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

FULL PUBLIC REPORT

**Erythrulose
(Erythrulose Pentapharm)**

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 Environment, Water, Heritage and the Arts.

For the purposes of subsection 78(1) of the Act, this Full Public Report may be inspected at our NICNAS office by appointment only at 334-336 Illawarra Road, Marrickville NSW 2204.

This Full 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
NICNAS**

TABLE OF CONTENTS

<u>FULL PUBLIC REPORT.....</u>	3
1. APPLICANT AND NOTIFICATION DETAILS.....	3
2. IDENTITY OF CHEMICAL	3
3. COMPOSITION.....	5
4. PHYSICAL AND CHEMICAL PROPERTIES.....	5
5. INTRODUCTION AND USE INFORMATION.....	6
6. HUMAN HEALTH IMPLICATIONS.....	6
6.1 Exposure assessment.....	6
6.1.1 Occupational exposure.....	6
6.1.2 Public exposure.....	7
6.2 Human health effects assessment.....	7
6.3 Human health risk characterisation.....	8
6.3.1 Occupational health and safety	8
6.3.2 Public health.....	8
7. ENVIRONMENTAL IMPLICATIONS	9
7.1 Environmental Exposure & Fate Assessment.....	9
7.1.1 Environmental Exposure.....	9
7.1.2 Environmental fate.....	9
7.1.3 Predicted Environmental Concentration (PEC)	10
7.2 Environmental effects assessment	11
7.2.1 Predicted No-Effect Concentration.....	11
7.3 Environmental risk assessment	11
8. CONCLUSIONS AND REGULATORY OBLIGATIONS.....	11
Hazard classification	11
Human health risk assessment	11
Environmental risk assessment	11
Recommendations.....	11
Regulatory Obligations	12
<u>APPENDIX A: PHYSICAL AND CHEMICAL PROPERTIES.....</u>	14
<u>APPENDIX B: TOXICOLOGICAL INVESTIGATIONS.....</u>	17
B.1. Acute toxicity – oral	17
B.2. Irritation – skin	17
B.3. Irritation – eye.....	18
B.4. Skin sensitisation	18
B.5. Repeat dose toxicity.....	19
B.6. Repeat Application Dermal Irritation	21
B.7. Phototoxic and Photoallergic Potential.....	21
B.8. Genotoxicity – bacteria.....	22
B.9. Genotoxicity – in vitro.....	23
B.10. Dermal Drug Delivery and Percutaneous Absorption	24
B.11. Irritative Potential in Humans.....	25
<u>APPENDIX C: ENVIRONMENTAL FATE AND ECOTOXICOLOGICAL INVESTIGATIONS.....</u>	26
C.1. Environmental Fate.....	26
C.1.1. Ready biodegradability	26
C.2.1. Acute toxicity to fish.....	26
C.2.2. Acute toxicity to aquatic invertebrates	27
C.2.3. Algal growth inhibition test.....	28
<u>BIBLIOGRAPHY.....</u>	30

FULL PUBLIC REPORT**Erythrulose
(Erythrulose Pentapharm)****1. APPLICANT AND NOTIFICATION DETAILS**

APPLICANT(S)

Bronson and Jacobs Pty Ltd (ABN 81 000 063 249)
5 Parkview Drive
HOMEBUSH BAY NSW 2140

Unilever Australia Ltd (ABN 66 004 050 828)
219 North Rocks Road
NORTH ROCKS NSW 2151

Procter & Gamble Australia Pty Ltd (ABN 91 008 396 245)
Level 3 & 4, 1 Innovation Road
MACQUARIE PARK NSW 2113

NOTIFICATION CATEGORY

Secondary Notification.

EXEMPT INFORMATION (SECTION 75 OF THE ACT)

No details are claimed exempt from publication.

VARIATION OF DATA REQUIREMENTS (SECTION 24 OF THE ACT)

No variation to the schedule of data requirements is claimed.

PREVIOUS NOTIFICATION IN AUSTRALIA BY APPLICANT(S)

LTD/1130

EX/86

EX/90

EX/95

The notified chemical has been assessed under the limited category and was also subject to three extensions of the assessment certificate. As the applicants are proposing to exceed the volume allowed under the limited category (1 tonne/year), the notified chemical was reassessed under the secondary notification provisions.

NOTIFICATION IN OTHER COUNTRIES

EU (2003).

