File No: PLC/35

Date: October 1996

NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

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Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT

1,3-benzenedicarboxylic acid, polymer with 3-(dodecenyl) dihydro-2,5-furandione and 1,1-[(1-methylethylidene)bis(4,1-phenyleneoxy)]bis[2-propanol]

1. APPLICANT

Brother Industries (Australia) Pty Ltd of 7 Khartoum Road NORTH RYDE NSW 2113 has submitted a notification statement accompanying their application for assessment of a synthetic polymer of low concern, 1,3-benzenedicarboxylic acid, polymer with 3-(dodecenyl) dihydro-2,5-furandione and 1,1-[(1-methylethylidene) bis(4,1-phenyleneoxy)]bis[2-propanol].

2. IDENTITY OF THE POLYMER

Chemical Name: 1,3-benzenedicarboxylic acid, polymer with 3-(dodecenyl) dihydro-2,5-furandione and 1,1-[(1-methylethylidene) bis(4,1-phenyleneoxy)]bis[2-propanol]

Chemical Abstracts Service (CAS) Registry No.: 173659-63-7

Molecular Formula: $(C_{21}H_{28}O_4.C_8H_6O_4.C_{16}H_{26}O_3)_x$

Structural Formula:

Number-Average

Molecular Weight: 5220

Weight-Average Molecular Weight: 8910

Polydispersity: 1.70

Maximum Percentage of Low Molecular Weight Species (polymers and oligomers)
.(Molecular Weight < 1000): 0.2%
.(Molecular Weight < 500): < 0.01%

Table 1: Polymer Constituents

Constituent	*CAS No.*	*% Weight*
2-propanol,1,1-[(1-methylethylidene)bis(4,1-phenyleneoxy)]bis-	116-37-0	68.6
1,3-benzenedicarboxylic acid	121-91-5	23.7
2,5-furandione,3-(dodeceney)dihydro-	25377-73-5	7.7

Means of Identification: infrared (IR), ultraviolet/visual(UV/Vis) and nuclear magnetic resonance (^{1}H NMR)

Spectral Data:

UV/Vis: in 1,2-dichloroethane at a concentration of 0.1 g/L, peak at 277.8 nm

IR (Kbr disk) : major characteristic peaks were observed at 3000 1730, 1610, 1515, 1455, 1300, 1240, 1070, 1040, 1000, 950, 835, 730 and 540 cm^{-1}

NMR a proton NMR spectrum was provided and was consistent with the expected structure of the chemical

3. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20°C and 101.3 kPa: light yellow powder

Melting Point: 104°C (softening temperature)

Density:	1 160 x kg/m^3 at 20^oC
Water Solubility:	< 0.1 mg/L at 20°C
Hydrolysis as a Function of pH:	stable between pH 1 to 9
Flammability Limits:	not available
Autoignition Temperature:	not available
Explosive Properties:	not available
Reactivity:	not available
Particle Size Distribution:	4 000 µm 76.9% 1 700 µm 12.6% 850 µm 0.3 % 150 µm 0.1 %
Stability:	thermal stability; stable, thermal decomposition occurs above 280^oC photostability; stable

Comments on Physico-Chemical Properties

The water solubility of the notified polymer was estimated equilibrating the polymer with ion exchange water at 25°C. After filtration the concentration of the polymer in water was estimated using UV spectroscopy. The notifier claims a detection limit of 0.1 ppm for this method.

The notifier also claims that the polymer is hydrolytically stable in the pH range 1 to 9. The polymer does not contain any charged groups and will not be cationic or anionic in the pH range of 4 to 9.

While the polymer contains a number of ester linkages these are not expected to hydrolyse under environmental conditions due to the low solubility of the polymer.

The data provided is acceptable for a polymer of low concern.

4. PURITY OF THE CHEMICAL

Table 2: Maximum weight-percentage of residual monomers and impurities

Impurity	*CAS No.*	*% Weight*
2-propanol,1,1-[(1-methylethylidene)bis(4,1-phenyleneoxy)]bis-	116-37-0	0.1
1,3-benzenedicarboxylic acid	121-91-5	0.1
stannane, dibutyloxo-	-	0.1
water	-	0.2

5. INDUSTRIAL USE, VOLUME & FORMULATION

The notified polymer will initially be imported as a component in toner, and subsequently as a component lining laminating pouches. The toner will be used in printers and facsimile machines, and will be imported in fully prepared cartridges. The notified polymer will constitute approximately 42% of the toner formulation. Over the next five years an estimated 1.82 tonnes of the notified polymer will be imported in this form. The laminating pouch is still in the developmental stages and it is not possible to estimate the import volumes of this product at this stage. However, it is assumed that the notified polymer to constitute 10 to 30% of the formulation that forms the lining of the laminating pouch.

