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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

Polymer in RHEOLATE 420

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Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT

Polymer in RHEOLATE 420

1. APPLICANT

International Sales and Marketing Pty Ltd of 262 Highett Rd Highett VICTORIA 3190 has submitted a limited notification statement in support of their application for an assessment certificate for Polymer in RHEOLATE 420.

2. IDENTITY OF THE CHEMICAL

The notified polymer in RHEOLATE 420 is not considered to be hazardous based on the nature of the chemical and the data provided. Therefore the chemical name, CAS number, molecular and structural formulae, molecular weight, spectral data and details of the polymer composition have been exempted from publication in the Full Public Report and the Summary Report.

Trade Name:	RHEOLATE 420 (contains 30% of notified polymer in a water based emulsion)
Number-Average Molecular Weight (NAMW):	36 000
Weight-Average Molecular Weight:	340 000
Maximum Percentage of Low Molecular Weight Species	
Molecular Weight < 500:	< 0.25%
Molecular Weight < 1 000:	< 0.58 %
Method of Detection and Determination:	the chemical has been analysed with gel permeation chromatography (GPC) and infrared (IR) spectroscopy. IR peaks identified include: 2 960, 2 915, 1 740, 1 440, 1 370, 1 250, and 1 125 cm^{-1}

3. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20°C and 101.3 kPa:	the imported product is a creamy white 30% water-based emulsion with a mild sweet odour
Melting Point:	dynamic glass transition at 15.3°C and 141°C
Boiling Point:	undergoes endothermic transition at 97°C with partial loss of water thermal decomposition occurs at 206°C
Specific Density:	1.071 $kg.m^{-3}$ (for Rheolate 240 suspension)
Vapour Pressure:	not determined
Water Solubility:	pH 1 at 22°C 5.43 $g.L^{-1}$ pH 7 at 20°C 7.93 g.L pH 10 at 22°C 1.19 g.L
n-Octanol Solubility:	135 $mg.L^{-1}$ at 20°C
Partition Co-efficient (n-octanol/water):	log P_{ow} -1.76 (estimated from solubilities)
Hydrolysis as a Function of pH:	not determined (see comments below)
Adsorption/Desorption:	not determined
Dissociation Constant:	not determined
Flash Point:	> 100°C
Flammability Limits:	not determined
Autoignition Temperature:	not determined
Explosive Properties:	not determined
Reactivity/Stability:	under normal conditions the polymer will not degrade or depolymerise.

Comments on Physico-Chemical Properties

The vapour pressure of the polymer has not been determined. The polymer is not expected to have a significant vapour pressure given its high molecular weight. At low pH, poly(carboxylic acid) polymers exist predominantly in the free carboxylic acid form, and the solubility in water is expected to be very low. However, at high pH the carboxylic acid groups are deprotonated and the resulting water solubility of

the polymer will be increased {Browning, 1983}. The observed pH dependence of the solubility of the poly, carboxylic acid, polymer in Rheolate 420 is the reverse of that generally observed.

The polymer contains ester linkages which have the potential to hydrolyse. It is unclear whether the notified polymer is likely to undergo hydrolytic decomposition in the environmental pH range of 4-9, due to its solubility. However, Environment Australia notes low exposure to the aquatic compartment. The notifier claims that the polymer has been designed to be stable in aqueous media in which it is manufactured and used.

The ratio of the solubility of the polymer in n-octanol and water provides an estimate of the partition coefficient of the notified polymer. At pH 7 this ratio is gives an estimate of log P_{ow} = -1.76.

4. PURITY OF THE CHEMICAL

Degree of Purity: > 95%

Toxic or Hazardous Impurities: none

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

Maximum Content of Residual Monomers: < 0.31% total, < 0.1% for each monomer

Additives/Adjuvants: see below

Chemical Name	*CAS No.*	*Weight %*
poly(oxy-1,2-ethanediyl), α-sulfo-φ-(nonylphenoxy)-, ammonium salt	9051-57-4	**0.23%**

5. USE, VOLUME AND FORMULATION

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The notified polyacrylic polymer is a member of a class of water-soluble polymers called hydrophobically-modified alkali-swellable emulsions (HASE) intended for use as rheological additives in water-based paints. Its introduction is part of a world-wide move from solvent-based to water-based paints in order to eliminate volatile organic compounds (VOCs) from paint formulations.