2. IDENTITY OF CHEMICAL

CHEMICAL NAME

2-butanone, 1,3,4-trihydroxy-, (3S)-

OTHER NAME(S)

Erythrulose

MARKETING NAME(S)

Erythrulose Pentapharm

CAS NUMBER

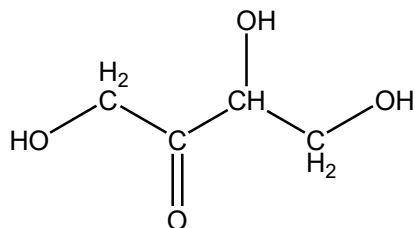
533-50-6*

MOLECULAR FORMULA

C₄H₈O₄

* =This is the CAS Number for L-Erythrulose which was the chemical assessed.

STRUCTURAL FORMULA



MOLECULAR WEIGHT

120

SPECTRAL DATA

ANALYTICAL METHOD	Ultraviolet/visible light (UV/VIS) Spectra
Remarks	$\lambda_{\text{max}}=278.77\text{nm}$, $\epsilon=0.315$ pH=7 $\lambda_{\text{max}}=279.20\text{nm}$, $\epsilon=0.286$ pH=1.55 $\lambda_{\text{max}}=297.05\text{nm}$, $\epsilon=1.591$ pH=11.90 Spectroscopy undertaken with sample from L-Erythrulose Lot 405045[307-01].
TEST FACILITY	Pentapharm (2002)

SPECTRAL DATA

ANALYTICAL METHOD	Infrared (IR) Spectrum
Remarks	Peaks at 3325.95, 2941.11, 2890.55, 2158.83, 1725.22, 1642.79, 1412.40, 1234.77, 1147.94, 1103.40, 1042.62, 998.54, 932.51, 881.06 cm ⁻¹ .
TEST FACILITY	Spectroscopy undertaken with sample from L-Erythrulose Lot 405045 [307-01] Pentapharm (2002)

SPECTRAL DATA

ANALYTICAL METHOD	Nuclear Magnetic Resonance (NMR) Spectra ¹ H Spectrum Shifts: 4.78, 4.63, 4.58, 4.55, 4.50, 4.46, 4.45, 4.44, 3.87, 3.86 (3 peaks) ppm ¹³ C Spectrum Shifts: 212.37, 76.61, 66.44, 63.71, 40.22, 40.02, 39.81, 39.60, 39.39, 39.18 ppm
Remarks	Spectroscopy undertaken with sample from L-Erythrulose Lot 405045 [307-01]
TEST FACILITY	Pentapharm (2002)

SPECTRAL DATA

ANALYTICAL METHOD	Mass (MS) Spectrum
	Peaks observed at 58.9, 60.8, 72.0, 74.9, 86.9, 88.9, 98.7, 99.8, 100.9, 101.6, 118.1, 119.0, 120.0 m/z
Remarks	Spectroscopy undertaken with sample from L-Erythrulose Lot 405045 [307-01]
TEST FACILITY	Solvias (2002)

METHODS OF DETECTION AND DETERMINATION

ANALYTICAL METHOD	High performance liquid chromatography
Remarks	A high performance liquid chromatographic (HPLC) method for the quantitative analysis of the test substance (Erythrulose Batch 405045/307-01 80% notified chemical and

TEST FACILITY 20%water) was developed.
NOTOX (2003a)

METHODS OF DETECTION AND DETERMINATION

ANALYTICAL METHOD UV/VIS, IR, NMR, and Mass spectroscopy

3. COMPOSITION

DEGREE OF PURITY
75-82%

HAZARDOUS IMPURITIES/RESIDUAL MONOMERS
None

NON HAZARDOUS IMPURITIES/RESIDUAL MONOMERS (>1% by weight)

<i>Chemical Name</i>	Water		
<i>CAS No.</i>	7732-18-5	<i>Weight %</i>	13-20
<i>Chemical Name</i>	Sulphated ash		
<i>CAS No.</i>		<i>Weight %</i>	<1.5

ADDITIVES/ADJUVANTS
None

4. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AT 20°C AND 101.3 kPa:

Property	Value	Data Source/Justification
Freezing Point	<-80.5°C	Measured
Boiling Point	>130°C at 101.3 kPa	Measured
Density	1390 kg/m ³ at 20°C	Measured
Vapour Pressure	0.861 kPa at 20°C	Measured
Water Solubility	≥1331 mg/L at 19.6±1°C	Measured
Hydrolysis as a Function of pH	Not determined	The notified chemical is stable for 18 months in water at low temperature according to a statement from the notifier.
Partition Coefficient (n-octanol/water)	log Pow = -2.16 at 20°C	Measured
Adsorption/Desorption	log K _{oc} <1,32 at 35°C	Measured
Dissociation Constant	Not determined	Not determined
Particle Size	Not applicable	Notified chemical is introduced as a liquid.
Flash Point	Not determined	Notified chemical boiled at 122°C and 121°C without flash point being observed.
Flammability	Not flammable	Based on its flash point the notified chemical is expected to have low flammability.
Autoignition Temperature	340°C	Measured
Explosive Properties	Not explosive	The notified chemical does not contain any chemically unstable or highly energetic groups that might lead to an

explosion.

