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**NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION
AND ASSESSMENT SCHEME**

FULL PUBLIC REPORT

2-propenoic acid, 2-methyl-, dodecyl ester, polymer with ethenylbenzene and 2-propenenitrile

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Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT**2-propenoic acid, 2-methyl-, dodecyl ester, polymer with ethenylbenzene and 2-propenenitrile****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, 2-propenoic acid, 2-methyl-, dodecyl ester, polymer with ethenylbenzene and 2-propenenitrile.

2. IDENTITY OF THE POLYMER

Chemical name: 2-propenoic acid, 2-methyl-, dodecyl ester, polymer with ethenylbenzene and 2-propenenitrile

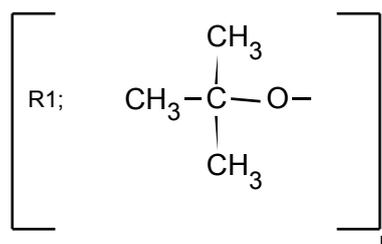
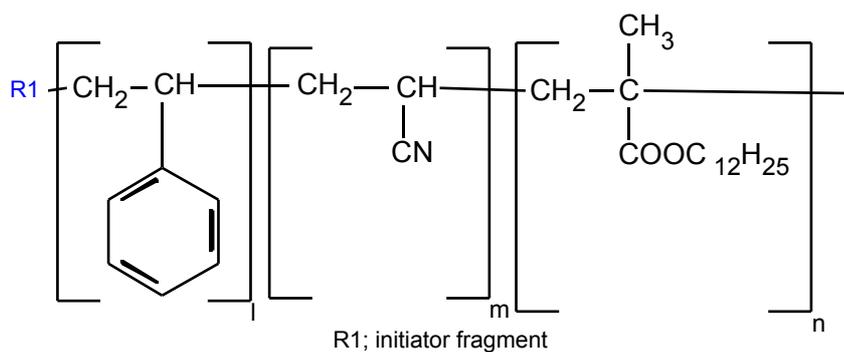
Chemical Abstracts Service

(CAS) Registry No.: 35725-18-9

Other names: styrene-acrylonitrile type copolymer resin

Trade names: none

Molecular formula: $(C_8H_8 \cdot C_3H_3N \cdot C_{16}H_{30}O_2)_x$

Structural formula:

Number-average molecular weight: 1.91 x 10⁵ (GPC Method)

Weight-average molecular weight: 1.58 x 10⁶ (GPC Method)

Maximum percentage of low molecular weight species (polymers and oligomers)

.(molecular weight < 1000): 0.1%
.(molecular weight < 500): < 0.01%

Table 1: Polymer Constituents

Constituent	CAS No.	% Weight
benzene, ethenyl	100-42-5	64.8
2-propenenitrile	107-13-1	16.2
2-propenoic acid, 2-methyl-, dodecyl ester	142-90-5	17.8
peroxide, bis (1,1-dimethylethyl)	110-05-4	1.2

Means of identification

(list of spectral data available): infrared (IR), ultraviolet (UV) and nuclear magnetic resonance (¹H NMR)

3. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20°C and 101.3 kPa: white powder

Melting Point/Glass-transition Temperature: 115°C (softening point)

Density: 1.06 x 10³ kg/m³ at 20°C

Water Solubility: < 0.0005 g/L at 20°C

Hydrolysis as a function of pH: stable (insoluble in water and stable in the pH 1 to 9 range)

Flammability Limits: not available

Autoignition Temperature: not available

Explosive Properties: not available

Reactivity: not available

Particle size distribution: range - 75- > 4000µm
mean - ~3800µm

Stability: hydrolysis; stable
thermal stability; stable, thermal decomposition occurs above 280°C
photo stability; 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 0.5 ppm for this method.

The notifier 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 polymer does not contain any functional groups that are intended to or can reasonably be anticipated to undergo further reaction. The data provided is acceptable for a polymer of low concern.

4. PURITY OF THE CHEMICAL

Table 2: Maximum weight-percentage of residual monomers

Impurity	CAS No.	% Weight
benzene, ethenyl (styrene)	100-42-5	0.01
2-propenenitrile (vinyl cyanide)	107-13-1	< 0.01
2-propenoic acid, 2-methyl-, dodecyl ester	142-90-5	0.05

Benzene, ethenyl, is harmful by inhalation and irritating to the eyes and respiratory system. A mixture is considered hazardous if it is in concentrations of 12.5% or more and is classified as irritant and harmful (1).

