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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

DP-2903 ACRYLIC COPOLYMER

This Assessment has been compiled in accordance with the provisions of *the Industrial Chemicals (Notification and Assessment) Act 1989,* and Regulations. This legislation is an Act of the Commonwealth of Australia. The National Industrial Chemicals Notification and Assessment Scheme (NICNAS) is administered by Worksafe Australia which also conducts the occupational health & safety assessment. The assessment of environmental hazard is conducted by the Department of the Environment, Sport, and Territories and the assessment of public health is conducted by the Department of Health, Housing, Local Government and Community Services.

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For Enquiries please contact Ms Tina Anderson at:

Street Address: 92 Parramatta Rd Camperdown, NSW 2050, AUSTRALIA
Postal Address: GPO Box 58, Sydney 2001, AUSTRALIA
Telephone: (61) (02) 565-9466 **FAX (61) (02) 565-9465**

Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT

DP-2903 ACRYLIC COPOLYMER

1. APPLICANT

Rohm and Haas Australia Pty Ltd, 969 Burke Rd, Camberwell, Vic, 3124.

2. IDENTITY OF THE CHEMICAL

DP-2903 acrylic copolymer 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, spectral data and amount to be imported have been exempted from publication in the Full Public Report and the Summary Report.

Other names: Experimental Emulsion E-2902 (development name of an emulsion of the polymer); E-2903 (spray dried form of the polymer)

Trade name: DP-2903 (contains 95% of the notified chemical)

Methods of detection and determination:

Infrared spectroscopy, NMR, pyrolysis GC/MS, GPC

3. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20°C and 101.3 kPa:	white powder
Softening Point:	approximately 60°C
Density:	1140 kg/m^3 at 25°C
Water Solubility:	120 g/L
Partition Co-efficient (n-octanol/water) log $P_{O/W}$:	not applicable as the polymer dissociates
Hydrolysis as a function of pH:	the polymer is stable at pH 8 over an extended time suggesting limited hydrolysis

Adsorption/Desorption:	not feasible to test given the inability to accurately measure the polymer concentration in solution
Dissociation Constant pKa:	6.5
Flash Point:	not applicable
Flammability Limits:	polymer not flammable
Decomposition Temperature:	> 177°C
Decomposition Products:	expected to be acrylate monomers
Combustion Products:	water and oxides of carbon
Pyrolysis Products:	acrylate monomers, water and oxides of carbon
Explosive Properties:	lower explosive limit: 100.1 g/m^3 upper explosive limit: 1001.1 g/m^3
Reactivity/Stability:	no known materials incompatible with the notified polymer and it will not undergo polymerisation. It is considered stable up to 177°C

Particle size distribution: (for DP-2903 containing 95% of the notified polymer)
range - 4.6 - 118.4 µm
mean - 42 - 52 µm
(0.2% of total volume < 7 µm)

Comments on Physico-Chemical Properties:

Water solubility is high as the polymer contains a proportion of carboxylate salt functionalities.

No data were provided for hydrolysis as it is known that acrylic polymers are stable in the pH range of 4-9. Experience shows that the polymer in solution is stable at pH8.

No data were provided for partition coefficient on the grounds that "the polymer is one that dissociates" which makes the standard test irrelevant.

No useful data were provided for adsorption/desorption. The polymer however has chemical properties that would make it likely to exhibit some environmental mobility.

The justifications provided in place of data are acceptable.

4. PURITY OF THE CHEMICAL

Degree of purity: 99.8%

Toxic or hazardous impurities (> 0.1% by weight): None

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

Maximum content of residual monomers: 0.12%

Additives/Adjuvants: None

5. INDUSTRIAL USE

The notified polymer is to be used as a modifier in Portland cement mortars and concretes.

6. OCCUPATIONAL EXPOSURE

The notified polymer will be imported in standard 'cement' bags, that is, layered paper/ cardboard bags containing 22.7 kg net DP-2903. Customers will formulate DP-2903 with cement, sand and other dry ingredients by physical mixing in conventional dry blending equipment prior to repackaging for sale to end users. The final dry blends will contain about 5% polymer.