DISCUSSION OF PROPERTIES

For full details of the physical-chemical properties tests please refer to Appendix A.

Reactivity

The notified polymer is expected to be stable under normal condition of use.

5. INTRODUCTION AND USE INFORMATION

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

The notified chemical will be imported in 1 kg to 25 kg steel drums as a ready to use ingredient of cosmetic mixtures. The notified chemical will also be imported in finished products in small jars and bottles up to 700mL.

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

<i>Year</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
Total	3.15t	2.83t	2.88t	2.88t	2.88t

PORT OF ENTRY: SYDNEY

IDENTITY OF MANUFACTURER/RECIPIENTS

The notified chemical will be stored at Bronson and Jacobs Pty Ltd warehouse Homebush Bay, NSW, the Unilever Australia Ltd warehouse, Ingleburn, NSW, and the Procter & Gamble Australia Pty Ltd warehouse, Sydney, for distribution to customers. The cosmetic products containing the notified chemical will be formulated at various sites mainly in Sydney and Melbourne.

TRANSPORTATION AND PACKAGING

The notified chemical will be imported in polyethylene bags inside 1 kg and 25 kg steel containers or in finished products in small jars and bottles up to 700mL. The end use containers will be High Density Polyethylene (HDPE) and PVC bottles or jars 50-700mL in size.

USE

The notified chemical is used in cosmetic skin products at <5.0% as a skin colouring ingredient.

OPERATION DESCRIPTION

The notified chemical will be imported in a finished cosmetic product or as a ready to use cosmetic ingredient. When used in formulation of cosmetic products, the notified chemical is weighed from the import container to a separate container and pumped directly into a mixing tank, where it is blended with other ingredients of the cosmetic products. The mixture will be heated and during the mixing process, laboratory staff will sample end use product for quality control testing. Once approved, the final product will be transferred by filling lines to the end use containers. The end use product will be stored and despatched to the customers.

6. HUMAN HEALTH IMPLICATIONS**6.1 Exposure assessment****6.1.1 Occupational exposure**

NUMBER AND CATEGORY OF WORKERS

The following is a typical pattern of exposure for the notified chemical.

<i>Category of Worker</i>	<i>Number</i>	<i>Exposure Duration (hours/day)</i>	<i>Exposure Frequency (days/year)</i>
Transport and storage	10	4	13
Professional compounder	1	8	13
Chemist	1	3	13
Packers (Dispensing and capping)	2	8	13

Store Persons	2	4	13
End Users	300 000	8	365

EXPOSURE DETAILS

Transport and Storage

Transport and storage workers handling the imported product, containing 75-82% (w/w) notified chemical, are not expected to be exposed to the notified chemical during transport except in the case of an accidental spill.

The finished product, containing <5.0% (w/w) of the notified chemical, will be transported to numerous sites.

Dermal exposure will be the main route of potential exposure for transport and storage workers. Normally these workers are likely to wear overalls, safety boots, and gloves when handling containers.

Reformulation

At reformulation sites, a compounder will weigh the notified chemical from the imported container to a separate container and then add it to the blending tank where it will be blended in a closed system.

During the weighing (for manual systems) and connection and disconnection of lines (for automated systems), incidental dermal, ocular and inhalation exposure from splashes, drips, spills and vapours is possible.

Compounders will wear safety glasses with shields, gloves, apron, and coveralls. Local exhaust ventilation will be in use to prevent inhalation exposure.

Following blending, the finished products are packaged into 50-700mL HDPE and PVC bottles. During the filling and capping of the bottles accidental dermal and ocular contact may occur. Packers monitoring the filling lines and capper will wear safety glasses, gloves and work uniforms.

The blending tank and the transfer lines are cleaned by rinsing with water and detergents. Maintenance workers handling the equipment used for blending and filling may come into dermal and ocular contact with residues containing the notified chemical (approximately 300-500 grams per tank). These workers will wear eye protection and gloves.

Laboratory Staff

Laboratory staff will take samples of the notified chemical as imported in the additive package as well as the final product for testing. During sampling and analysis there may be dermal and ocular contact. The laboratory testing will take a few minutes per batch. It is expected laboratory staff will wear adequate protection for the eyes, skin, body, and hands.

