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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

BIOMAX Copolymer

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Director
Chemicals Notification and Assessment

PLC/73

FULL PUBLIC REPORT

BIOMAX Copolymer

1. APPLICANT

DuPont (Australia) Ltd of 49-59 Newton Road WETHERILL PARK NSW 2164 has submitted a notification statement accompanying their application for assessment of a synthetic polymer of low concern, BIOMAX Copolymer.

2. IDENTITY OF THE CHEMICAL

BIOMAX Copolymer is considered not 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, details of the polymer composition and details of exact import volume and customers have been exempted from publication in the Full Public Report.

2. IDENTITY OF THE CHEMICAL

Name:	BIOMAX Copolymer
Number-Average Molecular Weight (NAMW):	> 1 000
Maximum Percentage of Low Molecular Weight Species (Polymers and Oligomers)	
(Molecular Weight < 1 000):	0.89% (theoretical determined upper level)
(Molecular Weight < 500):	not determined
Means of Identification (List of Spectral Data Available):	Infrared (IR) spectroscopy

3. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20°C and 101.3 kPa:	neutral to light yellow, transparent to translucent pellets
Melting Point:	approximately 200°C
Density:	1 370 $kg.m^{-3}$
Water Solubility:	< 1 ppm (by analogy with similar polyester resins))

Hydrolysis as a Function of pH:	not determined
Autoignition Temperature:	> 250°C
Decomposition Temperature:	310-320°C
Polymer Stability:	stable under conditions of use; polymer pellets may become statistically charged during transportation but do not represent an explosion risk; fine dusts of the polymer could be potentially explosive

Comments on Physico-Chemical Properties

No data were provided for the water solubility of the polymers. The notifier has provided arguments for the low solubility based on analogy to polyethylene terephthalate (PET).

The ester linkages of the polymer have the potential to hydrolyse. However, it is anticipated that due to the low solubility of the polymer that hydrolysis under environmental conditions (pH 4-9) is likely to be relatively slow in spite of this being an environmental degradation route (see below).

The polymer contains a small number of negative charge groups and will carry a low level of anionic charge (1 negative charge per 13,000 daltons).

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

4. PURITY OF THE CHEMICAL

Maximum Weight-Percentage of Residual Monomers: 1.12%

5. USE, VOLUME AND FORMULATION(start here)

The notified polymer is a polyester for use in a wide range of disposable/consumer products. It may also be used in agriculturally focused applications.

Projected import volume is greater than one tonne per year for the first five years.

6. OCCUPATIONAL EXPOSURE

The notified polymer, as pellets, will be imported in 25 kg kraft paper bags reinforced with polyethylene. Typically, the content of the sacks is automatically transferred to a hopper equipped with dust extractors. The resin is dried in the hopper and automatically conveyed to the extrusion machine where it is melted and injected into a preform mould. The mould is cooled and automatically discharged from the machine. The preforms are warehoused and subsequently transferred to other areas of disposable and consumer products manufacture. Limited exposure to the

notified polymer is possible by dermal and ocular contact: when opening bags containing pellets and at the extruder nip/injection port where the resin is in the molten state. The machines are fitted with local exhaust ventilation to prevent overheating of the workplace. Where the resin is held in the extruder at temperatures above 300°C for an extended period, some degradation of the resin may occur. This may give rise to fumes containing formaldehyde, ethanol, methanol, acetic acid and acetone.

7. PUBLIC EXPOSURE

No public exposure to the notified polymer is expected during distribution, transport and conversion of pellets into solid plastic articles. Disposal of any waste polymer by incineration or landfill is not expected to result in significant public exposure.

The public is expected to have extensive contact with some products containing the notified polymer. However, the polymer being a stable and a high molecular weight substance, is expected to be poorly absorbed across biological membranes.

8. ENVIRONMENTAL EXPOSURE

. Release

Release to the environment of the notified polymer as a result of manufacturing into articles is expected to be minimal. Manufacturing will take place in a closed system. The polymer will be fed automatically into extrusion and moulding machinery from a hopper. Scrap will be reground and reused. Contaminated polymer scraps will be deposited into municipal landfills or incinerated. Overall, such waste streams would account for at most 0.5% of the annual import of the polymer (i.e. a maximum of 2.5 tonnes of waste polymer may be deposited in landfill at the maximum rate of import).

Residues remaining in the Kraft bags will be disposed of with bags to landfill. Based on previous experience a trace (< 0.2%) of the polymer will remain in the bags and be disposed of to landfill. At the maximum rate of import, this corresponds to a maximum of 1 tonne per annum of polymer, which will be disposed of to landfill with packaging.

The use agricultural products into which the notified polymer will be manufactured is expected to be wide spread. Some of these products are expected to be disposed of to landfill at the end of their useful life. This is also expected to be the fate of the of disposable/consumer products if made from the polymer. The notifier has also indicated possible applications of this polymer which are likely to be left to degrade *in situ.*

. Fate

In the case of accidental spillage, pellets of the polymer are expected to remain where they are deposited. Should a spill occur to water, the pellets should settle onto the bottom sediments, where they could be collected. Due to the expected low

solubility of the polymer, leaching from landfill is highly unlikely, and no movement from the landfill site is expected.

