ORGANIC CHEMICALS DIVISION RESEARCH Report

REPORT NO.- P-1550 JOB NO.- 2-21-760.01-1113115

TENTATIVE PROCESS FOR

MCS 976 (Pydraul AC-A)

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

Monsanto

ST LOUIS, MISSOURI

MONS 020986

1) MCS 976 (Pydraul AC-A) a fire-resistant air compressor lubricant
2) Arolor 5442 - used for blending MCS 976
3) Cresyl diphenyl phosphate in place of Triethyl phosphate for blending MCS976

SAFETY REVIEW COMMITTEE
APPROVED BY
2/9/70
2/9/70
2/9/70

FILE Hydraulic Fluid

Monsanto Company
Organic Chemicals Division
St. Louis Research Department

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TENTATIVE PROCESS

FOR

MCS 976 (Pydraul AC-A)

Job No. 2-21-760.01-1113115

December 30, 1969

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Organic Chemicals Division
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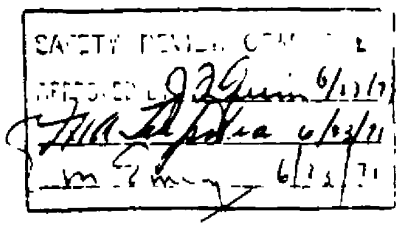
June 14, 1971



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TENTATIVE AMENDMENT A

TO THE

TENTATIVE PROCESS

FOR

PYDRAUL AC-A

Report No. P-1550, dated December 30, 1969

Job No. 2-21-760.01-1111015

Objective: Change of raw materials used in blend.

Present Practice

The present tentative process enables the blending of Pydraul AC-A, a fire resistant air compressor fluid.

Proposed Change

The revised formulation for Pydraul AC-A is presented. The change consists of substituting Aroclor 5432 for the Aroclor 5442 used in the original blend. This modification is intended to reduce or eliminate the formation of solids which has occurred in air compressor lubricators in isolated instances. The new blend also costs 7% less for raw materials and will be a step towards the elimination of Aroclor 5442 from Pydraul blends. This will simplify inventory control for Central Drumming and improve plant safety since the 5432 may be pumped at a lower temperature than 5442.

Bill of Materials

Basis: 100 lbs. of product

		Wt., lbs.
80151	Santicizer 140	46.5
82623	Aroclor 5432	53.5
20640	DuPont Oil Blue A Dye	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 dissolves. The sensible heat of the 5432 should facilitate blending of the two 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 AC-A 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 6 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 7 centistokes.

Material Specifications

Property	Tentative Specification	Typical Value	JFQ Method
Appearance	Clear blue liquid		16-B
Viscosity, Cs.			
at 100°F.	85-95	90.9	126-A
at 210°F.	5.6-6.0	5.81	
Acidity, mg. KOH/g.	0.15 max.	0.06	80-B
Specific Gravity 25/25°C.	1.25-1.29	1.271	116-A
Moisture, KF	0.15 max.	0.02	78-B

MONS 020990

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

L. R. Stark 6/18/71

File copy approved by:

W R Richard — 6/18/71
Manager, R&D — (date)

J R Savage — 6/21/71
Manager of Manufacturing — (date)