6.1.2. Public exposure

The notified chemical as imported will not be available to the public. The finished products containing the notified chemical at <5% will be widely available to the public. Public exposure will be restricted to those persons using self-tanning products. The tanning crèmes will be used twice daily, while the body lotions will be used once daily. Persons using the final product will be dermally exposed to the notified chemical. However, studies on percutaneous absorption of the notified chemical indicate that absorption will be negligible. Accidental ocular exposure to the notified chemical may also occur.

Direct public exposure during transport and storage or from manufacturing waste is unlikely.

6.2. Human health effects assessment

<i>Endpoint and Result</i>	<i>Assessment Conclusion for test substance containing notified chemical</i>
Rat, acute oral LD50 >2000 mg/kg bw	low toxicity
Rabbit, skin irritation	slightly irritating
Rabbit, eye irritation	slightly-irritating
Guinea pig, skin sensitisation – adjuvant test.	no evidence of sensitisation.
Rat, repeat dose oral toxicity – 28 days.	NOEL=1000 mg/kg bw/day
Phototoxicity and Photoallergic Potential	no evidence of phototoxicity or photoallergenicity
Repeat Application Dermal Irritation	non irritant
Genotoxicity – bacterial reverse mutation	non mutagenic
Genotoxicity – in vitro chromosomal aberration	genotoxic

Dermal Drug Delivery and Percutaneous Absorption	did not penetrate human skin in vitro within 48 hours
Irritative potential in humans	extremely low potential

The notified chemical exhibits low acute oral toxicity in rats and was found to be slightly irritating to the eyes and skin of rabbits. There was no evidence that the notified chemical was a skin sensitiser in the guinea pig maximisation test. The notified chemical produced no evidence of phototoxicity or photoallergenicity in guinea pigs.

The NOEL for the notified chemical a 28-day repeat dose oral toxicity study in rats was 1000 mg/kg bw/day based on the absence of any treatment related effects at any dose. In a repeat application dermal test, the notified chemical was found to be non-irritant in guinea pigs.

The notified chemical was not mutagenic in bacterial reverse mutation assays but was found to be clastogenic in an *in vitro* in Chinese Hamster V79 cells. Based on this evidence, the notified chemical is not classified as hazardous according to the *Approved Criteria for Classifying Hazardous Substances* [NOHSC: 1008 (2004)].

The notified chemical did not penetrate human skin *in vitro* within 48 hours and was found to have low irritative potential in humans.

Based on the available data, the notified chemical is not classified as a hazardous substance in accordance with the *Approved Criteria for Classifying Hazardous Substances* [NOHSC: 1008 (2004)].

6.3. Human health risk characterisation

6.3.1. Occupational health and safety

Occupational exposure can occur when handling the notified chemical as imported (75-82% notified chemical). During the formulation process, dermal and accidental ocular exposure to the notified chemical may occur during charging of the blending vessel, QC testing and cleaning of the blending tank. The notified chemical is slightly irritating to the eyes and skin and therefore operators should wear, gloves, safety glasses, and overalls.

Once the final product is packed, exposure should be low. Hence, exposure for warehousing and distribution workers and retail workers is unlikely unless the packaging is breached.

6.3.2. Public health

The level of the notified chemical in finished product <5% (w/w). Dermal absorption of the notified chemical is likely to be low based on the *in vitro* test using human skin. Data from animal and human studies indicate that the notified chemical is not a skin sensitiser and repeated dermal exposure is not of concern.

The self-tanning body lotions are used once daily and crème products twice daily. The notifier has calculated dermal exposure using:

$$\text{Systemic exposure} = [\text{dp} \times \text{c} \times \text{a} \times \text{f}] / \text{bw}$$

Where

- a = amt of product applied per application (mg)
- c = concentration in product
- dp = dermal penetration
- f = frequency of application
- bw = body weight

The following assumptions were made:

- c = 5% maximum concentration of notified chemical in products
- bw = 60 kg
- dp = 10% worst case scenario.

For Body Lotion:

8 gram of product per application once a day

$$\begin{aligned} & [\text{dp} \times \text{c} \times \text{a} \times \text{f}] / \text{bw} \\ &= (10\% \times 5\% \times 8000 \times 1) / 60 \\ &= 0.67 \text{ mg/kg bw/day} \end{aligned}$$

For general purpose crème:

1.2 gram of product per application twice a day

$$\begin{aligned} & [dp \cdot c \cdot a \cdot f] / bw \\ & = (10\% \times 5\% \times 1200 \times 2) / 60 \\ & = 0.2 \text{ mg/kg bw/day} \end{aligned}$$

For general purpose crème:

0.8 gram of product per application twice a day

$$\begin{aligned} & [dp \cdot c \cdot a \cdot f] / bw \\ & = (10\% \times 5\% \times 800 \times 2) / 60 \\ & = 0.13 \text{ mg/kg bw/day} \end{aligned}$$

Margin of Exposure (MOE) calculations were undertaken, based on the NOEL of 1000 mg/kg bw/day from the 28-day oral repeat dose subchronic study in rats and the highest exposure scenario of 0.67 mg/kg bw/day for the daily use of the body lotion given above.

$$\begin{aligned} \text{MOE} &= \text{NOEL} / \text{systemic exposure} \\ &= 1000 / 0.67 \\ &= 1492.54 \end{aligned}$$

The Margin of Exposure exceeds 100, and is hence acceptable.