The notified polymer will not be manufactured in Australia. It will be imported into Australia as a 30% emulsion in the product, Rheolate 420, in **210 kg plastic drums or 1.2 tonne totes.** The product will be stored in central warehouses for distribution via road.

Estimated import volumes for the notified polymer are as follows:

Year	1997	1998	1999	2000	2001
Import Volume (tonnes)	7	14	20	27	27

The product will be reformulated into paints at paint manufacturers in Perth, Adelaide, Sydney Melbourne and Brisbane. The paints in which the notified chemical will be incorporated will be used in both domestic and industrial applications.

6. OCCUPATIONAL EXPOSURE

The notification states that Rheolate 420 will be received by customers in steel drums and delivered on pallets, although it is noted that it will be shipped within Australia in 210 kg sealed plastic drums and in 1.2 tonne totes via road transport. Workers involved with the transport and storage of this chemical are unlikely to be exposed to the chemical. Exposure will only arise if accidental spills occur.

Worker exposure during the formulation of paints is expected to be minimal. Formulation of paints containing Rheolate 420 typically involves the pumping of the Rheolate emulsion directly into batch processing or formulation tanks from the drums, using dry couplings. Limited dermal exposure is expected for workers involved in disconnecting and cleaning lines. Potential exposure to the notified polymer will be for 15 to 30 minutes at a time.

Blending tanks may be enclosed or open but if open positive ventilation is provided. Blending is normally remotely controlled and would not normally involve worker exposure. Following mixing, the paint (containing the notified polymer at a final concentration of 0.6 to 0.9%) will be pumped via automated filling lines for packaging.

Workers exposed to the reformulated product will mostly consist of painters or building workers applying fillers or coatings to surfaces. Given that the final concentration of the notified polymer in paints will be less than 1%, worker exposure is expected to be low. The notifer states that if spray painting occurs it will be conducted in ventilated spray booths which are equipped with recirculating systems. In such cases, inhalational, dermal and ocular exposure is expected to be minimal.

Worker exposure to the notified polymer in dried paints or sealants is likely to be minimal, as the polymer will be encapsulated as part of the cured paint or sealant..

7. PUBLIC EXPOSURE

Finished paints, grouts or joint sealing compounds containing the notified polymer will be available to the general public, who may have contact with them either

before and during application to surfaces, or to dried treated surfaces. Due to the high molecular weight of the notified chemical, it is expected to have a low potential for absorption across biological membranes. In addition, it constitutes only a small fraction of the total concentration of the timshed product and will be bound within the solid matrix of the product after curing. Following application to surfaces, drying and curing, it is not expected to cause any significant public exposure to members of the public..

In the event of an accident, the spill will be contained and the material will be pumped into containers or taken up with an absorbent and disposed of according to local regulations. It is expected that at the end of their period of use, finished products containing surfaces treated with paints, grouts or joint sealing compounds containing the new polymer would mostly be disposed of by landfill.

8. ENVIRONMENTAL EXPOSURE

Release

No release or exposure to the environment is expected from this polymer during transportation, with the exception of accidental spillage. There are adequate instructions on the polymer's MSDS to cope with accidental spillage.
Once with customers, the polymer may be exposed to the environment during paint manufacture. Throughout manufacture of the paint, the polymer will be exposed during sampling and filling operations. When formulated, paints will contain between 2% and 3%, of the product, Rheolate 420, containing the notified polymer. Due to the anticipated low vapour pressure of the polymer, and the simple mixing process when being incorporated into paints, overall release to the environment through sampling and filling operations is expected to be low. The notifier has estimated that the paint loss during manufacture would be between 120 and 200 g per production run. For an average production of 8 000 L this would correspond to the loss of approximately 21 kg of the polymer per annum, at the maximum rate of import. This waste polymer would be disposed of to landfill.

The most likely range of container sizes for the formulated paints would be 1 L, 4 L, 10 L and 20 L. The notifier has indicated that typical residues remaining in these containers after emptying will be 1, 1.5, 2 and 3 mL, respectively. It is anticipated by the notifier that paint containing the notified polymer will be used by both the general public and industry. The paints will be applied using brush, roller or spray. Paints for use in the domestic market are applied in the main using brushes and rollers, by both professional painters and do-it yourself (D-I-Y) painters. Roller and brush application lead to a maximum of 5% loss that is observed as spatter onto drop sheets. These residues will be disposed of to landfill sites in accordance with local, state and federal regulations. Equipment will be cleaned in water. Environment Australia expects that the majority of these washings will be sent to the sewer, with some lost to the surrounding ground near the wash-up site.