O. De Garmo (JRG) — 6/23/71
Manager of Process Technology — (date)

/is
6/16/71

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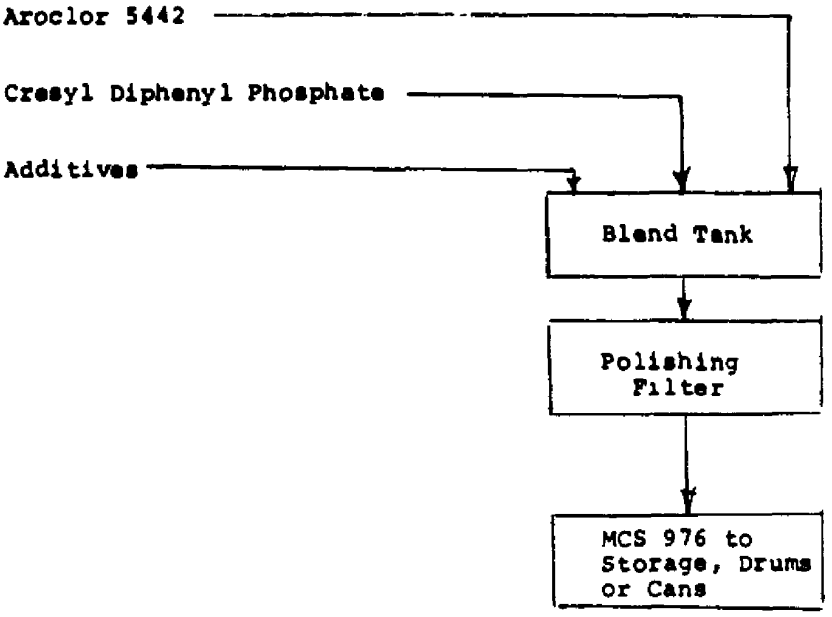
INTRODUCTION

MCS 976 (Pydraul AC-A) is a fire resistant air compressor lubricant. This formulation was developed to eliminate Aroclor 1254 from the Pydraul AC blend and to use cresyl diphenyl phosphate to replace tricresyl phosphate.

SYNOPSIS OF PROCESS

MCS 976 is prepared by blending Aroclor 5442 with cresyl diphenyl phosphate and blue dye. 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	43.4
80077 - Cresyl diphenyl phosphate	56.6
20640 - Dye, DuPont Oil Blue A	0.003

MONS 020993

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.

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 976 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 7 centistokes.

If the 100F viscosity is high, add CDP. One lb of CDP per 100 lb of blend will decrease the 100F viscosity about 7 cs.

The quantity of dye added should be carefully measured on a suitable small balance or scale. This is important to insure uniform color from batch-to-batch.

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 976

Typical analyses and suggested specification limits follow:

Property	Tentative Specification	Typical Value	JFQ Method
Appearance	Clear blue liquid		16-B
Viscosity, cs			
At 100 F	85-95	89.1	126-A
At 210 F	5.9-6.3	6.1	
Acidity, mg KOH/gm	0.15 max.	0.09	80-B
Specific Gravity, 25/25C	1.285-1.325	1.307	116-A
Moisture, KF	0.15 max.	0.02	78-B
Pour point (each 10th lot)	+5°F	-5°F	100-A

ANALYTICAL METHODS

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

File Copy Approved by
Manager of Research

Feb 2, 1970
Date of Approval

APPENDIX

PHYSICAL CONSTANTS DATA

CONTENT	STRUCTURAL FORMULA
MCS-976 (Pydraul AC-A)	Blend: 43.4% wt. Aroclor 5442 56.6% Cresyl diphenyl phosphate
COMPILED BY / DATE	

NAME		SOURCE & DATE
Formula	Blend	
Molecular Weight		
Appearance	Clear, blue oily liquid	
Boiling Point at 760 mm	787°F	
Boiling Point at 2, 3m	200C	
Boiling Point at mm 1.7×10^{-2} mm	100C	
Boiling Point at mm		
Crystallizing Point	None	
Melting Point	None	
Solution Point		
Specific Gravity v 25/25C	1.285-1.325	
Specific Gravity v		
Pounds per Gal v 25°C	10.9	
Coefficient of Expansion	.00045	
Refractive Index v n_D^{δ}		
Infra Red Spectrum (Reference)		
Ultra Violet Spectrum (Reference)		
Viscosity v 100F	85-95 cs	
Viscosity v 210F	5.9-6.3 cs	
Surface Tension		
Solubility in Water	NIL	
Solubility in		
Solubility in		
Pour Point	-5F typical (+5F max)	
Moisture	0.02 (typical)	
Thermal Cond. BTU/hr/ft/°F	00.0080	
Flash Point °F (Method) ASTM D-92	475F	
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	0.31 (est.)	
Critical Temperature		
Critical Pressure		
Dissociation Constant		
Acidity, mg KOH/gm	0.15 max.	
Foam, ASTM D-972, 75F	5ml, 0 sec.	