7. ENVIRONMENTAL IMPLICATIONS

7.1. Environmental Exposure & Fate Assessment

7.1.1 Environmental Exposure

RELEASE OF CHEMICAL AT SITE

There will be no release due to manufacture of the notified chemical as it will not be manufactured in Australia but will be used in the formulation of cosmetic products. In this process the potential sources of release include spills, process equipment cleaning, and import container residues. Loss due to spills will be minimal due to the size and type of the import containers. It is estimated that up to 3% (ie up to 95 kg) may be released annually due to equipment cleaning and up to 1% (ie up to 32 kg) via residues in empty import containers. Equipment cleaning effluent will go into the onsite effluent treatment plant. Container residues may be rinsed into the batch or disposed of with the container via a licensed waste contractor.

RELEASE OF CHEMICAL FROM USE

The cosmetic product will be applied to the skin and then washed off during bathing into the aquatic environment. Up to 1% (32 kg) annually will remain in the empty container.

RELEASE OF CHEMICAL FROM DISPOSAL

Disposal from the product formulation plants, will consist of the release of treated effluent into the sewer system, containing up to 95 kg of notified chemical annually, and the disposal of containers and solid wastes (including cleanup rags), up to 32 kg annually, to landfill via a licensed waste contractor.

The empty container will be disposed of by the end user in the general domestic garbage then to landfill. Up to 95% of the imported notified chemical will be released into the aquatic environment during bathing.

7.1.2 Environmental fate

For the details of the environmental fate studies please refer to Appendix C.

The majority of the notified chemical will eventually be released into the environment (up to 3,118 kg) via discharge into sewerage systems through bathing. It is expected that up to 32 kg per annum will remain in the consumer product containers and will be disposed of to landfill.

The notified chemical is expected to be highly soluble in water and as such will be mobile in both the aquatic and terrestrial compartment. It will not readily hydrolyse in natural waters at environmental pH values, however, is readily biodegradable. Residual chemical disposed of to landfill within empty containers will readily degrade.

7.1.3 Predicted Environmental Concentration (PEC)

The majority of the notified chemical will eventually be released into the environment (up to 3,118 kg) via discharge into sewerage systems through bathing. It is expected that up to 32 kg per annum will remain in the consumer product containers and will be disposed of to landfill.

The notified chemical is expected to be highly soluble in water and as such will be mobile in both the aquatic and terrestrial compartment. It will not readily hydrolyse in natural waters at environmental pH values, however, is readily biodegradable. Residual chemical disposed of to landfill within empty containers will readily degrade.

The ready biodegradability test results showed that up to 70% of the notified chemical was eliminated after 28 days and therefore the notified chemical was considered to be readily biodegradable. The SIMPLETREAT model (European Commission, 2003) for modelling partitioning and losses in sewage treatment plants (STP) was used to estimate the proportions of the chemical partitioning into the different environmental compartments. The results indicate that when the chemical is released into the aqueous phase of a STP, about 13% would partition to water and 87% would degrade while there is no release to air through volatilisation or partitioning to biosolids. These results are consistent with the non-volatility, high solubility and low log P_{ow} values of the notified chemical and the results of the adsorption/desorption test indicating that the test substance has no tendency to adsorb onto the sludge.

As the majority of the notified chemical will be released into the aquatic environment via the sewerage systems and assuming 13% of the notified chemical may potentially remain in solution, the PEC_{inland} and PEC_{ocean} are calculated as follows:

Predicted Environmental Concentration (PEC) for the Aquatic Compartment		
Total Annual Import/Manufactured Volume	3 150	kg/year
Proportion expected to be released to sewer	96%	
Annual quantity of chemical released to sewer	3 024	kg/year
Days per year where release occurs	365	days/year
Daily chemical release:	8.28	kg/day
Water use	200.0	L/person/day
Population of Australia (Millions)	20.496	million
Removal within STP	13%	
Daily effluent production:	4,099	ML
Dilution Factor - River	1.0	
Dilution Factor - Ocean	10.0	
PEC - River:	2.02	µg/L
PEC - Ocean:	0.202	µg/L

STP effluent re-use for irrigation occurs throughout Australia. The agricultural irrigation application rate is assumed to be 1000 L/m²/year (10 ML/ha/year). The notified chemical in this volume is assumed to infiltrate and accumulate in the top 0.1 m of soil (density 1000 kg/m³). Thus the soil concentration can be estimated in the following table.

