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**NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME  
(NICNAS)**

**PUBLIC REPORT**

**Polymer in Lioduras TYZ 74-02NS**

This Assessment has been compiled in accordance with the provisions of the *Industrial Chemicals (Notification and Assessment) Act 1989* (Cwlth) (the Act) and Regulations. This legislation is an Act of the Commonwealth of Australia. The National Industrial Chemicals Notification and Assessment Scheme (NICNAS) is administered by the Department of Health and Ageing, and conducts the risk assessment for public health and occupational health and safety. The assessment of environmental risk is conducted by the Department of Sustainability, Environment, Water, Population and Communities.

For the purposes of subsection 78(1) of the Act, this Public Report may be inspected at our NICNAS office by appointment only at Level 7, 260 Elizabeth Street, Surry Hills NSW 2010.

This Public Report is also available for viewing and downloading from the NICNAS website or available on request, free of charge, by contacting NICNAS. For requests and enquiries please contact the NICNAS Administration Coordinator at:

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**Director  
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## SUMMARY

The following details will be published in the NICNAS *Chemical Gazette*:

ASSESSMENT REFERENCE	APPLICANT(S)	CHEMICAL OR TRADE NAME	HAZARDOUS SUBSTANCE	INTRODUCTION VOLUME	USE
LTD/1555	Toyo Ink Australia Pty Ltd	Polymer in Lioduras TYZ 74-02NS	ND*	<5 tonnes per annum	Printing industry

\*ND = not determined

## CONCLUSIONS AND REGULATORY OBLIGATIONS

### Hazard classification

Based on the structural alerts relating to functional groups of the notified polymer, it should be considered as though it is classified as hazardous according to the *Approved Criteria for Classifying Hazardous Substances* [NOHSC:1008 (2004)] with the following risk phrases:

R36/38 Irritating to eyes and skin

R43 May cause sensitisation by skin contact

and

The classification of the notified polymer using the Globally Harmonised System for the Classification and Labelling of Chemicals (GHS) (United Nations 2009) is presented below. This system is not mandated in Australia and carries no legal status but is presented for information purposes.

	<i>Hazard category</i>	<i>Hazard statement</i>
Skin irritation	2	Warning: Causes skin irritation
Eye irritation	2B	Warning: Causes eye irritation
Skin sensitisation	1	May cause an allergic skin reaction

### Human health risk assessment

This risk to occupational health and safety is considered acceptable provided that the notified polymer is only used under controlled conditions by trained workers wearing PPE.

When used in the proposed manner, the notified polymer is not considered to pose an unacceptable risk to public health.

### Environmental risk assessment

Based on its expected low hazard and assessed use pattern, the notified polymer is not considered to pose an unreasonable risk to the environment.

### Recommendations

#### REGULATORY CONTROLS

##### Health Surveillance

- As the notified polymer is a potential skin sensitizer, health surveillance should be carried out for any worker who has been identified in the workplace risk assessment as having a significant risk of sensitisation.

#### CONTROL MEASURES

## Occupational Health and Safety

- Employers should implement the following engineering controls to minimise occupational exposure to the notified polymer as imported in varnish products at <15% concentration:
  - Automated processes, where possible
- Employers should implement the following safe work practices to minimise occupational exposure during handling of the notified polymer as imported in varnish products at <15% concentration:
  - Avoid contact with skin and eyes
- Employers should ensure that the following personal protective equipment is used by workers to minimise occupational exposure to the notified polymer as imported in varnish products at <15% concentration:
  - Gloves
  - Goggles
  - Coveralls

Guidance in selection of personal protective equipment can be obtained from Australian, Australian/New Zealand or other approved standards.

- A copy of the MSDS should be easily accessible to employees.
- If products and mixtures containing the notified polymer are classified as hazardous to health in accordance with the *Approved Criteria for Classifying Hazardous Substances* [NOHSC:1008(2004)] workplace practices and control procedures consistent with provisions of State and Territory hazardous substances legislation must be in operation.

