File No: NA/166

Date: July 22, 1994

NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

M390B Unsaturated Polyester Resin

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Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT

M390B Unsaturated Polyester Resin

1. APPLICANT

Paint Industries (Aust) Pty Ltd, 1-19 Bennet Street, Mortlake, NSW 2137

2. IDENTITY OF THE CHEMICAL

Chemical name: 1,3-Benzene dicarboxylic acid, polymer with 1,4-cyclohexane dimethanol, 2,2-dimethyl-1,3-propanediol and 2,5-furandione

Synonyms: 1,4-Cyclohexanedimethanol-isophthalic acid-maleic anhydride-neopentyl glycol copolymer

1,3-Propanediol, 2,2-dimethyl- polymer with 1,3-benzenedicarboxylic, 1,4-cyclohexanedimethanol and 2,5-furandione

2,5-Furandione, polymer with 1,3-benzene dicarboxylic acid, 1,4-cyclohexanedimethanol and 2,2-dimethyl-1, 3-propanediol

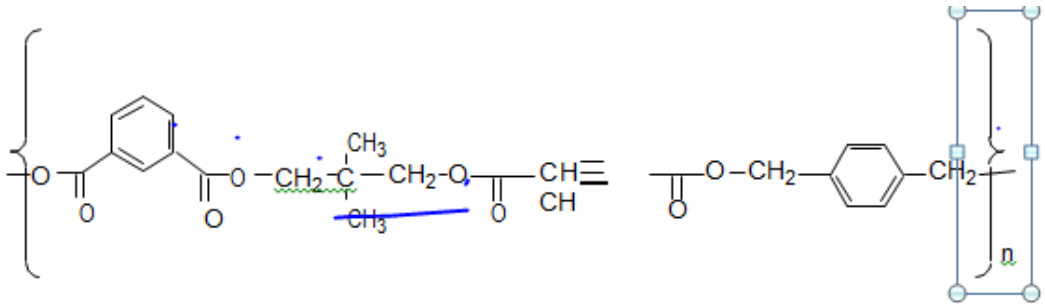
1,4-Cyclohexanedimethanol, polymer with 1,3-benzene-dicarboxylic acid, 2,2-dimethyl-1, 3-propanediol and 2, 5-furandione

Chemical Abstracts Service (CAS) Registry No.: 92230-55-2

Trade name: M390B Unsaturated Polyester Resin

Molecular formula: $(C_8H_6O_2, C_8H_{16}O_4, C_5H_{12}O_2, C_4H_2O_3)_n$

Structural formula:



Number-average molecular weight: 2200

Maximum percentage of low molecular weight species (molecular weight < 1000): 10%

Method of detection and determination: Infra-red spectroscopy

Spectral data:

An infra-red spectrum was provided for the notified polymer. Major peaks at 3580, 2938, 1727, 1646, 1476, 1397, 1377, 1304, 1263, 1161 (cm-1) were observed.

3. PHYSICO-CHEMICAL PROPERTIES

The polymer is made and used as a 67.5% solution in styrene, and is never used in isolation. Therefore the physical and chemical properties listed below, which are those of the polymer solution, reflect this, except where indicated.

Appearance:	light amber liquid
Odour:	pungent styrene smell
Melting Point:	not supplied
Boiling Point:	154^{o}C (for styrene)
Specific Density:	1.194 kg/m3 (base polymer) 1.080 kg/m3 (polymer solution)
Vapour Pressure:	4.5 mm Hg @ 20^{o}C (for styrene)

Comments on physico-chemical properties:

The boiling point was determined for styrene, as the polymer will only exist in a 67.5% solution in styrene.

The melting point was not supplied. This is acceptable as the substance is only present as a solution in styrene.

Water solubility was not determined, due to the presence of styrene in the polymer solution. This is acceptable, as polyesters are known to be highly insoluble in water.

The insolubility of M390B Unsaturated Polyester Resin also precluded the tests being conducted to determine partition coefficient, adsorption/desorption and dissociation, under the relevant OECD Guidelines.

The polymer contains a number of ester linkages, and thus hydrolysis is theoretically possible. However, the low solubility will preclude hydrolysis under environmental conditions.