Concentration in effluent	0.271 µg/L
PEC_{soil} (µg/kg) (assumes no degradation in soil or movement out of soil)	

Soil concentration	1 year	2.71
	5 years	13.57
	10 years	27.13

Bioaccumulation is not expected due to the high water solubility and low log P_{ow} of the notified chemical, which indicates a poor affinity to lipids. The readily biodegradable nature of the notified chemical would also limit its bioaccumulation potential.

7.2. Environmental effects assessment

<i>Organism</i>	<i>Duration</i>	<i>Outcome</i>
Fish	96 h	LC ₅₀ > 100 mg/L
Daphnia	48 h	EC ₅₀ > 100 mg/L
Algae	72 h	E _b C ₅₀ > 100 mg/L

7.2.1 Predicted No-Effect Concentration

Since data are available for three trophic levels a safety factor of 100 along with the LC₅₀/EC₅₀ value of >100 mg/L are used to estimate a predicted no effect concentration (PNEC for aquatic ecosystems) of >1 mg/L by dividing the LC₅₀ value by the safety factor.

7.3. Environmental risk assessment

Risk Assessment	PEC µg/L	PNEC µg/L	Q
Q - River:	0.271	>1 mg/L	<0.000271
Q - Ocean:	0.0271	>1 mg/L	<0.0000271

Describe/characterise Environmental Risk

Since the RQ values are much less than 1, the proposed use of the notified chemical is unlikely to pose an unacceptable risk to aquatic life. Even if the chemical's degradation was not taken into account the RQ value is much less than 1.

8. CONCLUSIONS AND REGULATORY OBLIGATIONS

Hazard classification

Based on the available data the notified chemical is not classified as hazardous under the *Approved Criteria for Classifying Hazardous Substances* [NOHSC: 1008(2004)].

Human health risk assessment

Under the conditions of the occupational settings described, the risk to workers is considered to be acceptable.

When used in the proposed manner the risk to the public is considered to be acceptable.

Environmental risk assessment

On the basis of the PEC/PNEC ratio:

The notified chemical is not considered to pose a risk to the environment based on its reported use pattern.

Recommendations

REGULATORY CONTROLS

CONTROL MEASURES

Occupational Health and Safety

- Employers should implement the following safe work practices to minimise occupational exposure during handling of the notified chemical as introduced:
 - Minimise drips and spills

- Employers should ensure that the following personal protective equipment is used by workers to minimise occupational exposure to the notified chemical as introduced:
 - Safety glasses, gloves and 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 chemical are classified as hazardous to health in accordance with the NOHSC *Approved Criteria for Classifying Hazardous Substances*, workplace practices and control procedures consistent with provisions of State and Territory hazardous substances legislation must be in operation.

Environment

- The following control measures should be implemented by cosmetic manufacturer to minimise environmental exposure during formulation of the notified chemical:
 - Process equipment should be within bunded areas with only process drains in the vicinity.

Disposal

- The notified chemical should be disposed of to landfill.

Emergency procedures

- Spills/release of the notified chemical should be contained and either pumped into sealable containers or absorbent material used, which should then be placed in sealable labelled containers ready for disposal to landfill.

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 chemical, have post-assessment regulatory obligations to notify NICNAS when any of these circumstances change. These obligations apply even when the notified chemical 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:

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 chemical, have post-assessment regulatory obligations to notify NICNAS when any of these circumstances change. These obligations apply even when the notified chemical 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(2) of the Act; if
 - the function or use of the chemical has changed from a skin colouring ingredient or is likely to change significantly;

- the amount of chemical being introduced has increased from 3.15 tonnes, or is likely to increase, significantly;
- the amount of chemical in finished cosmetic products exceeds 5.0%;
- if the chemical has begun to be manufactured in Australia;
- additional information has become available to the person as to an adverse effect of the chemical 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.

No additional secondary notification conditions are stipulated.

Material Safety Data Sheet

The MSDS of the notified chemical (and products containing the notified chemical) provided by the notifier were reviewed by NICNAS. The accuracy of the information on the MSDS remains the responsibility of the applicant.

