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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

Polymer in Polyester RP2988

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Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT

Polymer in Polyester RP2988

1. APPLICANT

Courtaulds Coatings of 51 McIntyre Road SUNSHINE VIC 3020 has submitted a limited notification statement in support of their application for an assessment certificate for Polymer in Polyester RP2988.

2. IDENTITY OF THE CHEMICAL

Polymer in Polyester RP2988 is not considered to be hazardous based on the nature of the polymer and the data provided. Therefore the chemical name, CAS number, molecular and structural formulae, molecular weight, spectral data, details of the polymer composition and details of exact import volume have been exempted from publication in the Full Public Report and the Summary Report.

Trade Name:	Polymer in Polyester RP2988
Number-Average Molecular Weight:	> 1 000 g/mol
Method of Detection and Determination:	gel permeation chromatography

3. PHYSICAL AND CHEMICAL PROPERTIES

On production Polymer in Polyester RP2988 is immediately dissolved at a concentration between 30 and 60%, in an organic solvent mixture of aromatic solvent and 2-butoxyethanol. For this reason many of the physical properties belong to the dissolved formulation, not the pure notified chemical.

Appearance under ambient conditions	clear, light yellow to amber, viscous liquid in solution
Melting Point:	not calculated, in solution
Specific Gravity:	1.15 (calculated) of polymer 1.075 at 20°C, of solution

Vapour Pressure:	negligible for polymer solvent naptha 0.5 kPa at 38°C 2-butoxyethanol 0.8 kPa at 20°C
Water Solubility:	not soluble in water (polymer) soluble in range of organic solvents
Partition Co-efficient (n-octanol/water):	not supplied
Hydrolysis as a Function of pH:	not water soluble, therefore not calculated
Adsorption/Desorption:	not determined
Dissociation Constant:	insoluble in water, not applicable
Flash Point:	not supplied for polymer 65°C for solution
Flammability Limits:	not supplied for polymer LEL 0.9%, UEL 10.6% for solvent naptha
Autoignition Temperature:	not supplied for polymer 443°C for solvent naptha
Explosive Properties:	none
Reactivity/Stability:	extreme hydrolysis or high temperature (> 300°C) will result in depolymerisation or pyrolysis; with pyrolysis, combustion would produce oxides of carbon; under normal final use conditions polymer is cross-linked into an inert surface coating film at a temperature of 195°C

Comments on Physico-Chemical Properties

The notifier has stated that water solubility could not be measured because the polymer is produced in solution and removing the solvents will remove some residual monomers and low molecular weight fractions, thus changing its water solubility. The notifier claims that under general classification the polymer is insoluble in water and its hydrophobic structure indicates its water solubility is likely to be extremely low. These claims are acceptable. Polyesters designed for the coating industry are usually highly insoluble.

The notifier has provided the results of a study done in Germany where the

migration of the polymer cured on to substrates at a rate of 13 $g.m^{-2}$ dry polymer was measured to check the influence of the polymer on food stuffs. The extractability into distilled water was 70 $mg.m^{-2}$ after 10 days at 40°C and 100 $mg.m^{-2}$ after 2 hours at 70°C. These low extractabilities (0.54% at 40°C and 0.77% at 70°C) confirm the polymer's low solubility.

The polymer contains a large proportion of ester functionality, but hydrolysis in the environmental pH range (4-9) is not expected due to the low water solubility.

Partition coefficient and adsorption/desorption have not been performed due to the low water solubility of the polymer. The partition coefficient is expected to be high and the polymer can be expected to bind strongly to, or be associated with, soil and sediment.

The polymer does not contain dissociable or reactive functionalities except perhaps for a very small amount of free carboxylic acid groups with typical acidity.

4. PURITY OF THE CHEMICAL

Degree of Purity: > 95%

Non-hazardous Impurities (> 1% by weight): one monomer estimated to be present at approximately 1%

Maximum Content of Residual Monomers: estimated as approximately 1% or below

Comments on Residual Monomers

The level of residual monomers is estimated (not measured) by the notifier using the Stockmayer model (1) to be approximately 1% *in toto*.