The most common form of the mixer is a horizontal closable cylinder with a slow speed blade or blade agitator arm. The sand, cement and DP-2903 are charged to the mixer, the vessel is closed and agitation commenced. Dust extraction is used where necessary.

For the medium to large sites, sand and cement are stored in silos and correct amounts are metered into the mixer. The bags of polymer are placed in an automatic opening device which discharges it down a chute into the mixer.

For smaller sites, some have automatic dispensing equipment for the bags of polymer but others use manual weighing (where necessary) and manual feeding.

It is expected that blending will take place at about 25 customer sites. At each site less than 10 workers are expected to be required for vessel loading, operating and packaging the final product. After blending, the packaged product will be sold primarily to concreting/ building contractors who blend it with water to form concrete or mortar which is then applied by trowelling, spraying or pouring.

7. PUBLIC EXPOSURE

Public exposure to the notified polymer during its distribution is not expected to occur.

No information has been provided on the dust extraction systems employed during mixing of the polymer with sand and cement. It is possible that some public exposure to low atmospheric concentrations of the notified polymer could occur.

It is estimated that, during use by building contractors, 0.05% of the notified polymer may be lost to the environment due to dust or spills and some public exposure may occur.

Public exposure resulting from disposal of any waste polymer by landfill or incineration is not expected to occur.

Public exposure to the notified polymer resulting from contact with concrete or mortar is not expected to occur as the polymer will be bound in and become an integral component of the cement/ sand matrix. Further, no decomposition or depolymerisation is expected.

8. ENVIRONMENTAL EXPOSURE

. Release

The notified product is to be imported to the Geelong warehouse of Rohm and Hass and dispatched to formulators as a spray dried polymer in 22.7 kg (50 lb) multiwall paper bags.

The process used by the formulators to produce the final use product is by dry blending where the mixing vessel is charged with dry ingredients (cement/sand and the notified polymer) and the mixture is slowly blended using a mechanical blade. Dust emissions are kept low by slow speed of the operation and use of forced ventilation where required. The final product is then bagged or drummed for sale to the end user. The notifier expects at worst 25 kg per year of the notified polymer will be released at each of the blending sites. This release is as spillage usually from the blender loading operation and will usually be collected and reused. If this is not possible it will be incinerated or disposed of to approved landfill under appropriate State regulations.

End use of the product containing the notified polymer is mixed at site of use where water is added and the mixture applied using conventional placing techniques and allowed to set. Once encapsulated in the dry concrete matrix the polymer is bonded and not subject to environmental exposure or potential release from

the finished or repaired article. The release to environment of mixing waste and unused concrete mixture estimated to contain 0.05% w/w of the notified polymer is usually disposed to landfill where no release is expected as the polymer would be tightly bound in the concrete matrix.

. Fate

Manufacturing spillages and container residues in empty paper bags are likely to be disposed of in landfill, where the polymer may persist but can be expected to remain immobile and stable to hydrolysis or biodegradation.

9. EVALUATION OF TOXICOLOGICAL DATA

The *Industrial Chemicals (Notification and Assessment) Act 1989* does not require the provision of toxicological data for polymers of number average molecular weight greater than 1,000. No data are available for the notified chemical. However, a summary of data was supplied for a related acrylate copolymer, Rhoplex DP-2605. In addition, an acute inhalation toxicity study on another compositionally similar material, Acryloid K-120N was provided.

9.1 Acute toxicity

Table 1 Summary of the acute toxicity of Rhoplex DP-2605

Test	Species	Outcome
Acute oral toxicity	Rat	LD_{50} > 5000 mg/kg
Acute dermal toxicity	Rabbit	LD_{50} > 5000 mg/kg
Skin irritation	Rabbit	Non-irritant
Eye irritation	Rabbit	Non-irritant

9.1.1 Oral toxicity

Ten CRCD rats were gavaged with 0.5% aqueous Methocel dispersions of the white solid test substance at 5000 mg/kg. A control group of animals was gavaged with the dosing vehicle alone.

