Application Data

N-Methyl-2-Pyrrolidone

(NMP)
Graffiti Remover Formulations

General

Graffiti fighters can use NMP-based graffiti formulations to remove spray paints and permanent marker ink from brick, concrete, metal, glass, and even painted surfaces such as bathroom stalls, automobiles, and road signs. Based on cost, performance, safety, and environmental impact we recommend the following two starting formulations:

Component	Painted Surfaces Wt%	Brick Concrete Wt%	Function
NMP[1]	25	35	Ink & Paint Remover
DPMA or PC-1000[2]	69-71	59-61	Ink Remover /Degreaser
Strong Base[3]	0-2	0-2	0ptional Ink "Ghost" Rernover
Surfactant[4]	1-2	1-2	Compatibilizer /Rinsing Aid
Hydroxypropylcellulose[5]	1-2	1-2	Cellulosic Thickener
Flash Point (SETA, °F)	191[6]	191[6]	

1. N-Methyl-2-Pyrrolidone
2. Dipropylene Glycol Methyl Ether Acetate or Propylene
3. Carbonate e.g. Sodium Hydroxide
4. e.g. Triton X-100 (Union Carbide)
5. e.g. Klucel-H (Aqualon; a division of Hercules, Inc. (302)594-6786 or Methocel
6. 311 (DOW) Flash points were determined without added surfactant or hydrocarbons

Lyondell Chemical Company optimized the NMP content in the "Brick & Concrete" formulation to remove KRYLON® and Rustoleum® spray paints from uncoated porous surfaces. In addition, it can be used to remove spray paints from automobiles, road signs, bathroom stalls and other surfaces coated with epoxy or polyurethane-based paints. This formulation is, however, an effective paint stripper and will rapidly strip interior or exterior latex and alkyd paints. It should not be used to remove graffiti from surfaces coated with these types of paints. The "Painted Surfaces" formulation should be used on alkyd or latex-coated surfaces and also quickly removes permanent ink from hard surfaces. Do not use these formulations on plastic or vinyl surfaces without testing first.

Formulating Tips

- The addition of surfactants can improve storage stability and water rinseability.
- For the removal of the "ghost" caused by permanent ink dyes on painted surfaces, small amounts of sodium hydroxide (<2 wt%) can be added to the above formulations.
- The level of cellulosic thickener can be increased to 2% to make a gel or lowered for spray-on application. Non-cellulosic thickeners such as bentonite clays, fumed silicas, and polymers such as polystyrene or PVC are also effective but at higher levels (4-6 wt%).
- To ensure a well-blended product, the solvents and surfactant should be mixed together first under low speed and low shear with a paddle-type mixer. The thickener should then be added in four to five gradual increments to promote dispersion and prevent clumping.

Other Formulations

Low VOC Formulation

Up to 30% water can also be added to these formulations to meet new VOC regulations. A small amount of t-butanol must also be added to prevent phase separation. Although these formulations are slightly less effective than the water-free formulations, they are still effective graffiti removers and paint strippers on most paints.

Component	Low-VOC Formulation Wt%	Function
NMP	32	Ink & Paint Remover
DPMA or PC-1000	32	Ink Remover/Degreaser
Water	30	VOC Diluent
Alcohol[1]	3.5	Compatibilzer/Rinsing Agent
Surfactant[2]	2.0	Compatibilzer/Rinsing Agent
Klucel-H or HMPC[3]	0.5	Thickener

1. t-butyl alcohol (TEBOL®99 Lyondell Chemical Company, 1-888-777-0232).
2. e.g. Triton x-100 (Union Carbide) or Calsoft L-60 (Pilot Chemical)
3. Cellulosics (Aqualon, a division of Hercules, Inc., (302)594-6786

"Green" Formulations

NMP can also be formulated with organically-derived solvents such as terpenes and soy esters to give cost effective formulations which provide low flammability and are made predominantly from natural and renewable resources:

Component	No Flash Formulation Wt%	High Flash Formulation Wt%	Function
NMP	36	36	Paint/Ink Remover
Methyl Soyate	56	-	Degreaser
Glidsol 180	-	56	Degreaser
Triton X-100	2	2	Compatibilizer/Rinsing Aid
PVC	6	6	Thickener
Flash Point (SETAF)	>200	>140	
Viscosity (cps)	2777	318	

1. soybean oil-derived ester (Interchem Environmental, (913)599-0800);
2. Terpene blend (Lyondell Chemical)
3. Polyvinylchloride.

Low Cost Formulations

Hydrocarbons such as aromatics or mineral spirits can also be blended with NMP to lower cost and improve performance on some paints, crayons, lipstick and other non-polar graffiti. Flammable aromatics such as xylene and toluene are effective co-solvents but are listed on the EPA's list of hazardous air pollutants (HAPs list) and increase the formulation's flammability and worker inhalation hazards. The disadvantages of using hydrocarbon co-solvents include higher odor and flammability (aromatics), lower biodegradability, storage instability (mineral spirits), and lower water rinseability.

Water rinseability and storage stability can be improved by adding surfactants and using a non-cellulosic thickener. The following formulation combines low cost and performance comparable to straight NMP on alkyds and other low-resistance paints and coatings:

Component	Low-Cost Formulation Wt%	Function
NMP	26	Ink & Paint Remover
Mineral Spirits	70	Low Cost Diluent
Triton X-100	1	Compatibilizer/Stabilzer
Styrene/Isoprene Polymer	3	Thickener

Applicator

Graffiti Removal from Brick & Concrete

Apply the formulation using a paint brush, roller, or spray pump, depending on the thickness of the formulation. Let stand 10-15 minutes then rinse off with cold, medium- or high-pressure water. A power washer is recommended to remove the last traces of solid pigment imbedded in the brick or concrete. Allow the surface to dry and reapply if necessary.

Graffiti Removal from Painted Surfaces

Permanent ink can be removed from painted surfaces by applying the formulation to a dry rag and wiping the surface. The clean surface should then be wiped with a wet sponge or paper towel to remove residual formulation and prevent blistering of the paint.

Houston, Texas, USA l Tel: +1 713 309 7200 or toll-free within USA +1 888 777 0232
Rotterdam, The Netherlands l Tel: +31 10 275 5500
Hong Kong, China l Tel: +852 2882 2668

www.lyondellbasell.com

2593-V2-0511
Supersedes 2593-V2-0104