6. OCCUPATIONAL EXPOSURE

As the notified polymer will only be imported as a component of a toner and a laminating pouch there is limited opportunity for occupational exposure during transport and warehousing. The printer toner will only be imported in cartridges, therefore even in the event of an accident, spillage from cartridges will be limited. The cartridges only contain 100 g of the toner of which the notified polymer constitutes little less than one half.

Occupational exposure to the notified polymer will be greatest during replacement of the toner cartridges and maintenance of the printer and facsimile machines utilising the cartridges. The cartridges can only be removed from printer or facsimile machine when the shutter of the cartridge is completely closed. Occupational exposure during use will therefore be limited.

7. PUBLIC EXPOSURE

Although some public exposure to the notified polymer may occur during the replacement of printer toner cartridges, the design of the cartridge is such that there is minimal potential for exposure to occur. Given that specialised equipment will

most likely be required for processing of laminated pouches, processing of pouches will be limited to businesses who have such equipment. Although, the public may come into contact with processed laminated products, at this stage the pouch will be sealed and public exposure to the notified polymer is unlikely.

8. ENVIRONMENTAL EXPOSURE

Release

Toner contains the notified polymer as a component in a concentration of around 42%, and is contained within a cartridge. When more toner is required, the operator removes a toner cartridge and replaces it with another. An emptied toner cartridge contains a residue of around 5 grams of toner (2 g of the notified polymer). Unless cartridges are recycled, they will invariably be landfilled where the polymer residue will be immobile due to its low water solubility.

Releases to the environment as a result of accidents (during transport or in the workplace) are expected to be negligible.

The polymer is coated on the inside of the pouch in order to bind upper and lower films of the pouch. Release during laminating would be negligible, and after laminating, the polymer will be immobilised within the sealed pouch. Its ultimate fate would be as landfill along with domestic waste.

Releases to the environment may occur through processing of waste paper. This possibility is explored further below.

Fate

The polymer will most likely share the fate of its paper substrate, and be disposed of to landfill, incinerated or recycled. Small quantities, as residual toner in empty cartridges, will also be disposed of to landfill. Polymer disposed of to landfill is unlikely to leach or contaminate surface water because of its low water solubility and expected high Log P_{ow}.

Incineration of paper and combustion of the notified polymer in the presence of excess air will result in products of oxides of carbon and water.

Paper recycling is a growing industry in Australia. Waste paper is repulped using a variety of alkalis, dispersing agents, wetting agents, water emulsifiable organic solvents and bleaching agents. These chemicals enhance the fibre separation, ink detachment from the fibres, pulp brightness and the whiteness of the paper. After pulping, the contaminants and the ink are separated from the fibres by pumping the stock through various heat washing, screening, cleaning, flotation and dispersion stages. The notifier has provided no data on the likely behaviour of the polymer during the recycling process. The hydrolysis of ether linkages under alkaline conditions will be minimal due to the low solubility of the polymer. The polymer therefore is likely to survive the paper recycling conditions, either remaining bound to the pulp or becoming associated with the sludge. In the latter case, the polymer will arrive in landfill where it can be expected to remain intact, or be destroyed through incineration.

9. ASSESSMENT OF ENVIRONMENTAL EFFECTS

Ecotoxicological data were not provided, which is acceptable for polymers of low concern according to the Act.

Bioaccumulation of the polymer is not expected due to its large molecular mass (1,2).

10. ASSESSMENT OF ENVIRONMENTAL HAZARD

The polymer is only to be used as a toner in printers and facsimile machines, or as a component in laminating pouches. The cartridge type containing the new polymer has a typical capacity of 80 g. An emptied toner cartridge contains a residue of around 5 g, or 6.25%. Therefore, in a year, the amount of polymer likely to be landfilled with disposed cartridges is 375 kg (or around 1.03 kg per day), spread over many sites around Australia.

The remainder of the polymer is likely to either remain bound to pulp or become associated with the sludge during paper recycling. In the latter case, the polymer will arrive in landfill where it can be expected to remain intact, or be destroyed through incineration.