It is expected that residues in empty paint product containers used by professional painters will be minimised, and will be close to the amounts proposed by the

notifier (see above), with empty cans will be disposed of as industrial waste. The amount of residue left in cans supplied to D-I-Y painters is unknown, and depends on how close the amount purchased is to the amount of paint required. It is likely that some left over paint will be retained for future use. However, it is expected that ultimately paint cans and the associated residues will be disposed of through municipal waste collection systems to landfill.

Paints applied by industry are mainly applied by spray (e.g. automotive refinishing industry). Loss rates up to 70% are possible with 30% being typical when the paint is applied using spray equipment. Industrial applications will generally occur in conventional spraying in booths. Applications are carried out in the confines of a factory and protection is provided by scrubber apparatus or by filters. This minimises any release to the environment during application operations, although the significant quantities captured by pollution control technology would be disposed of to landfill.

Taking the worst case assumption, that all the paint is applied using spray equipment (ie. a loss rate of 30% of the polymer), a maximum of 8 100 kg per annum of the polymer (encapsulated in the cured paint matrix) will be disposed of from paint application, mostly to landfill, but some to the sewer.

Fate

The notified polymer is intended to be bound to surfaces. In its final form the polymer will be a part of a cross-linked hardened film of the paint matrix. Any fragments, chips or flakes of the cured paint would be of little concern as they are expected to be inert and spray droplets are expected to dry to inert particles. Articles coated with the polymer may be reused (the polymer film may be removed by either mechanical or chemical means or may be burned from the surface) or disposed of to landfill at the end of their useful life.

Environmental exposure of the uncured notified polymer from spillage is expected to be incinerated or sent to approved landfill sites. Combustion products would include oxides of carbon and hydrogen. Incomplete combustion may yield acrylic monomers. In landfill the polymer is expected to slowly cure and crosslink or to bind to soil and be immobile.

Exposure to the uncured polymer following formulation is expected to be as a residue in cans disposed to landfill. It is expected that residues will be cured rapidly in landfill and therefore have a low mobility in the soil.

Notified polymer that is released to the sewer, from the washing of application equipment, is expected to become associated with settleable solids during sewerage treatment {Yeoman, 1990}. Hence, it will be disposed of to landfill or incinerated with the sewerage sludge.

The insoluble nature of the cured polymer will ensure any hydrolysis or breakdown that may occur will be at an extremely low rate under normal environmental

conditions and the polymer should undergo limited biodegradation.
Biological membranes are not permeable to polymers of very large molecular size and therefore bioaccumulation of the notified polymer is not expected {Anliker, 1988}, {Gobas, 1986}.

9. EVALUATION OF TOXICOLOGICAL DATA

9.1.1 Oral Toxicity {Merriman, 1996}

Species/strain:	Sprague-Dawley rats
Number/sex of animals:	5/sex
Observation period:	14 days
Method of administration:	oral gavage
Clinical observations:	decreased activity, breathing abnormalities, soft/mucoid stools, urine/faecal staining, and dark material around facial area
Mortality:	1 male rat on study day 6
Morphological findings:	rat that died showed distention of the abdominal tract with gas and/or mucoid material, lack of rugae on gastric mucosa, depleted body fat. No significant gross abnormal findings at necropsy of surviving animals.
Test method:	similar to OECD guidelines {Organisation for Economic Co-operation and Development, }
LD_{50}*:*	> 5 000mg.kg^{-1}
Result:	the notified chemical was of low acute oral toxicity in rats

The notified polymer shows low acute toxicity in the rat and suggests that it is unlikely that accidental ingestion will give rise to severe toxicological symptoms. No other toxicological data was provided, which is acceptable for polymers of NAMW greater than 1 000 according to the Act.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

Although no ecotoxicological data has to be provided for polymers of NAMW >1000 according to the Act, the company did provide data for an Acute Toxicity test for

Daphnia. The result is summarised below:

Species	Test	Results
Daphnia magna	Acute Immobilisation (OECD Method 202, Part 1)	EC50 = 1 900 $mg.L^{-1}$ NOEC = 1 100 $mg.L^{-1}$