5. USE, VOLUME AND FORMULATION

The notified polymer will be manufactured in Australia by Courtaulds utilising standard existing polyester manufacturing techniques. The mixture of the constituent monomers in specific proportions is charged to a reactor vessel and cooked at above 150°C to the designed end point and added to the solvent blend (see below) to cool to approximately 50°C before storing in labelled 200 L drums in bunded storage. The product RP2988 will contain the notified polymer at a concentration of between 30 and 60% w/w in solvent where the solvent composition is:

aromatic hydrocarbon solvent 150	(CAS No. 64742-94-5)	10 to 30% w/w
2-butoxyethanol	(CAS No 111-76-2)	10 to 30% w/w

The polymer in Polyester RP2988 is a polyester which will be used as a film forming agent in a heat cured internal varnish coating for the ends of food cans. When the paint formulation is to be made the resin formulation is transferred to the paint plant for blending to the finished product and storing in labelled drums for transfer to the customer's site for application. The product will not be available directly to the public and at this point only one industrial customer in VIC, will be utilising it.

The notifier estimates that up to 10 tonnes of the notified polymer will be manufactured annually for each of the next 5 years.

6. OCCUPATIONAL EXPOSURE

The categories of workers with a potential to be exposed to RP2988 polymer during manufacture of polymer and paint at Courtaulds and the lining of cans at the applicators facility include as follows:-reactor operators, maintenance personnel, laboratory technicians, paint plant operators, development personnel and applicators. Polyester RP2988, the formulation containing the polymer, is transferred to drums after manufacture. These are stored on-site until required to be blended into paint formulations where the polymer, which then forms 20 to 60% of the paint formulation, acts as a film forming agent.

RP2988 polymer will be synthesised, transferred, reformulated and stored in closed systems with very little exposure to the atmosphere. The potential for exposure to the polymer or solvents is thereby reduced. Storage conditions will be such that any spills will likely be contained on site. Storage and transport personnel are unlikely to be routinely exposed to the material but exposure may occur in rare cases of accidental spillage.

At the application facility, the coating operation process first involves decanting from 200 L to 20 L drums. The possibility of dermal, eye and respiratory exposure to the solvents exists. However, the area where decanting occurs, is equipped with solvent extraction equipment. The material is then transferred via a closed container to a sealed pressure pot. The material from this point is contained within a delivery and application system which the applicator controls remotely. The product is baked in a closed, forced air oven, flashing off the solvents and rendering the polymer largely inert, according to the notifier. Exposure after this point is considered minimal.

7. PUBLIC EXPOSURE

The paints containing the notified polymer will be used as a coating for the internal surfaces of the ends of food and beverage cans. In use, the paint containing the notified polymer is heat cured forming a varnish. Under normal circumstances, and from the evidence of minimal migration of the polymer or any of its constituents into the

food within the can, the public will have little or no exposure to the notified polymer, as it will be cross linked and bound into the matrix of the varnish.

The results of two studies, provided by the notifier, reveal migration of total material from the can lining product into water, 3% acetic acid and 15% ethanol.

First Migration Test (2)

Extraction Solvent	Treatment	Total dry residue ($mg.m^{-2}$) #	Chloroform soluble parts of # ($mg.m^{-2}$)	Organic bound nitrogen of # ($mg.m^{-2}$)
distilled water	40°C 10 days	70	-	12
	70°C 2 hours	100	-	
3% acetic acid	40°C 10 days	90	-	9
	70°C 2 hours	100	-	
15% ethanol	40°C 10 days	190	170	10
	70°C 2 hours	220	210	

Second Migration Test (3)

Extraction Solvent	Treatment	Total dry residue of migrates ($mg.m^{-2}$)
3% acetic acid	0.5 hour 100°C & 40°C 10 days	410
15% ethanol	0.5 hour 100°C &40°C 10 days	600

Migratable levels of formaldehyde, phenolic compounds, epichlorohydrin, styrene, melamine and a range of metals were below the detection limits in all tests. The first test also found no taste, appearance or odour adulteration of drinking water, mineral water and apple juice . The first test results reported that the Polyester RP2988 compound migration levels were below the German agency for Public Health and the U.S. F.D.A. requirements for food containers. The second test reported that the results met the limits provided by the Netherlands Packaging and Food-Utensils Regulations.

The manufacture of Polyester RP2988 and the use of paints containing it in coating tin ends, is conducted in enclosed equipment, minimising release to the environment. Decanting and thinning of paints containing Polyester RP2988 may release quantities of solvent but will not provide a source of exposure to the notified polymer for the public, due to its non-volatility.

8. ENVIRONMENTAL EXPOSURE

At the Courtaulds site waste from accidental spills and residues accumulating on filters are disposed of to landfill. Wash solvent residues produced in the solvent recovery unit are adulterated with other resin residues and also disposed of to landfill. The empty drums are cleaned by licensed drum reconditioners who would dispose of the residues in them by environmentally approved methods. Test samples of polymer solution are discarded in a highly diluted form through authorised waste disposers.