4. PURITY OF THE CHEMICAL

Degree of purity : 90% (expected)

Toxic or hazardous impurities: none (contains < 0.1% of monomeric reactants)

Non-hazardous impurities (> 1% by weight)**:** none

Additives/Adjuvants:

(a) **Chemical name:** 1,2-benzenediol, 2-methyl-
Synonym: tert-butylpyrocatechin
CAS No.: 27213-78-1
Weight percentage: 0.005%

(b) **Chemical name:** 1,4-benzene diol, 2-methyl-
Synonym: toluhydroquinone
CAS No.: 95-71-6
Weight percentage: 0.007%

5. INDUSTRIAL USE

The polymer is used in the manufacture of pigmented gelcoats for fibre reinforced plastics. The gelcoats are applied to open mould surfaces by airless spray guns after the addition of chemical polymerisation initiators. Approximately 10-100 tonnes will be manufactured per annum over the next five years.

6. OCCUPATIONAL EXPOSURE

The notified polymer, M390B Unsaturated Polyester Resin, will be manufactured and formulated into gel coats at Mortlake, NSW.

The polymer will be manufactured in an enclosed heated reaction vessel. The reactant monomers, which are solids, will be loaded manually to a cold reactor which is sealed and heated. After melting, the esterification reaction will proceed with the elimination of water. Additional maleic anhydride will be added midway through the reaction when the temperature drops. When the reaction is complete, the batch will be cooled and polymerisation inhibitors added (tert-butylcatechol and toluhydroquinone). The batch will then be run into a churn containing cold styrene monomer and drummed through a filter into 200 litre steel drums. The resin solution is then transferred to a mixer for the addition of pigment to convert it to gelcoat. The formulated gelcoat will then be tapped from the mixer and packaged in 20 litre pails.

A total of 26 workers will be involved in the manufacturing, storage and transport of the polymer. Of these 26 workers, 12 will be involved in batch weighing and operation of the chemical plant. There will be 4 workers involved in storage and loading, and 2 drivers involved in transporting the notified product. Quality control testing and supervision involve another 8 workers. Occupational exposure will be minimal for the workers involved in operating the chemical plant as the process is fully automated.

7. PUBLIC EXPOSURE

The notified polymer will be used in the formulation of a gelcoat for use on fibre reinforced plastics. When applied, further polymerisation occurs, due to the addition of chemical polymerisation initiators, to form a laminate which is suitable for use in aquatic environments. The notifier has stated that the laminate is resistant to hydrolysis, weathering and environmental degradation. Therefore, when used in the intended fashion, the polymer is not expected to leach from the coating as it is tightly bound in a matrix which is resistant to degradation.

The polymer will be manufactured in Australia, stored in 200 L metal drums, and formulated on-site into the final gelcoat product. While contact with the materials which have been fabricated with the gelcoat is likely to be high, exposure to the polymer is expected to be negligible. Disposal of waste materials will be by incineration, treated water to sewer, or by approved landfill. Solids from the biodigestion processing of aqueous waste are transported to a farm location and incorporated into the soil as an approved fertiliser. While the notified polymer in styrene solution is only used at the site of manufacture, the formulated gelcoat (consisting of the polymer solution with pigmentation) is stored in 20 L pails, palletised, and transported by road.

8. ENVIRONMENTAL EXPOSURE

. Release

The company expects that the only release of the polymer during the formulation process will occur as a result of accidental spills during loading and unloading of the reaction chamber. Very small amounts of waste are expected from these incidents, and although the company has provided no estimates of the amounts expected, only 1-2% loss of the polymer could be reasonably expected to occur. This equates to 1 to 2 tonnes per year. Such spillages would be either be collected on adsorbent material or passed through the biodigestion process, with both sources of waste ultimately being sent to landfill. The inline incinerators, located in the production line, are expected to yield carbon monoxide, carbon dioxide and water vapour to the atmosphere.

The polymer resin solution is transferred to a mixer to allow the addition of pigments to convert the mix to gel coats. The company claims that approximately 3 kg per day of solid waste (for a 100 tonne per annum production volume) will be produced a day as a result of these processes. Assuming a worst-case scenario where production occurred every day of the year, this would result in approximately 1100 kg waste to landfill each year. Solid wastes will polymerise and be sent to landfill following collection. Gelcoats are drummed off into 20 L pails for distribution to customers.

Packaging wastes from the formulation processes will be disposed of in two ways. Empty drums will be sent to a drum recycler, with empty plastic and paper bags being landfilled. Again, no estimates of the quantity of residues that are likely to remain in these empty packs have been given, but minimal amounts of wastes are expected from these sources.