2-propenenitrile has a toxic cutoff of 0.1% for a mixture to be classified as hazardous according to Worksafe Australia's *List of Designated Hazardous Substances* (1). In concentrations above 0.1% it is considered a carcinogen by inhalation, a teratogen and can potentially cause heritable genetic damage. In concentrations above 0.2% it is considered to be harmful by inhalation and toxic through dermal contact. However, as the concentration in the notified polymer is < 0.01% the polymer is not classified as hazardous.

2-propenoic acid, 2-methyl-, dodecyl ester is not listed on the *List of Designated Hazardous Substances* (1) or *Toxline* (2).

Maximum weight percentage of impurities: water, 0.2%

5. INDUSTRIAL USE

The notified polymer is imported as a finished product and is not manufactured, reformulated or repackaged locally. The notified polymer will initially be imported in laser printer toner cartridges. It will constitute approximately 33% of the toner formulation. Over the next five years an estimated 1.43 tonnes of the notified polymer will be imported in this form. An alternative use is in the lining of laminating pouches; it is not possible to estimate the import volumes of this product as it is still in the developmental stage.

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 laser 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 one third.

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

The particle size range of the imported toner formulation has a low percentage of what is considered as inspirable according to the International Organisation for Standardisation and the American Conference of Governmental Industrial Hygienists (3). The respirable fraction will be negligible according to the Standards Australia definition (3). The applicable standard for workplace exposure is likely to be that for nuisance dusts (3) this is; TWA 10 mg/m³ for inspirable dusts. It should also be noted that there are standards for carbon black and iron oxide; commonly used additional components of toners, these are 3 and 5 mg/m³ respectively. The atmospheric exposure standard for the residual monomer, styrene, of TWA 50 ppm is unlikely to be attained during use of the formulations, containing the notified polymer, due to the low concentration of styrene in the formulations.

7. PUBLIC EXPOSURE

The imported end-use products will initially be stored at Brother's North Ryde warehouse in Sydney prior to being distributed to potential customers. No reformulation, repacking, or refilling of cartridges or laminating pouches will be required prior to distribution. No public exposure to the notified polymer is expected to occur during its distribution.

Disposal of any waste containing the notified polymer will be by landfill or incineration and therefore, no public exposure is expected to occur.

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 33%, 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 (1.7 g of the notified polymer). Unless cartridges are sent to a recycler, 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.

Laminating pouches contain the notified polymer in a concentration of around 10-30%. 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. Its ultimate fate would be ending up in 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 by 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 (4,5).

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 have 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 190000, which is sufficiently high to prevent passage across biological membranes. The notified polymer contains 0.1% 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 laser 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 has a low percentage of what is considered as inspirable and the respirable fraction is negligible. The applicable standard for workplace exposure is likely to be that for nuisance dusts (3) this is; TWA 10 mg/m³ for inspirable dusts.

Although there is some potential for public exposure to the notified polymer to occur during the replacement of printer toner cartridges, the high NAMW for the polymer suggests that if contact were to occur, absorption is unlikely, and therefore there is negligible risk to public safety.

12. RECOMMENDATIONS

To minimise occupational exposure to 2-propenoic acid, 2-methyl-, dodecyl ester, polymer with ethenylbenzene and 2-propenenitrile the following guidelines and precautions should be observed:

- 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.
- Observe exposure standard for nuisance dusts (10 mg/m³) during maintenance of copiers and use of toner

13. MATERIAL SAFETY DATA SHEET

The attached Material Safety Data Sheet (MSDS) for the notified chemical was provided in Worksafe Australia format (6).

This MSDS was provided by the applicant Brother Industries (Australia) Pty Ltd as part of the 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. National Occupational Health and Safety Commission, 1994. *List of Designated Hazardous Substances* [NOHSC:10005(1994)], AGPS, Canberra.
2. Toxline Silver Platter 1995. *Toxline SilverPlatter CD-ROM database, 1994-September 1995*, Silver Platter International N.V.
3. National Occupational Health and Safety Commission, 1995. *Exposure Standards for Atmospheric Contaminants in the Occupational Environment*, AGPS, Canberra.
4. Anliker 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.
5. 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.
6. National Occupational Health and Safety Commission, 1994, *National Code of Practice for the preparation of Material Safety Data Sheets* [NOHSC:2011(1994), AGPS, Canberra.