The notifier claims that all waste waters originating from the process areas are passed through a treatment tank prior to discharge to the sewer. The notifier estimates the maximum waste of polymer through all these sources to be 2% per annum. For a possible 10 tonne manufacture volume per annum, for example, this equates to 200 kg.

At the applicator's plant minor spills are collected into the empty drums. These drums are taken away by a licensed waste disposal agent where the residual liquid waste is collected and the drum discarded to landfill. The liquid waste collected is distilled whereby the solvent is recovered and the residue containing the polymer is incinerated. At this site some polymer is also lost as coating on rejected metal. Disposal of this metal is through metal recyclers who would melt metals under high temperature during which the polymer would be destroyed. It is estimated that up to 4% of the polymer would be lost per annum as waste at the applicator's plant. This amounts to a maximum of 400 kg per annum if, for example, 10 tonnes are produced per annum.

The total waste from both the manufacturer's and applicator's sites would therefore be about 6% of the manufacture volume. For a maximum annual manufacture volume of 10 tonnes the release as waste would be 0.6 tonnes.

9. EVALUATION OF TOXICOLOGICAL DATA

No toxicological data were provided, which is acceptable for polymers of NAMW greater than 1 000 according to the Act.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

No ecotoxicology data was provided, which is acceptable for polymers of NAMW greater than 1 000 according to the Act.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The polymer is unlikely to present a hazard to the environment when handled, and disposed of as proposed. Disposal of waste polymer or cans lined with the polymer to landfill will not pose a hazard to the environment due to high molecular weight and the low water solubility. Incineration will break down the polymer into oxides of carbon and water vapour.

The US EPA considers polynonionic polymers with NAMW greater than 1 000 and low solubility to be of low concern (4).

The environmental hazard from the notified polymer can be rated as low.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

The polymer in RP2988 is not water soluble,and since the notified polymer has a molecular weight greater than 1 000, it is unlikely to readily cross biological membranes. Monomer levels together are approximately 1%. The levels of low molecular weight species below 1 000 are approximately 10%. Since none of the monomers is classified as hazardous and the polymer constitutes up to 60% of the RP2988 product, little toxicity from this source is likely. In the final heat cured internal coating both the polymer and the low molecular weight species will be cross-linked in the varnish matrix preventing any release of material. The migration studies previously quoted, which were conducted in Germany and the Netherlands, confirm the low levels of extractable material in the final can lining. The polymer, which is not flammable, is dissolved in a mixture of two organic solvents, (hydrocarbon solvent 150 and 2-butoxyethanol), both of which are flammable.

On the information provided, the polymer in RP2988 is not considered hazardous and is unlikely to pose a health risk to workers. The main health risk associated during production, transport, or application with Polyester RP2988 would more likely relate to its solvent content. 2-butoxyethanol is considered hazardous according to *National Occupational Health and Safety Commission* criteria.(5). It is very rapidly absorbed through the skin and other membranes and by inhalation (6). The Time-Weighted Average exposure standard for 2-butoxyethanol in the workplace is 25 ppm (7).

Local exhaust ventilation will be used during manufacture and application of polymer and paint, for the following operations: vessel charging, sampling, testing and drum filling. The notifier states that personal protective equipment for handling of raw materials, including polymers, is controlled at Courtaulds by a colour coding system which specifies minimum handling requirements. The polymer solution will be coded "Blue" due to the presence of 2-butoxyethanol in solution. This code requires the wearing of chemical resistant gloves, safety glasses and a half face respirator, when handling the chemical. All operational areas, laboratories and storage areas are compulsory safety glasses areas.

The manufacture of the polymer and the paint will be performed in closed vessels and this serves to reduce the potential for worker exposure to the RP2988 polymer. This manufacture is also performed in fixed areas of the manufacturer's site. The occupational health risk posed to storage and transport workers is minimal, given the expected low exposure under normal working conditions.

The general public will be exposed to the notified polymer in food and drink containers but this form is heat fixed at temperatures over 200°C, driving off all solvents. According to studies provided by the notifier, migration from this form of the polymer is negligible. During the manufacture and application processes, polymer RP2988 will not be available to the general public and there is only a minor potential for public exposure during use, transport and disposal of the notified polymer. If accidentally spilt, it is unlikely that the notified polymer will pose a significant hazard to public health when used in the proposed manner.