APPENDIX A: PHYSICAL AND CHEMICAL PROPERTIES

Freezing Point	<-80.5°C
Method	OECD TG 102 Melting Point/Melting Range EC Directive 92/69/EEC A.1 Melting/Freezing Temperature.
Remarks	Erythrulose had no defined freezing point or freezing range. With a decrease in temperature, the viscosity of test substance increased without showing a clear phase transition of the liquid into the solid state.
Test Facility	NOTOX (2002a)
Boiling Point	Not determined
Method	OECD TG 103 Boiling Point. EC Directive 92/69/EEC A.2 Boiling Temperature.
Remarks	An exothermic effect was observed at temperatures above 180°C, and in combination with observed changes of colour of the test substance, indicated reaction or decomposition of the test substance at these temperatures. Two endothermic effects that were observed at temperatures below 180°C and were probably caused by evaporation of different components of the test substance. Reaction or decomposition, are likely to have started at a temperature below 180°C and this probably interfered with the process that caused the second endothermic effect. There was no indication for reaction or decomposition of the test substance, at temperatures up to 130°C. Boiling of the test substance was not observed below the temperature at which reaction or decomposition started.
Test Facility	NOTOX (2002b)
Density	1390 kg/m ³ at 20°C
Method	OECD TG 109 Density of Liquids and Solids. EC Directive 92/69/EEC A.3 Relative Density.
Remarks	A glass pycnometer was used.
Test Facility	NOTOX (2003b)
Vapour Pressure	0.861 kPa at 20°C
Method	OECD TG 104 Vapour Pressure. EC Directive 92/69/EEC A.4 Vapour Pressure.
Remarks	The static technique was used with a capacitance manometer fitted. A measured amount of the test substance was placed in the sample vessel which was then attached to the mechanism. After evacuation the vessel was immersed in thermostatic water bath at various temperatures and the vapour pressure measured. The vapour pressure at 20°C was extrapolated from the curve. Since the measured vapour pressures were greater than 0.1 Pa, no correction for thermal transpiration was made.
Test Facility	The notified chemical is highly volatile (Mensink, 1995). NOTOX (2003c)
Water Solubility	≥1331 mg/L at 19.6±1°C
Method	OECD TG 105 Water Solubility. EC Directive 92/69/EEC A.6 Water Solubility.
Remarks	A measured amount of test substance (1331 mg) was added to 1 mL of distilled water in a glass tube and was stirred magnetically for 12 days. After this the solution was visually checked for any undissolved material, of which none was observed.
Test Facility	NOTOX (2002d)

Hydrolysis as a Function of pH Not determined.
Remarks The notified chemical is stable for 18 months in water at low temperature. However, at pH greater than 5.5 it becomes unstable, and may eventually hydrate to an aliphatic tetra alcohol.

Partition Coefficient (n-octanol/water) log Pow = -2.16 at 20°C

Method OECD TG 107 Partition Coefficient (n-octanol/water)
EC Directive 92/69/EEC A.8 Partition Coefficient.
Remarks The notified chemical was added to three different ratios of n-octanol and water (1:1, 1:2 and 2:1). The test vessels were shaken by hand for 5 mins, centrifuged at 3500 g for 5 mins at 20°C and samples from each phase were analysed by HPLC.
Test Facility The value derived by the Rekker calculation method was very similar at -2.5.
NOTOX (2003d)

Adsorption/Desorption log K_{oc} <1.32 at 35°C

Method OECD TG, Proposal for new guideline 121: "Estimation of the Adsorption Coefficient (K_{oc}) on Soil and on Sewage Sludge using High Performance Liquid Chromatograph (HPLC)".
Remarks The estimation software Pkalc version 5 was used to calculate the expected pK_a values for the notified chemical. From this estimation it was determined that in the pH range 5.5–7.5 the substance would be in its non-ionised form. Therefore the HPLC mobile phase was not buffered in the study.
Test Facility Phenol, at 1.3 g/L, with a known log K_{oc} of 1.32, was used as a reference substance.
NOTOX (2003e)

Dissociation Constant Not determined
Remarks While under extreme pH conditions the notified chemical may become ionised, in the environmental pH range of 4-9 this is unlikely.

Particle Size Not determined.

Remarks The notified chemical is a component of an aqueous solution.

Flash Point Not determined.