## Disposal

- The notified polymer should be disposed of to landfill. Storage
- The following precautions should be taken by Toyo Ink Australia Pty Ltd regarding storage of the notified polymer as imported at <15% in varnish products:
  - Avoid strong light, heat or free radical forming conditions caused by exposure to oxidizing chemicals or reactive metals.

## Emergency procedures

- Spills or accidental release of the notified polymer should be handled by physical containment, collection and subsequent safe disposal.

## Regulatory Obligations

### *Secondary Notification*

This risk assessment is based on the information available at the time of notification. The Director may call for the reassessment of the chemical under secondary notification provisions based on changes in certain circumstances. Under Section 64 of the *Industrial Chemicals (Notification and Assessment) Act (1989)* the notifier, as well as any other importer or manufacturer of the notified polymer, have post-assessment regulatory obligations to notify NICNAS when any of these circumstances change. These obligations apply even when the notified polymer is listed on the Australian Inventory of Chemical Substances (AICS).

Therefore, the Director of NICNAS must be notified in writing within 28 days by the notifier, other importer or manufacturer:

- (1) Under Section 64(1) of the Act; if
  - the polymer has a number-average molecular weight of less than 1000;
  - the function or use of the polymer has changed from a component of varnish products at <15% for industrial use, or is likely to change significantly.

or

- (2) Under Section 64(2) of the Act; if
- the amount of polymer being introduced has increased from 5 tonnes per annum, or is likely to increase, significantly;
  - the polymer has begun to be manufactured in Australia;
  - additional information has become available to the person as to an adverse effect of the polymer on occupational health and safety, public health, or the environment.

The Director will then decide whether a reassessment (i.e. a secondary notification and assessment) is required.

#### *Material Safety Data Sheet*

The MSDS of a product containing the notified polymer provided by the notifier was reviewed by NICNAS. The accuracy of the information on the MSDS remains the responsibility of the applicant.

## **ASSESSMENT DETAILS**

### **1. APPLICANT AND NOTIFICATION DETAILS**

#### APPLICANT(S)

Toyo Ink Australia Pty Ltd (ABN 29 006 294 837)  
29 Garden St  
KILSYTH VIC 3137

#### NOTIFICATION CATEGORY

Limited: Synthetic polymer with Mn  $\geq$ 1000 Da.

#### EXEMPT INFORMATION (SECTION 75 OF THE ACT)

Data items and details claimed exempt from publication: chemical name, CAS number, molecular and structural formulae, molecular weight, analytical data, degree of purity, polymer constituents, impurities, use details, import volume.

#### VARIATION OF DATA REQUIREMENTS (SECTION 24 OF THE ACT)

Variation to the schedule of data requirements is claimed as follows: Boiling point, Melting point, Vapour pressure, Hydrolysis as a function of pH, Partition coefficient, Dissociation constant, Adsorption/desorption, Particle size, Flash point, Flammability limits, Explosive properties

#### PREVIOUS NOTIFICATION IN AUSTRALIA BY APPLICANT(S)

None

#### NOTIFICATION IN OTHER COUNTRIES

None

### **2. IDENTITY OF CHEMICAL**

#### MARKETING NAME(S)

Polymer KRC-280 (notified polymer at <90% concentration)  
Lioduras TYZ 74-02NS (imported varnish product containing the notified polymer at <15% concentration)

#### MOLECULAR WEIGHT

Mn >1,000 Da.

#### ANALYTICAL DATA

Reference IR and GPC spectra were provided.

### **3. COMPOSITION**

DEGREE OF PURITY <90%

HAZARDOUS IMPURITIES

<i>Chemical Name</i>	2- Propenoic acid, 2,2-bis[[ (1-oxo-2-propenyl)oxy]methyl]-1,3-propanediyl ester		
<i>CAS No.</i>	4986-89-4	<i>Weight %</i>	11
<i>Hazardous Properties</i>	Conc $\geq$ 20%: Xi; R36/38; R43 $\geq$ 1% Conc <20%: Xi; R43		

