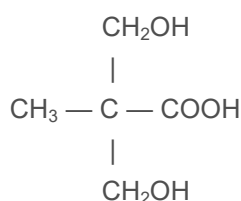


DMPA[®]

DMPA[®] Dimethylolpropionic Acid in Fast Drying Water Soluble Enamels



CAS Number: 4767-03-7

DMPA[®] Dimethylolpropionic Acid can be used in the preparation of alkyd resins capable of producing fast drying water soluble enamels. The alkyd resin formulations listed below, WA-78 and WA-101, were produced with a *two-stage resin processing technique* in which **DMPA[®]** was coupled to a hydroxyl terminated pre-polymer with a dibasic acid. These formulations demonstrate the ability to develop waterborne alkyd resins without the use of trimellitic anhydride (TMA), a hazardous chemical that poses significant safety and handling concerns.

Specifications

Property	Regular Grade
Hydroxyl Content, wt %	24.0 min
Neutralization Equivalent	141.0 max
Ash as Na ₂ O, wt %	0.03 max
Moisture, wt %	0.3 max
Water Insolubles, ppm	50.0 max
Colour, APHA	250 max

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Data generated on coatings formulated with WA-78 and WA-101 resins are compared to a popular, commercially available, water-borne alkyd paint made with TMA (labelled "Control"). As the data demonstrate, the enamels containing DMPA showed equivalent performance when compared to the enamel containing TMA.

The benefits of using **DMPA[®]** in alkyd resins are summarized as follows:

- Elimination of a hazardous raw material -TMA,
- Potential for improved processing time,
- Very fast air drying (19 min. soft to touch ; 3.5 hrs. completely dry),
- Good weathering and gloss retention,
- Improved stability in the presence of metal ions.

In addition, it is worthwhile to mention that **TRIMET[®] TME** Trimethylolethane was also utilized in the WA-78 and WA-101 formulations. Both **DMPA[®]** and TME based resins are known to have excellent hydrolytic stability, heat stability and resistance to yellowing due to the stable neopentyl structure of these compounds.

All information and data, including the formulations and procedures discussed herein, are believed to be correct. However, this should not be accepted as a guarantee of their accuracy, and confirming tests should be run in your laboratory or plant. No statement should be construed as a recommendation for any use which would violate any patent rights. Sales of all products are pursuant to terms and conditions included in GEO Specialty Chemicals sales documents. Nothing contained therein shall constitute a guarantee or warranty with respect to the products described or their use. Safety information regarding these products is contained in their Safety Data Sheets. Users of these products are urged to review and use this information.

REVISION DATE: OCTOBER 2020

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Resin Production

Table 2—Clear Water Soluble Varnish formulation

Formula	WA-78		WA-101	
	moles	grams	moles	grams
Stage 1				
Pamolyn 200 1	0.47	133	0.82	233
TRIMET [®] TME 2	1.97	242	1.64	202
Isophthalic Acid	1.37	227	1.25	208
Benzoic Acid	1.10	134	1.39	169
Pentaerythritol, Technical	0.22	32	0.46	67
Stage 2				
DMPA [®] Dimethylolpropionic Acid 3	0.55	73	0.52	70
Phthalic Anhydride	1.10	162	1.04	155
Pamolyn 200	0.35	100	-	-
Water of Reaction	-	(104)	-	(104)
Yield	-	1000	-	1000

Processing:

1 Charge Stage 1 materials and slowly heat to a maximum temperature of 230°C. Hold until the acid value is below 10. Cool to 175°C and add Stage 2 materials.

2 Cook at a maximum temperature of 205°C to an acid value of 52 and an ICI cone and plate viscosity of 16-18 poise at 125°C. (To preserve the hindered -COOH on DMPA, batch temperature should be controlled at or slightly below 205°C for Stage 2).