13. RECOMMENDATIONS

To minimise occupational exposure to solvents associated with Polymer in Polyester RP2988 the following guidelines and precautions should be observed:

- It is good work practice to wear industrial clothing which conforms to the specifications detailed in Australian Standard (AS) 2919 (8) and occupational footwear which conforms to Australian and New Zealand Standard (AS/NZS) 2210 (9) to minimise exposure when handling any industrial chemical;

- When handling the formulation containing the notified polymer, safety goggles should be selected and fitted in accordance with Australian Standard (AS) 1336 (10) to comply with Australian/New Zealand Standard (AS/NZS) 1337 (11) and impermeable gloves or mittens should conform to AS 2161 (12) should be worn;

- Spillage of the notified polymer formulation should be avoided; spillages should be cleaned up promptly with absorbents which should then be put into containers for disposal;

- Good personal hygiene should be practised to minimise the potential for ingestion;

- A copy of the MSDS should be easily accessible to employees.

In addition, the Worksafe Australia document *Exposure Standards for Atmospheric Contaminants in the Occupational Environment: Guidance Note and National Exposure Standards* (7) should be used as a guide in the control of workplace exposure to 2-butoxy ethanol in products containing the notified polymer, and appropriate personal protective equipment should be worn where necessary to minimise exposure to this substance.

14. MATERIAL SAFETY DATA SHEET

The MSDS for the notified polymer was provided in accordance with the *National Code of Practice for the Preparation of Material Safety Data Sheets* (13)

This MSDS was provided by the applicant 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.

15. REQUIREMENTS FOR SECONDARY NOTIFICATION

Under the Act, secondary notification of the notified polymer shall be required if any of the circumstances stipulated under subsection 64(2) of the Act arise.

16. REFERENCES

1. Stockmayer, W.H. 1952, 'Molecular Distribution in Condensation Polymers', *Journal of Polymer Science*, vol. 9 and errata 11, pp. 69-71 errata 424.

2. Nehring, P. 1983, *Examination of Organosol IP319-801 (0881 C 8569) as inside coating for aluminium easy-open ends for beverage cans according to current food legislation.*, Project no., 83-6421-G1, Institut fur Konserventechnologie, Braunschweig.

3. de Vos, R.H. 1984, *Investigation of Glass Panels Coated with IP 2319, an Internal Lacquer for Beer and Soft Drink Cans*, Project no., A 10038/3223/B 84-0453/dKr-PvW, Division of Food Research, Netherlands Organisation for Applied Scientific Research, Zeist.

4. Nabholz, J.V., Miller, P. & Zeeman, M. 1993, 'Environmental Risk Assessment of New Substances under the Toxic Substances Control Act Section Five', in *Environmental Toxicology and Risk Assessment, American Society for Testing and Materials*, ASTM STP 1179, Philadelphia, pp. 40-55.

5. National Occupational Health and Safety Commission 1994a, *List of Designated Hazardous Substances [NOHSC:10005(1994)]*, Australian Government Publishing Service, Canberra.

6. ECETOC, 1995a, *The Toxicology of Glycol Ethers and its Relevance to Man*, Technical Report, vol. technical Report No 64, (ECETOC), Brussels, Belgium.

7. National Occupational Health and Safety Commission 1995, 'Exposure Standards for Atmospheric Contaminants in the Occupational Environment, [NOHSC:1003(1995)]', in *Exposure Standards for Atmospheric Contaminants in the Occupational Environment: Guidance Note and National Exposure Standards*, Australian Government Publishing Service, Canberra.

8. Standards Australia 1987, *Australian Standard 2919-1987, Industrial Clothing*, Standards Association of Australia, Sydney.

9. Standards Australia/Standards New Zealand 1994, *Australian/New Zealand Standard 2210-1994, Occupational Protective Footwear*, Standards Association of Australia/Standards Association of New Zealand, Sydney/Wellington.

10. Standards Australia 1994, *Australian Standard 1336-1994, Eye protection in the Industrial Environment*, Standards Association of Australia, Sydney.

11. Standards Australia/Standards New Zealand 1992, *Australian/New Zealand Standard 1337-1992, Eye Protectors for Industrial Applications*, Standards Association of Australia/Standards Association of New Zealand, Sydney/Wellington.

12. Standards Australia 1978, *Australian Standard 2161-1978, Industrial Safety Gloves and Mittens (excluding electrical and medical gloves)*, Standards Association of Australia, Sydney.

13. National Occupational Health and Safety Commission 1994d, *National Code of Practice for the Preparation of Material Safety Data Sheets [NOHSC:2011(1994)]*, Australian Government Publishing Service, Canberra