LOSS OF MONOMERS, OTHER REACTANTS, ADDITIVES, IMPURITIES  
None

DEGRADATION PRODUCTS  
None

#### 4. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AT 20 °C AND 101.3 kPa: Light yellow viscous liquid

Property	Value	Data Source/Justification
Melting Point/Freezing Point	<0 °C	Estimated (EpiSuite, v.3.20)
Boiling Point	Not determined	Expected to cross-link before boiling.
Density	1,180 kg/m <sup>3</sup> at 20 °C	Analogue data
Vapour Pressure	<1.3x10 <sup>-9</sup> kPa	Estimated based on NAMW > 1000 Da. (US EPA, 2010)
Water Solubility	7.65x10 <sup>-11</sup> g/L at 20 °C	Estimated for an analogue (WSKOW v1.41, US EPA, 2009)
Hydrolysis as a Function of pH	Not determined	Contains hydrolysable functionality. However, hydrolysis is not expected at environmental pH due to limited water solubility.
Partition Coefficient (n-octanol/water)	log Pow = 6.36 at 20 °C	Estimated for an analogue (KOWWIN v1.67, US EPA, 2009)
Adsorption/Desorption	log K <sub>oc</sub> = 3.49 at 20 °C	Estimated for an analogue (KOCWIN v2.00, US EPA, 2009)
Dissociation Constant	Not determined	Does not contain any readily dissociable functionality at environmental pH
Flash Point	>100 °C at 100 kPa	Analogue data
Flammability	Not expected to be highly flammable	Estimated
Autoignition Temperature	Not expected to autoignite	Estimated based on stability at temperatures up to 350 °C
Explosive Properties	Not predicted to be explosive	Estimated based on chemical structure

#### DISCUSSION OF PROPERTIES

For full details of tests on physical and chemical properties, refer to Appendix A.

#### Reactivity

The notified polymer may polymerise/cross-link in the presence of strong light, heat or free radical forming conditions caused by exposure to oxidizing chemicals or reactive metals.

#### Dangerous Goods classification

Based on the submitted physical-chemical data in the above table the notified polymer is not classified according to the Australian Dangerous Goods Code (NTC, 2007). However the data above do not address all Dangerous Goods endpoints. Therefore consideration of all endpoints should be undertaken before a final decision on the Dangerous Goods classification is made by the introducer of the polymer.

Note: The product containing the notified polymer at <15% concentration will be classified as a Class 3 (Flammable) dangerous good according to the Australian Dangerous Goods Code (NTC, 2007).

#### 5. INTRODUCTION AND USE INFORMATION

## MODE OF INTRODUCTION OF NOTIFIED POLYMER (100%) OVER NEXT 5 YEARS

The notified polymer will be imported as a component of a UV-curable varnish at a concentration of up to 15%.

## MAXIMUM INTRODUCTION VOLUME OF NOTIFIED POLYMER (100%) OVER NEXT 5 YEARS

<i>Year</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
<i>Tonnes</i>	<5	<5	<5	<5	<5

## PORT OF ENTRY

Melbourne, Sydney

## IDENTITY OF RECIPIENTS

Toyo Ink Australia Pty Ltd

KILSYTH VIC 3137

## TRANSPORTATION AND PACKAGING

The notified polymer will be imported at <15% in UV-curable varnish products in 20 L metal cans. Cans of the varnish containing the notified polymer will be transported to customer sites by road for end use.

## USE

The notified polymer will be used as a component of UV-curable varnish products at <15% concentration. The varnish products containing the notified polymer will be applied over the top of print to plastic and metal substrates.

## OPERATION DESCRIPTION

Varnish products containing the notified polymer at <15% concentration will be transported from the notifier's storage to customer sites. The varnish will be poured manually into flexographic or gravure printing equipment. Once the equipment is filled with the varnish containing the notified polymer, it will be applied automatically to a plastic or metal substrate and fixed with other ink ingredients onto the substrate matrix.