MONS 020997

Analytical Procedures

Property	WOK	JNC	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	12805	54-A	-	D-892
Refractive Index	13123	104-A	048	D-1218
Distillation Range	10117	-	054	Modified D-86

* Approximate equivalent ASTM method.

MONSANTO COMPANY
ORGANIC CHEMICALS DIVISION

J. F. QUEENY PLANT
FINISHED PRODUCT
SPECIFICATION

PRODUCT CODE: 80077/80151
DEPT. OR JOB:
USE: Sales - W.F.Waychoff, Manager and Internal for blends
SALES CODE: 7680-940-04-001

ISSUED JAN. 23,1967
STANDARDS SUPERSEDED
[illegible]

PRODUCT (Trade Name): SANTICIZER 140 — TYPE: A GRADE
PRODUCT (Chemical Name): CRESYL DIPHENYL PHOSPHATE — TYPE: A GRADE
CHEMICAL FORMULA:

MOL WT.:
SUPERSEDES SPEC OF: November 26, 1963
SAMPLE FOR ANALYSIS: 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	1.560 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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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. B. Stark /s/ 3-11-66
SALES	QUALITY CONTROL (Senior Chemist)
W. E. Ault /s/ 3-2-66	O. E. Dolin /s/ 12-29-65

GENERAL DESCRIPTION

Mixture

CHEMICAL FORMULA

MOL WT.		
SUPERSEDES SPEC. DT.	SAMPLE FOR ANALYSIS	REQUEST 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	C-1
(R) Color, HPA, Molten	2 Max.	C-4
(R) Softening Point, °C	46 - 52	115
Acid No., mg. KOH/g	0.05 Max.	116

Monsanto

William H. Hunt - Medical Department

DATE January 23, 1970

SUBJECT Pydraul AC-A, MCS-976
Acute Toxicity Screen

TO P.D. Fowlkes

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

The undiluted sample was classed as practically non-toxic when administered orally to mixed sex rats. The acute oral LD_{50} was 10,200 mg/kg. Most deaths occurred in 2 days. Toxic signs were reduced appetite and activity, increasing weakness, collapse, and death. Macroscopic examination of those that succumbed revealed slight liver discoloration, hemorrhagic lungs and gastrointestinal inflammation. Macroscopic examination of those that were sacrificed revealed areas of lung congestion in those receiving the higher doses, while those that received the lower doses exhibited a normal viscere.

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 greatly reduced appetite and activity, mild diarrhea and lethargy. Macroscopic examination of the sacrificed animals revealed lung congestion, slight liver discoloration, and slight gastrointestinal inflammation in the higher dosed animals, while the lower doged animals revealed a normal viscera.

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. Maximum irritation (2/8) occurred 24 hours after removal of the sample from the skin. The maximum irritation consisted of well defined erythema but no edema. The skin was normal 96 hours after removal of the sample.

The undiluted sample was classed as a slight irritant when instilled and retained for 24 hours in the conjunctival sac of the rabbit eye. Maximum irritation (1.3/110) occurred 1 hour after instillation and consisted of slight erythema with no edema. At 24 hours of contact the eye was normal (0/110), at which time it was irrigated.

The saturated vapors of the sample, at ambient temperature, were classed as practically non-toxic when male rats were exposed to them for 6 hours. There were no toxic signs. Macroscopic examination of the sacrificed animals revealed a normal viscera.

No special handling of this product appears necessary.

In case of excessive skin contact wash off with soap and water.

In case of accidental eye contact flush out with water.

William H. Hunt, Ph.D.

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P-1550

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