3 Cool to 150°C or below and let down to 75% NVM in 4:1 by volume butoxyethanol / s-butyl alcohol.

1 Eastman, Inc.

2 GEO Specialty Chemicals, Inc., Paints & Coatings Group

3 GEO Specialty Chemicals, Inc., Paints & Coatings Group

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Resin Properties

Resin Properties		
	WA-78	WA-101
Viscosity, Gardner (75%) NVM	Z6	Z6
Colour, Gardner	6-7	5-6
Density, grams / litre	1120	1110
Flash Point, Pensky Martins, °C	50	53

Enamel Preparation

Resin Properties		
	kg	litres
Resin WA-78*, 75% NVM	93.4	82.1
Water, de-ionized	131.7	132.1
Ammonia, 28%	5.6	6.1
Titanium Dioxide, R-960 ⁴	95.8	23.5
Disperse to NS 6+, then add		
Resin WA-78*, 75% NVM	34.3	30.3
Ammonia, 28%	2.7	3.0
s-Butyl Alcohol	6.4	7.9
Drier Pre-mix		
Exkin No. 2 ⁵	0.4	0.4
18% Zirco ⁶	0.4	0.4
6% Cobalt Naphthenate ⁶	1.4	1.5
Butoxyethanol	11.8	7.9
BYK 301 ⁷	0.8	0.8
Water, de-ionized	82.3	82.5
Total	467.0	378.5
Adjust pH to 8.0-8.5		

4 E.I. DuPont de Nemours, Inc.

5 Nuodex Chemicals, Inc.

6 Interstab Chemicals, Inc.

7 BYK Gardner

8 A commercial waterborne alkyd made the conventional way using TMA

* similar paints were prepared with WA-101 and Control⁸

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Enamel Properties

	Values
Density, grams / litre	1223
Solids by weight, %	41.4
Solids by volume, %	26.4
Pigment / binder ratio	1.0
Volatile organic comp., grams / litre	300

Registration & Regulatory Information: Please refer to the safety datasheet.

Handling & Storage: DMPA[®] is classified as “DOT not regulated” by the US Department of Transportation and requires no special labelling for shipment. The Harmonized Tariff Code is 2918.19.40

DMPA[®] should be stored in a clean, dry area, following good warehousing practices.

Shelf-life: DMPA[®] has a minimum shelf of not less than 3 years if stored in its original unopened container and under normal storage conditions.

Miscellaneous: DMPA[®] is packaged in 250lb fibre drums, 50lb and 25kg multi-wall paper bags with HDPE liners and 500kg super sacks with LDPE liners.

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Enamel Test Results

Enamel Properties

	Enamel Based on WA -78 Resin	Enamel Based on WA-101 Resin	Enamel Based on Control Resin
Dry times ⁹			
Set-to-touch min.	19	20	27
500g Zapon, hr.	2	2.25	5.5 - 6.0
Through dry, hr.	3.5	3.5	5
Stability 50°C			
Initial pH	8.3	8.3	8.2
Viscosity KU	81	94	53
3 week pH	7	7	7.5
Viscosity KU	89	100	53
Weeks to fail	5	4	5
Sensitivity to Metal Ions ¹⁰, ml of .1N solution / 100g resin solids			
Calcium	69	48	20
Magnesium	71	49	25
Barium	84	53	31
Zinc	68	44	71
Lead II	52	37	37
Aluminium	13	8	35
Dry Film Properties ¹¹			
Pencil Hardness	F-H	F	H
Reverse Impact, in-lb	< 4	< 4	< 4
Crosshatch Adhesion	100	100	100
Weatherometer 500 hrs.			
Initial Gloss, 60°	91	91	84
Final Gloss	72	75	69
% Retention	80	83	82
Initial Gloss, 20°	73	74	50
Final Gloss	25	29	23
% Retention	34	40	47

9 0.025 mm dry film thickness; 25° C, 42% relative humidity

10 A. Heitkamp, J. Waterborne Coatings, May 1984 p.11

11 Tested at 0.025 mm dry film thickness on Bondrite 1000 panel after 7 days drying

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