The ecotoxicity data for the notified polymer indicate that the polymer is practically non-toxic to *Daphnia*. The measured concentration of the notified polymer in the test media was well below the nominal concentration. This solubility in the test media was also well below its solubility in water at comparable pH. The reduction in solubility possibly reflects a salting out of the notified polymer due to the presence of calcium (170 $mg.L^{-1}$) or similar cations in the test media. Additionally, the solubility of the notified polymer in the test media decreased over the 48 h duration of the test.
Polymers with free carboxylic acid functions are known to be moderately toxic to green algae, especially those with large numbers of free carboxylic acids. Toxicity values range from 1-100 ppm, depending on the number of free carboxylic acids. The most potent structure for poly(carboxylic acid) polymers is paired acids that are equal distant from the polymer backbone and which have one acid on alternating carbons {Nabholz, 1993}. Based on the structure of the notified polymer it may be presumed that it will be slightly toxic to green algae.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The polymer is unlikely to present a hazard to the environment when it is incorporated into the paint and applied to solid substrates and cured. Such painted objects will be consigned to landfill at the end of their useful life and the paint containing the notified substance will share their fate. Due high molecular weight of the polymer it is unlikely to bioaccumulate.

The release of the notified polymer to the sewer as a result of the cleaning of application equipment is not expected to present a hazard to the environment. As a worst case, an environmental concentration of 2.7 ppb is predicted if 10% of the imported polymer is washed down the drain and remains suspended in sewage waters (assuming: 27 t maximum annual use, an Australian population of 18 million and a daily per capita waste water discharge of 150 L). This is 3 orders of magnitude lower than the levels at which poly(carboxylic acid) polymers have been shown to be toxic to algae {Nabholz, 1993}. Further, it is anticipated that the concentration of the notified polymer in sewerage waters will be further reduced at sewerage treatment works through association with settleable solids {Yeoman, 1990}. It is anticipated that the majority of the polymer will be associated with sewerage sludge, which will be landfilled or incinerated.

Hence, the overall environmental hazard of the chemical can be rated as low, given the low environmental exposure.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

The supplied data shows low acute oral toxicity in the rat and demonstrates the probable low hazard in the event of acute ingestion. Although the information provided for the notifed chemical is insufficient to characterise its toxicological hazard completely, the low monomer residues together with the high number average molecular weight of the polymer, provides substantial assurance of the likely low toxicological hazard presented to workers and the public by the notified chemical.

Worker exposure to the notified polymer is expected to be minimal. The notifier states that reformulation of paints will only occur in well-established specialist paint manufacturers that employ state-of -the art engineering controls. Application of the paints will be carried out in spray booths, thus inhalation exposure to the polymer in these processes will be minimal. The low concentration of polymer in the final paint products (1.5%) ensures that occupational exposure is minimal. This combined with the expected low hazard of the notified polymer, and the use of engineering controls indicates that the occupational health and safety risks are likely to be minimal.

Exposure to the public will only occur via exposure to surfaces covered in paints containing the notified polymer. Therefore, the notified polymer is expected to pose minimal risk to public health since the polymer becomes fixed in the matrix of the cured paint.

13. RECOMMENDATIONS

To minimise occupational exposure to the polymer in RHEOLATE 420, the following guidelines and precautions should be observed:

- Industrial clothing should conform to the specifications detailed in AS 2919 {Standards Australia, 1987};
- All occupational footwear should conform to AS/NZS 2210 {Standards Australia/Standards New Zealand, 1994a};
- Spillage of the notified chemical 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 Material Safety Data Sheet should be easily accessible to employees.

14. MATERIAL SAFETY DATA SHEET

The MSDS for the product containing the notified chemical was provided in accordance with the *National Code of Practice for the Preparation of Material Safety Data Sheets* {National Occupational Health and Safety Commission, 1994d}.

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 chemical 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

Merriman

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

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Gobas FAPC, Opperhuizen A & Hutzinger O (1986) "Bioconcentration of hydrophobic chemicals in fish: relationship with membrane permeation". *Environmental Toxicology and Chemistry* 5:637-646.

Nabholz JV, Miller P & Zeeman M (1993) Environmental risk assessment of new chemicals under the Toxic Substances Control Act (TSCA) Section Five. In: Landis WG, Hughes JS & Lewis MA eds, Environmental Toxicology and Risk Assessment. ASTM STP 1179. American Society for Testing and Materials, Philadelphia, pp 49 - 50.

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