. Fate

Spillages as a result of formulation and use of gelcoats at the customers factories will be disposed of to approved landfills. Leaching from these sites is extremely unlikely as the polymer resin has a high molecular weight, and is relatively insoluble. In addition, the polymer is cured on application to surfaces, leading to greater insolubility in water. Hydrolysis and biodegradation of the cured resin under landfill conditions is also unlikely.

The notifier states that the polymer will form water vapour and oxides of carbon on combustion. The ultimate degradation products are likely to be oxides of carbon and hydrogen.

The fabricated products have been designed to resist weathering, and only minimal amounts of material could be expected from these sources. All fabricated products would be expected eventually to be disposed of to landfill.

9. EVALUATION OF TOXICOLOGICAL DATA

No toxicity data are required under the Industrial Chemicals (Notification and Assessment) Act 1989 for polymers with NAMW > 1000.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

No ecotoxicological data were provided, which is acceptable for polymers of NAMW >1000, according to the Act.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

As a result of both formulation and use of an assumed 100 tonnes of the polymer resin, an overall loss of approximately 20 tonnes per year can be expected. All of this waste would ultimately be placed in landfill. In the final, cured form the notified product is relatively inert and is not expected to biodegrade or accumulate in the environment when disposed of in landfill.

Less than 10% of the polymer has a molecular weight of under 1000. Whilst this fraction may be more bioavailable, the curing of the polymer after evaporation of the solvent and exposure to light and air will serve to minimise this hazard.

The main environmental hazard would arise through spillage in transport accidents that may release quantities of the uncured polymer to drains and waterways. In such a situation the polymer is expected to quickly become immobilised on association with the soil/sediment layer.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

The notified chemical has a low water solubility and a high molecular weight (NAMW > 1000) and is therefore unlikely to cross biological membranes and cause health problems. Measures taken to avoid exposure to the solvent styrene, which is more hazardous than the polymer itself, should minimise exposure to the notified polymer. The vapours can form explosive mixtures with air. The polymer contains less than 0.1% of hazardous monomer constituents. However, the potential for occupational exposure should be low and therefore the notified polymer should not pose a significant health and safety risk to humans.

When used as a component for the fabrication of fibre reinforced plastics, tightly bound in a polymer matrix, the potential for public exposure to the notified polymer is minimal.

In the case of an accidental spillage of the formulated gelcoat, the public may be exposed to the notified polymer. However this is minimised by normal recommended practices of storage and transportation.

13. RECOMMENDATIONS

To minimise occupational exposure to the notified polymer the following guidelines and precautions should be observed.

. If engineering controls and work practices are insufficient to reduce exposure to the polymer to a safe level then suitable personal protective equipment which complies with Australian Standards should be worn:

  . goggles with face shield (AS 1337-1984) (1);

- protective clothing (AS 3765.1-1990) (2); and
- chemically resistant gloves (AS 2161-1978) (3).

- Good work practices should be implemented to avoid spills, and prompt and proper cleaning should be practised in the event of a spill.
- Good personal hygiene practices should be observed.
- A copy of the Material Safety Data Sheet (MSDS) should be easily accessible to all employees.

14. MATERIAL SAFETY DATA SHEET

The MSDS for M390B Unsaturated Polyester Resin (Attachment 1) was provided in Worksafe Australia format (4). This MSDS was provided by Paint Industries (Aust) Pty Ltd as part of their notification statement. It is reproduced here as a matter of public record. The accuracy of this information remains the responsibility of Paint Industries (Aust) Pty Ltd.

15. REQUIREMENTS FOR SECONDARY NOTIFICATION

Under the Industrial Chemicals (Notification and Assessment) Act 1989, secondary notification of M390B Polyester Unsaturated Resin shall be required if any of the circumstances stipulated under subsection 64(2) of the Act arise. No other specific conditions are prescribed.

16. REFERENCES

1. Australian Standard 1337-1984 Eye Protectors for Industrial Applications, Standards Association of Australia Publications, Sydney, 1984.
2. Australian Standard 3765.1-1990 Clothing for Protection against Hazardous Chemicals Part 1 Protection against general or Specific Chemicals Standards Association of Australia Publications, Sydney, 1990
3. Australian Standard 2161-1978 Industrial Safety Gloves and Mittens (excluding Electrical and Medical Gloves), Standards Association of Australia Publications, Sydney, 1978.
4. National Occupational Health and Safety Commission, Guidance Note for Completion of a Material Safety Data Sheet, 3rd Edition, Australian Government Publishing Service Publications, Canberra 1991.