, °C	46 - 52	115
Acid No., mg. KOH/g	0.05 Max.	116

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MONSANTO COMPANY
ORGANIC CHEMICALS DIVISION
J. F. QUEENY PLANT
FINISHED PRODUCT SPECIFICATION

PRODUCT CODE	DEPT. OR JOB
80077/80151	

USE: Sales - W.F.Waychoff, Manager and Internal for blends

SALES CODE: 7680-940-04-001

ISSUED JAN. 23,1967
STANDARDS DEPARTMENT
J. F. Queeny Plant
By Paul N. Brien

PRODUCT (Trade Name)	TYPE
SANTICIZER 140	A GRADE
PRODUCT (Chemical Name)	TYPE
CRESYL DIPHENYL PHOSPHATE	A GRADE

CHEMICAL FORMULA

MOL WT.

SUPERSEDES SPECS OF	SAMPLE FOR ANALYSIS
November 26, 1963	1 x 16-ounce NN Flint Bottle

TEST	UNRESTRICTED SALES LIMITS	CONTROL LIMITS	METHODS
On each lot			
Acidity	0.20 meq/100 g. max. (=0.01% max. as H_3PO_4)	0.15 meq/100 g. max.	4-A
Appearance	Clear, mobile liquid	Clear, mobile liquid	16-B
Color	APHA 40 max.	APHA 15 to 35	38-D
Moisture (By KF in methanol)	0.15% max.	0.12% max.	78-B
Odor	Essentially odorless	Essentially odorless	84-A
Specific gravity @ 25/25°C	1.203 to 1.213	1.205 to 1.208	116-B
Stability to $KMnO_4$	65% transmission, min.	65 to 90% transmission	118-D
Upon request			
Refractive index @ 25°C	1.550 to 1.570	1.558 to 1.563	104-A

Sampling procedure

1. Circulate storage tank the night before filling shipping containers.
2. While filling drums or tank car, take one 16-ounce bottle from the filling line and submit to the laboratory for analysis.

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J. F. QUEENY PLANT
MONSANTO COMPANY
ORGANIC CHEMICALS DIVISION

RAW MATERIAL SPECIFICATION

MATERIAL CODE: 31100.

USING DEPTS.: Fluid Blends

SUPPLIER: Dow Corning Corporation

FEB. 8, 1968

MATERIAL: DOW CORNING 200 FLUID - 350 cs.

CHEMICAL FORMULA:

MOL WT.:

SUPPLIER DATED OF: October 28, 1964

SAMPLE FOR ANALYSIS: 1 x 8-ounce Bottle

TEST	UNRESTRICTED PURCHASE LIMITS	METHODS
On each lot		
Appearance	Syrupy liquid	16-B
Refractive index @ 25°C	1.4020 to 1.4040	104-A
Specific gravity @ 25/25°C	0.969 to 0.975	116-A
Viscosity @ 25°C	332.5 - 367.5	126-31100
Upon request		
Color - modified Barrett	1.5 max.	38-H
Flash point	600°F min.	50-A
Neutralization No.	0.01 max.	80-B
Volatility (24 hrs./150°C)	0.5% max.	128-B

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MONSANTO COMPANY
ORGANIC CHEMICALS DIVISION

J. F. QUEENY PLANT
RAW MATERIAL
SPECIFICATION

MATERIAL CODE
81797

USING PLANTS
Fluid Blends

SUPPLIER
Monsanto - Nitro Plant

MAY 9, 19

MATERIAL
SANTOLUBE 70-A

CHEMICAL FORMULA

Blend of: Santolube 70 98.35%
Santolene C 1.65%

MOL. WT.

SUPERSEDES SPECS OF 6-21-67 for
Santolube 70: Nitro code 81787

SAMPLE FOR ANALYSIS
1 x 16 ounce WM Bottle

TEST	RESTRICTED INTER-PLANT LIMITS	PROCEDURES NITRO	JFQ
On each lot			
Appearance	Dark, oily liquid	6-C-01	16-B
Color ASTM Dilute	5.5 max.	6-C-21	38-1
Neutralization No.	51 to 61	6-A-24	80-A
Solubilities: 5%/vol. in PE	Clear	6-V-15	112-A
Specific gravity @ 25/25°C	0.89 to 0.97*	6-D-07	116-1
Upon request			
Emulsification test	40, 40, 0 (30 min.)	6-S-26	--
Santolene C presence	Positive phosphorous test	-----	----
Viscosity @ 210°F	70 to 300 SUS*	6-X-02	126-A

*Typical ranges submitted by Nitro.

Special requirements

This material is shipped upon invoice certification of compliance with specifications. Prior permission will be obtained to ship non-specification grade material.

This specification is the property of Monsanto and is intended for internal use only.

DSW 620152

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Monsanto

FROM (NAME & LOCATION) William H. Hunt, - Medical Department

DATE January 23, 1970

cc C.W. Richard
L.R. Stark
J.F. Herber
J.D. Sullivan

SUBJECT Pydraul 625-A MCS-975
Acute Toxicty Screen

REFERENCE

TO : P.D. Fowlkes

The undiluted sample was classed as practically non-toxic when administered orally to mixed sex rats. The acute oral LD_{50} was 12,300 mg/kg. Time to death was 1 to 2 days. Toxic signs were reduced appetite and activity, increasing weakness, collapse, and death. Macscopic examination of those that succumbed revealed slight liver discoloration, hemorrhagic lungs, and gastrointestinal inflammation. Macroscopic examination of those that were sacrificed revealed slight lung congestion and slight liver discoloration from the higher dosed animals and a normal viscera in the lower dosed animals.

The undiluted sample was classed as practically non-toxic when applied to and retained for 24 hours on the clipped intact skin of mixed sex rabbits. The acute minimal lethal dose was greater than 7940 mg/kg. Toxic signs were reduced appetite and activity, mild diarrhea, and lethargy. Macroscopic examination of the sacrificed animals revealed areas of lung congestion, slight liver discoloration, and slight gastrointestinal inflammation in the higher dosed animals, but a normal viscera in the lower dosed animals.

The undiluted sample was classed as a slight to mild irritant when applied to and retained for 24 hours on the clipped intact skin of mixed sex rabbits. The average maximum score (2/8) was attained 24 hours after removal of the sample from the skin. The skin was normal (0/8) 96 hours after removal of the sample. Maximum irritation produced a well defined erythema, but no edema.

The undiluted sample was classed as a slight irritant when instilled into and retained for 24 hours in the conjunctival sac of the rabbit eye. Maximum irritation (2/110) occurred 1 hour after instillation and consisted of slight erythema with no edema. At 24 hours of contact the eye was normal (0/110) and at this time the eye was irrigated with water.

When male rats were exposed for 6 hours to the vapors from the undiluted sample, at ambient temperature, there were no deaths nor toxic signs. The sample was classed as practically non-toxic under the conditions of this test. Macroscopic examination of the sacrificed animals revealed a normal viscera.

No special handling of this product appears necessary.

If excessive skin contact, wash off with soap and water.

In case of accidental eye contact, flush out with water.

William H. Hunt

William H. Hunt, Ph.D.

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