## 6. HUMAN HEALTH IMPLICATIONS

### 6.1. Exposure Assessment

#### 6.1.1. Occupational Exposure

## NUMBER AND CATEGORY OF WORKERS

<i>Category of Worker</i>	<i>Number</i>	<i>Exposure Duration (hours/day)</i>	<i>Exposure Frequency (days/year)</i>
Transport and Storage	10-20	4-8	50
Printer Operators	>1000	1-2	25
Service Technicians	200	8	200

## EXPOSURE DETAILS

#### *Transport, Warehousing and Wholesale Printer Supply Workers*

Workers are not expected to be exposed to the notified polymer, as it will be transported in sealed containers. Exposure is possible in the event of an accident where the packaging is breached.

#### *Print operators*

Print operators may experience dermal and ocular exposure to small amounts of the notified polymer at <15% concentration during the manual addition of the varnish containing the notified polymer to printing machines, stocking substrate feeders and attending to substrate jams. Exposure of these workers is expected to be minimised by the automated and enclosed nature of the printing equipment used to transfer the varnish to the substrate. In addition, exposure will be minimised through the use of personal protective equipment (PPE) including impervious gloves, safety glasses and coveralls. Inhalation exposure may also occur to aerosols of the notified polymer during addition of the varnish and the operation of the printers. However, this is expected to be minimised using exhaust ventilation fitted to the machines and respirators (during addition of the varnish) worn by workers.

#### *Service technicians*

Service technicians may experience dermal and ocular exposure to the notified polymer during printer maintenance and cleaning but this is expected to be minimized by the use of impervious gloves, safety glasses, coveralls and safety boots. Inhalation exposure may also be possible but is expected to be minimised through the use of respirators and exhaust ventilation fitted to the machines.

After application to the substrate, the varnish containing the notified polymer will be UV-cured (fixed) onto the plastic or metal substrate. Once the varnish is dried and cured, the notified polymer is reacted into a polymer matrix and will not be bioavailable.

#### **6.1.2. Public Exposure**

The varnish products containing the notified polymer will not be sold to the public. Articles coated with varnish containing the notified polymer may be sold to the public. However, once the varnish is dried and cured, the notified polymer will be reacted into a polymer matrix and will not be bioavailable.

### **6.2. Human Health Effects Assessment**

#### *Toxicokinetics, metabolism and distribution.*

The notified polymer has a high molecular weight (>1000 Da.) and limited water solubility (<1 mg/L). Based on these characteristics, it is not expected to be absorbed following oral, dermal or inhalation exposure. The notified polymer has relatively high levels of low molecular weight species (approx. 25% with molecular weight <1000 Da.). However, a large proportion of these low molecular weight species are due to the presence of an impurity.

#### *Irritation and Sensitisation*

The notified polymer contains a structural alert for skin sensitisation (Barratt et al. 1994) and skin and eye irritation (Hulzebos et al. 2005). An impurity known to cause skin sensitisation is also present at >1%, the cut-off concentration for classification as a skin sensitizer according to [NOHSC:1008 (2004)]. The notified polymer is considered to have the potential to cause skin sensitisation as well as skin and eye irritation.

#### *Mutagenicity*

The notified polymer was found not to be mutagenic in a bacterial reverse mutation test (See Appendix A for details).

#### **Health hazard classification**

Based on the structural alerts relating to functional groups of the notified polymer, it should be considered as though it is classified as hazardous according to the *Approved Criteria for Classifying Hazardous Substances* [NOHSC:1008 (2004)] with the following risk phrases:

R36/38 Irritating to eyes and skin

R43 May cause sensitisation by skin contact

### **6.3. Human Health Risk Characterisation**

#### **6.3.1. Occupational Health and Safety**

The notified polymer has the potential to cause skin sensitisation as well as skin and eye irritation. However, the notified polymer in varnishes at <15% is not expected to cause irritation.

The main risk for print operators and service technicians is skin sensitisation. These workers may experience dermal and potentially ocular exposure to the notified polymer during addition of the substrate to printing equipment, stocking substrate feeders, attending to paper jams, cleaning and maintenance. However, exposure is expected to be minimised by the use of PPE such as impervious gloves, safety glasses, coveralls and safety boots.

Provided that PPE is used as described to prevent dermal and ocular exposure, the risk to workers exposed to the notified polymer at <15% is not expected to be unreasonable.