No deaths occurred during a 14-day observation period and no gross changes were observed on necropsy.

It can be concluded that the acute oral LD_{50} of Rhoplex DP-2605 is > 5000 mg/kg.

9.1.2 Dermal toxicity

Six New Zealand White rabbits were used to assess dermal toxicity. The white solid test substance, prepared as a paste in 0.85% saline (1:1) at 5000 mg/kg, was held under an impervious cuff in continuous 24 hour contact with the intact shaved skin.

After removal of the cuff, the application sites were wiped gently with paper towels.

No deaths occurred during a 14-day observation period and no toxic signs were observed. Slight to well-defined erythema without oedema was observed on day 1 and had disappeared by day 10.

It can be concluded that the acute dermal toxicity of Rhoplex DP-2605 is > 5000 mg/kg.

9.1.3 Skin irritation

An area of hair was closely clipped on the backs of six New Zealand White rabbits prior to the administration of 0.5 g of white, solid test substance, prepared as a paste in saline, under a patch covered by an impervious cuff. After 4 hours the patches were removed and the application sites wiped.

Observations of the test site were made at 1, 24 and 72 hours and at 7 days post-treatment. No erythema or oedema was observed at any time point.

It can be concluded that Rhoplex DP-2605 is not irritating to rabbit skin.

9.1.4 Eye irritation

One hundred milligrams of the white powdered test substance was applied to the corneal surface of one eye of each of 9 New Zealand White rabbits. Approximately 35% of the applied test substance was blinked or fell from the treated eye.

With 3 of the rabbits, the treated eyes were irrigated with water for approximately 60 seconds.

No effects of the test substance were observed on the cornea, iris or conjunctivae of any eye of any animal at any time up to 72 hours after dosing.

It can be concluded that Rhoplex DP-2605 is not irritating to the rabbit eye.

9.2 Acute inhalation toxicity of Acryloid K-120N (1)

Sprague-Dawley rats (12/sex) were exposed whole body for 4 hours to an aerosol of Acryloid K-120N (mean particle size 10 μm) at a concentration of 3.36 mg/L.

All animals appeared normal on removal from the exposure chamber and during a 14-day post-exposure period.

Some effects of exposure were observed in female rats. These were effects on body weight (all females) and red spotted cervical lymph nodes at necropsy (11/12 females). These effects

were judged to be treatment-related.

It can be concluded that the 4 hour LC_{50} of Acryloid K-120N is > 3.36 mg/L.

9.3 Overall Assessment of Toxicological Data

Rhoplex DP-2605, which is related to the notified polymer is of very low oral toxicity in rats and very low dermal toxicity in rabbits. It is not a skin irritant or an eye irritant in rabbits. However, evidence of slight skin irritation was observed in the dermal toxicity study.

Acryloid K-120N, also related to the notified polymer is of low acute inhalation toxicity in rats but is not without effect.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

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

The literature suggests that poly (acrylic acid) derivatives may be moderately toxic to green algae (2), the proportion of acid salt functionalities in the polymer is low and toxicity is not expected.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The polymer is unlikely to present a hazard to the environment when it is used as specified. However because of the high solubility of the polymer in the unbound state there remains a potential threat to aquatic organisms if the polymer is exposed in large quantities to aquatic systems. Aquatic exposure may occur in a transport accident involving release of the spray dried polymer to the environment. Adequate warnings exist on Material Safety Data Sheets that accompany loads in transit to alert cleanup crews to the need to block release to drains and waterways.

Spillages from blending plants would cause minimal hazard when disposed of to licensed landfill as the large molecule is likely to be immobile.

The main environmental exposure would be from landfill disposal of waste concrete and demolished concrete structures. However, since the polymer is encapsulated in the concrete matrix, the predicted environmental hazard is minimal.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

The notified polymer has a NAMW > 1000 so that it is unlikely to cross biological membranes and cause adverse health effects. This is supported by toxicological data on two related acrylic copolymers supplied by the notifier one of which is of very low oral toxicity in rats and very low dermal toxicity in rabbits and not irritating to rabbit skin or eye. The other related polymer was of low inhalation toxicity in rats but was not without effect.