Any incineration of the notified polymer will result in the destruction of the polymer and produce water and oxides of carbon and sulfur.

The majority of the polymer is not expected to be released to the environment until it has been moulded into films, sheeting or containers. The polymer has been designed to biodegrade through the incorporation of "weak" links which are more susceptible to hydrolysis and photodegradation. As a result of these "weak" links the polymer chains will break down into shorter lengths. Once the average length of the polymer falls below a certain level the properties of the plastic will be lost and the plastic will disintegrate. No indication of the rate of breakdown of the polymer has been given other than occurring over a shorter timeframe than the degradation of PET. The shorter PET chains which remain will degrade more slowly to give the monomers 1,2- ethanediol and terephthalic acid. The physico-chemical properties of both these monomers indicate that while they are of low toxicity they are potentially mobile. However, they will be formed relatively slowly and in a dispersed manner, and biodegradability studies on these monomers indicate that they are readily mineralised (2).

Biological membranes are not permeable to polymers of very large molecular size and therefore bioaccumulation of the notified polymer is not expected (3).

9. ASSESSMENT OF ENVIRONMENTAL EFFECTS

No ecotoxicological data were provided which is acceptable for polymers of low concern with a NAMW > 1000 according to the *Industrial Chemicals (Notification and Assessment)* Act.

10. ASSESSMENT OF ENVIRONMENTAL HAZARD

Disposal of the notified polymer to landfill is unlikely to present a hazard to the environment as it will be in a pellet form or as finished products. Bioconcentration and leaching are both considered to be unlikely to occur, due to the high molecular weight of the polymer and its insoluble nature. The polymer will slowly degrade in landfill or *in situ* to its constituent monomers which will ultimately be mineralised. Incineration of the notified polymer will result in its destruction, producing water and oxides of carbon and sulfur.

Little exposure of the aquatic compartment may be expected from the proposed use and together with the expected low environmental toxicity, this indicates that the overall environmental hazard should be minimal.

11. ASSESSMENT OF OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY EFFECTS

BIOMAX Copolymer has been notified as a synthetic polymer of low concern under section 23 for the purposes of section 24A of the Act. The polymer meets the criteria for a synthetic polymer of low concern specified in regulation 4A of the Act and can, therefore, be considered to be of low hazard to human health.

The occupational risk posed to transport and storage workers is negligible, given the expected negligible exposure to the notified chemical under normal circumstances, and the anticipated low health hazard.

The occupational health risk to workers involved in the melting and extruding of the notified polymer is low. Dermal and ocular contact is expected to be the main form of exposure during "opening bags containing the notified polymer and melting injection process. Since, the polymer is in the form of pellets, the level of polymer dust in the working environment is stated to be low. Melting and extrusion of the notified polymer is expected to take place in closed systems, which will limit contact with the polymer in molten form, and local exhaust ventilation will be employed. This will further limit the worker exposure to fumes containing formaldehyde, ethanol, methanol, acetic acid and acetone.

There is negligible potential for public exposure to the polymer arising from transportation, manufacture of plastic products and disposal. While there may be significant public contact with the notified chemical in the form of plastic products, the polymer is unlikely to be absorbed through biological membranes. The polymer is expected to be used for making items that come in contact with food such as disposable eating containers and cutlery. There are no studies to indicate migration of chemicals similar to the notified polymer into food from plastic products. The notifier states that the notified polymer is a member of the polyester family, which has been approved by the US FDA for use in contact with food.

12. RECOMMENDATIONS

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

- It is good work practicee to wear industrial clothing which conforms to the specifications detailed in Australian Standard (AS) 2919 (4) and occupational footwear which conforms to Australian and New Zealand Standard (AS/NZS) 2210 (5) to minimise exposure when handling any industrial chemical;

- Spillage of the notified polymer should be avoided, spillages should be cleaned up promptly and 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 (MSDS) should be easily accessible to employees.

Given that the notified polymer will be used for food contact applications, the notifier may need to contact the individual Australian State jurisdictions, as State food laws require that manufacturers ensure that materials used in food packaging are fit for that purpose.

In addition, The National Occupational Health and Safety Commission document *Exposure Standards for Atmospheric Contaminants in the Occupational Environment: Guidance Note and National Exposure Standards* (6) should be used as a guide in the control of any fumes containing formaldehyde, methanol, acetic acid and acetone released during melting and extrusion of the notified polymer. Workplace monitoring for these components should be carried out on a regular basis.

13. 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* (7).

This MSDS was provided by the notifier 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 notifier.

14. 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. No other specific conditions are prescribed.

15. REFERENCES

1. Billmyer F.W., (1979) *Text Book of Polymer Science,* Wiley and Sons, London Publication

2. IUCLID (1996) *International Uniform Chemical Information Database*. Edition. European Commission, Environment Institute, Ispra (Italy).

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

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

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

6. National Occupational Health and Safety Commission 1995, 'Adopted National 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 Publ., Canberra.

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