#### **6.3.2. Public Health**

The public may experience contact with articles coated with varnish containing the notified polymer. However, once the varnish is dried and cured, the notified polymer will be reacted into a polymer matrix and will not be bioavailable. Therefore, when used in the proposed manner, the risk to public health is not considered to be unreasonable.



## **7. ENVIRONMENTAL IMPLICATIONS**

### **7.1. Environmental Exposure & Fate Assessment**

#### **7.1.1. Environmental Exposure**

##### **RELEASE OF CHEMICAL AT SITE**

The notified polymer will be imported in a finished overprint varnish and there will be no reformulation or repackaging in Australia. Therefore, there will be no release from manufacturing or reformulation activities. Release of the notified polymer to the environment may occur in the event of an accident during transport, distribution or storage. Spills are expected to be treated with adsorbent material, collected and disposed of to landfill.

##### **RELEASE OF CHEMICAL FROM USE**

The product containing the notified polymer is to be used in industrial applications and therefore minimal release to the aquatic environment is expected. Residues in empty import containers, accounting for 1% of the import volume, are expected to be disposed of to landfill. Spills and residues in equipment washings are estimated to account for a further 1% of the import volume and are expected to be disposed of in accordance with local regulations.

##### **RELEASE OF CHEMICAL FROM DISPOSAL**

Notified polymer in varnish is expected to share the fate of the plastic and metal substrates to which it has been applied. Articles to which the notified polymer has been applied are expected to either be disposed of to landfill, or recycled.

#### **7.1.2. Environmental Fate**

The majority of the notified polymer is expected to be UV-cured to form an inert matrix adhering to plastic and metal substrates during its normal use as a varnish. The notified polymer is irreversibly bound into the matrix and, in this form, is not expected to be bioavailable or readily biodegradable. Notified polymer in solid waste disposed of to landfill is not expected to be mobile due to its high molecular weight and the predicted adsorption coefficient of the analogue. Although the predicted partition coefficient of the analogue is greater than 5, the notified polymer is not expected to cross biological membranes due to its high molecular weight and therefore is not expected to bioaccumulate. The notified polymer will eventually degrade in landfill, or by thermal decomposition during recycling processes, to form water and oxides of carbon.

#### **7.1.3. Predicted Environmental Concentration (PEC)**

The Predicted Environmental Concentration (PEC) has not been calculated for the notified polymer as, based on its reported use pattern, ecotoxicologically significant quantities are not expected to be released to the aquatic environment.

### **7.2. Environmental Effects Assessment**

No ecotoxicity data were submitted. Polymers without significant ionic functionality are generally of low concern to the aquatic environment. Further, the analogue is not expected to be bioavailable at its limit of solubility in water due to its high predicted partition coefficient. Therefore, no effects on aquatic organisms were predicted for the analogue, and by inference the notified polymer, at its limit of water solubility (ECOSAR v1.00, US EPA, 2009).

#### **7.2.1. Predicted No-Effect Concentration**

A Predicted No Effect Concentration (PNEC) has not been calculated as, on the basis of the predicted effects for the analogue, the notified polymer is not expected to be readily bioavailable and is predicted to have no effect on aquatic biota at its limit of water solubility.

### **7.3. Environmental Risk Assessment**

The risk quotient ( $Q = \text{PEC}/\text{PNEC}$ ) for the notified polymer has not been calculated as release to the aquatic environment is not expected based on its reported use pattern as a varnish for metal and plastic substrates. The majority of the notified polymer will be disposed of to landfill as cured varnish where it is irreversibly bound into a solid inert matrix, and is unlikely to be bioavailable or mobile in this form. Therefore, based on its expected low hazard and assessed use pattern, the notified polymer is not considered to pose an unreasonable risk to the environment.