The percentage of hazardous residual acrylate monomers is very low and should not present a health hazard.

The toxicity data on related polymers suggests that the notified polymer would not have any acute toxic effects except perhaps at very high levels of inhaled dust. The notified polymer is stable at room temperature and the respirable fraction of the dust is < 0.2% so that adverse health or safety effects are not expected under normal conditions of use.

When the polymer is in the final blend at about 5% (w/w) for the use of concreting/ building contractors, no adverse health or safety effects are expected.

The sole potential adverse health effect may result from exposure to polymer dust during addition to mixers for dry blending. This exposure is not expected to be of long duration even where the notified polymer is added to the mixer manually. The sites where manual addition is carried out are the smaller ones so that exposure is expected to be low.

While the public contact with the notified polymer may be significant, exposure levels will be low and as the notified polymer has a high NAMW absorption is unlikely to occur.

Given the low hazard and low exposure the health risk to workers and the public is also expected to be low.

13. RECOMMENDATIONS

To minimise occupational exposure to DP-2903 acrylic copolymer the following guidelines and precautions should be observed:

- during dry blending of the polymer powder, dust levels should not exceed the Worksafe exposure standard for nuisance dusts of 10 mg/m^3 (3);
- if engineering controls and work practices are insufficient to reduce exposure to a safe level, then personal protective devices which conform to and are used in accordance with Australian Standards (AS) for eye protection (AS 1336, AS 1337) (4,5), respiratory protection (AS 1715) (6), impermeable gloves (AS 2161) (7) and protective clothing (AS

3765.1, 3765.2) (8,9) should be worn;

. a copy of the Material Safety Data Sheet should be easily accessible to employees.

14. MATERIAL SAFETY DATA SHEET

The attached Material Safety Data Sheet (MSDS) for DP-2903 acrylic copolymer was provided in Worksafe Australia format (10).

This MSDS was provided by Rohm and Haas Australia Pty Ltd as part of their notification statement. The accuracy of this information remains the responsibility of Rohm and Haas Australia Pty Ltd.

15. REQUIREMENTS FOR SECONDARY NOTIFICATION

Under the *Industrial Chemicals (Notification and Assessment) Act 1989*, secondary notification of DP-2903 acrylic copolymer 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. *Acryloid K-120N Acute Inhalation Toxicity Study in Rats*, Data on File, Rohm and Haas Company, Spring House, Pennsylvania, USA, Report No.: 80R-75, 1982.

2. USEPA draft document *Discussion of US Regulatory Strategies for Certain New Chemical Polymers*, 1991.

3. National Occupational Health and Safety Commission, *Exposure Standards for Atmospheric Contaminants in the Occupational Environment*, Australian Government Publishing Service Publ., Canberra, 1991.

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. Australian Standard 1715- 1991, *Selection, use and maintenance of Respiratory Protective Devices*, Standards Association of Australia Publ., Sydney, 1991.

7. Australian Standard 2161-1978, *Industrial Safety Gloves Association of Australia Publ, Sydney 1991.and Mittens (excluding Electrical and Medical Gloves)*, Standards Association of Australia Publ., Sydney, 1978.

8. Australian Standard 3765.1-1990, *Clothing for Protection Against Hazardous Chemicals, Part 1: Protection Against General or Specific Chemicals*, Standards Association of Australia Publ., Sydney, 1990.

9. Australian Standard 3765.2-1990, *Clothing for Protection Against Hazardous Chemicals, Part 2: Limited Protection Against Specific Chemicals*, Standards Association of Australia Publ., Sydney, 1990.

10. National Occupational Health and Safety Commission, *Guidance Note for the Completion of a Material Safety Data Sheet*, 2nd. edition, AGPS, Canberra, 1990.