Given that release will be spread out over many sites across Australia; the low water solubility and absence of reactive groups within the polymer the environmental hazard posed by the polymer is rated as negligible when incorporated into a toner.

It is not possible to predict an environmental hazard with respect to polymer associated with laminating pouches as there is no indication of import volumes, disposal methods etc. related to this end use. However, it would be expected to be low.

11. ASSESSMENT OF OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY EFFECTS

No toxicology data has been submitted on the notified polymer, however, the Material Safety Data Sheet (MSDS) indicates that it is 'essentially' non irritating to the skin and eyes, and that as a dust it may cause corneal injury from physical abrasion. The number-average molecular weight (NAMW) of the polymer is 5220, which is sufficiently high to prevent passage across biological membranes. The notified polymer contains 0.2% of low molecular weight species (< 1000) and the maximum weight percentage of individual residual monomers is not greater than 0.2%.

As the notified polymer will only be imported as a component of a toner contained within a cartridge and a laminating pouch there is limited opportunity for occupational exposure during transport and warehousing.

Occupational exposure to the notified polymer will be greatest during replacement of the toner cartridges and maintenance of the fax and printers utilising the cartridges. Exposure to the toner dust will be limited by the cartridge design.

The particle size range of the imported toner formulation is in the range of 4 000 to 75 μm. As such, the applicable standard for workplace exposure is likely to be that for nuisance dusts (3) this is; time weighted average (TWA) 10 mg/m^3.

There is negligible potential for public exposure to the unbonded compound, from the printing process, other than at the time of exchanging cartridges. Widespread contact with the polymer bonded to paper is expected, but its adhesion t the paper and its physicochemical properties will be sufficient to preclude absorption across biological membranes.

12. RECOMMENDATIONS

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

- In the highly, unlikely event of exposure to dust the following personal protective equipment should be worn:

  . goggles (selected and fitted according to AS1336 (4) and meeting the requirements of AS/NZS 1337 (5)); and

  . appropriate respiratory device should be selected and used in accordance with AS/NZS1715 (6) and should conform to AS/NZS 1716 (7).

- A copy of the MSDS for the relevant Brother toners should be easily accessible to employees.

- Implement good work practices to avoid the generation of dusts; avoid spillage.

13. MATERIAL SAFETY DATA SHEET

The attached MSDS for 1,3-benzenedicarboxylic acid, polymer with 3-(dodecenyl) dihydro-2,5-furandione and 1,1-[(1-methylethylidene) bis(4,1-phenyleneoxy)]bis[2-propanol] was provided in accordance with the *Code of Practice for the Preparation of Material Safety Data Sheets* (8).

This MSDS was provided by the applicant 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 the applicant.

14. REQUIREMENTS FOR SECONDARY NOTIFICATION

Under the Act, secondary notification of the notified chemical shall be required if any of the circumstances stipulated under subsection 64(2) of the Act arise. No other specific conditions are prescribed.

15. REFERENCES

1. Ankler R., Moser P and Poppinger D. (1988). Bioaccumulation of dyestuffs and organic pigments in fish. Relationships to hydrophobicity and steric factors. Chemosphere 17(8): 1631-1644.

2 Gobas F. A. P. C., Opperhuizen A. and Hutzinger O. (1986). Bioconcentration of hydrophobic chemicals in fish: relationship with membrane permeation. Environmental toxicology and Chemistry 5: 637-646.

3. National Occupational Health and Safety Commission, 1995. *Exposure standards for atmospheric contaminants in the occupational environment,* AGPS, Canberra.

4. Australian Standard 1336-1982, *Recommended Practices for Eye Protection in the Industrial Environment*, Standards Association of Australia Publ., Sydney, 1982.

5. Australian Standard 1337-1984. *Eye Protectors for Industrial Applications*, Standards Association of Australia Publ., Sydney, 1984.

6. Standards Australia, Standards New Zealand, 1994. *Australian/New Zealand Standard 1715 - 1994 Selection, Use and Maintenance of Respiratory Protective Devices.* Standards Association of Australia Publ., Sydney, Australia, Standards Association of New Zealand Publ., Wellington, New Zealand.

7. Standards Australia/ Standards New Zealand, 1991. *Australian/New Zealand Standard 1716 - 1991 Respiratory Protective Devices.* Standards Association of Australia Publ., Sydney, Australia.

8. National Occupational Health and Safety Commission, 1994, *National Code of Practice for the preparation of Material Safety Data Sheets* [NOHSC:2011(1994), AGPS, Canberra.