## APPENDIX A: TOXICOLOGICAL INVESTIGATIONS

### A.1. Genotoxicity – bacteria

TEST SUBSTANCE	Notified polymer
METHOD	According to the modifications adopted by the Japanese Ministry of Health, Labour and Welfare similar to OECD TG 471 Bacterial Reverse Mutation Test.
Species/Strain	Pre incubation procedure <i>S. typhimurium</i> : TA1535, TA1537, TA98, TA100 <i>E. coli</i> : WP2uvrA
Metabolic Activation System	S9 mix was prepared from the livers of phenobarbital/5,6-Benzoflavone induced male Sprague-Dawley rats.
Concentration Range in Main Test	a) With metabolic activation: 20, 78, 313, 1250 and 5000 µg/plate
Vehicle	b) Without metabolic activation: 20, 78, 313, 1250 and 5000 µg/plate
Remarks - Method	DMSO No preliminary toxicity test was conducted to determine the cytotoxicity of the notified polymer.

#### RESULTS

Metabolic Activation	Test Substance Concentration (µg/plate) Resulting in:			
	Cytotoxicity in Preliminary Test	Cytotoxicity in Main Test	Precipitation	Genotoxic Effect
<i>Absent</i>				
Test 1	5000	5000	-	negative
Test 2	5000	5000	-	negative
<i>Present</i>				
Test 1	-	-	5000	negative
Test 2	-	-	5000	negative

Remarks - Results	Reduced growth of the background lawn was observed in several strains at 5000 µg/plate in the absence of metabolic activation. Precipitate was observed in several strains at 5000 µg/plate in the presence of metabolic activation.  All the positive control chemicals used in the test induced marked increases in the frequency of revertant colonies thus confirming the activity of the S9-mix and the sensitivity of the bacterial strains.
CONCLUSION	The notified polymer was not mutagenic to bacteria under the conditions of the test.
TEST FACILITY	Toyo Ink SC Holdings Co., Ltd. (2011)

### **BIBLIOGRAPHY**

- Barratt et al. (1994) An Expert System Rulebase for Identifying Contact Allergens, *Toxicology In Vitro*: 8(5), pp.1053-1060.
- Hulzebos, E., Walker, J.D., Gerner, I. and Schlegel, K. (2005) Use of structural alerts to develop rules for identifying chemical substances with skin irritation or skin corrosion potential. *QSAR Combinatorial Science*. 24:332-342
- NOHSC (1994) National Code of Practice for the Labelling of Workplace Substances [NOHSC:2012(1994)]. National Occupational Health and Safety Commission, Canberra, Australian Government Publishing Service.
- NOHSC (2003) National Code of Practice for the Preparation of Material Safety Data Sheets, 2<sup>nd</sup> edition [NOHSC:2011(2003)]. National Occupational Health and Safety Commission, Canberra, Australian Government Publishing Service.
- NOHSC (2004) Approved Criteria for Classifying Hazardous Substances, 3<sup>rd</sup> edition [NOHSC:1008(2004)]. National Occupational Health and Safety Commission, Canberra, AusInfo.
- NTC (National Transport Commission) 2007 Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG code), 7th Edition, Commonwealth of Australia
- Toyo Ink SC Holdings Co., Ltd (2011) Toyo Ink SC Holdings Report: Microbial Metabolic Activation Test to Assess the Potential Mutagenic Effect. Tokyo, Japan. 18 April 2011 (Unpublished report provided by the notifier)
- United Nations (2009) Globally Harmonised System of Classification and Labelling of Chemicals (GHS), 3<sup>rd</sup> revised edition. United Nations Economic Commission for Europe (UN/ECE), <[http://www.unece.org/trans/danger/publi/ghs/ghs\\_rev03/03files\\_e.html](http://www.unece.org/trans/danger/publi/ghs/ghs_rev03/03files_e.html)>.
- US EPA (2009) Estimations Programs Interface Suite™ for Microsoft® Windows, v.3.20. United States Environmental Protection Agency. Washington, DC, USA.
- US EPA (2010) Interpretive Assistance Document for Assessment of Polymers. US EPA Sustainable Futures Assessment Summary Updated April 2010. Available online [9 June 2011]: [www.epa.gov/oppt/sf/pubs/iad\\_polymers\\_042010.pdf](http://www.epa.gov/oppt/sf/pubs/iad_polymers_042010.pdf).