Method EC Directive 92/69/EEC A.9 Flash Point.
Remarks The flashpoint of Erythrulose was determined using a Pensky-Martens closed cup flash point apparatus. In two separate tests no flash point was observed up to 122°C and 121°C, at which temperatures the test substance boiled out of the test cup. After the test, the test substance appeared to be a light brown liquid.
Test Facility NOTOX (2003f)

Flammability Limits Not flammable

Method EC Directive 92/69/EEC A.12 Flammability (Contact with Water).
Remarks The notified chemical does not contain groups that might lead to evolution of highly flammable gases in dangerous quantities. No metals, transition metals, boron or silicon are present. Therefore it can be concluded that the test substance is incapable of developing a dangerous amount of (flammable) gas in contact with air, damp air or water. No spontaneous ignition nor evolution of gas occurred when a small quantity of the test substance was added to double distilled water. Erythrulose is known to be water soluble.
Test Facility NOTOX (2002d)

Autoignition Temperature 340°C

Method 92/69/EEC A.15 Auto-Ignition Temperature (Liquids and Gases).
Remarks The lowest measured autoignition temperature was 342°C at an injection volume of 100 µL. Rounding down to the nearest 5°C gives an autoignition temperature of 340°C.
Test Facility NOTOX (2003g)

Explosive Properties Not explosive

Method EC Directive 92/69/EEC A.14 Explosive Properties.
Remarks The calculated oxygen balance of the notified is -107%, which indicates potential for explodability. However, there are no bond groupings known to confer explosive properties (plosophores) and explosive enhancing groups (auxoploses) present in the structure. The relatively high oxygen balance is due the presence of the two hydroxyl groups and a carbonyl group in a relatively small molecule. The notified chemical does not contain any chemically unstable or highly energetic groups that might lead to an explosion.
Test Facility NOTOX (2002h)

Oxidising Properties No oxidising properties

Method EC Directive 92/69/EEC A.17 Oxidising Properties (Solids).
Remarks Erythrulose consists of 80% of the active ingredient and 20% water. Water is known not to be oxidising. On examination of the structure of the active ingredient, it was determined that the substance is incapable of burning, when mixed with cellulose, at a higher or equal rate with the maximum burning rate of a reference mixture of cellulose and barium nitrate. The oxygen in the molecule is chemically bonded to carbon atoms.
Test Facility NOTOX (2003i)

Pyrophoric Properties Not pyrophoric.

Method EC Directive 92/69/EEC A.13 Pyrophoric Properties of Solids and Liquids
Remarks From the structural formula of the notified chemical, it can be concluded that it is not pyrophoric. The notified chemical does not contain any chemical group that might lead to spontaneous ignition a short time after coming into contact with air at room temperature. Experience in handling the test substance (80% notified chemical 20% water) shows that it does not ignite coming in contact with air.
Test Facility NOTOX (2002e)

Reactivity

Remarks The notified chemical is expected to be stable under normal environmental conditions and has no oxidising potential.

APPENDIX B: TOXICOLOGICAL INVESTIGATIONS**B.1. Acute toxicity – oral**

TEST SUBSTANCE	Product No 7451/307-01 (81.5% notified chemical)
METHOD	OECD TG 401 Acute Oral Toxicity – Limit Test. EC Directive 92/69/EEC B.1 Acute Toxicity (Oral) – Limit Test.
Species/Strain	Rat/Sprague–Dawley
Vehicle	None.
Remarks - Method	No significant protocol deviation.

RESULTS

<i>Group</i>	<i>Number and Sex of Animals</i>	<i>Dose mg/kg bw</i>	<i>Mortality</i>
1	5/sex	2000	0/10

LD50	>2000 mg/kg bw
Signs of Toxicity	No signs of systemic toxicity were noted.
Effects in Organs	No abnormalities were observed necroscopy.
Remarks - Results	All animals showed expected gain in bodyweight.

CONCLUSION The test substance is of low toxicity via the oral route.

TEST FACILITY Safepharm Laboratories (1994a).

B.2. Irritation – skin

TEST SUBSTANCE	Product No. 7451/307-01 (81.5% notified chemical)
METHOD	OECD TG 404 Acute Dermal Irritation/Corrosion. EC Directive 92/69/EEC B.4 Acute Toxicity (Skin Irritation).
Species/Strain	Rabbit/New Zealand White
Number of Animals	Three
Vehicle	Distilled water
Observation Period	14 days
Type of Dressing	Semi-occlusive.
Remarks - Method	No significant protocol deviation.

A 20% aqueous dilution of the test substance was used.

RESULTS

<i>Lesion</i>	<i>Mean Score*</i> <i>Animal No.</i>			<i>Maximum Value</i>	<i>Maximum Duration of Any Effect</i>	<i>Maximum Value at End of Observation Period</i>
	1	2	3			
<i>Erythema/Eschar</i>	0	0	0	1	1 hour	1 hour
<i>Oedema</i>	0	0	0	-	-	-

*Calculated on the basis of the scores at 24, 48, and 72 hours for EACH animal.

Remarks - Results	Very slight erythema was noted at one treated skin site in one female one hour after patch removal. No skin reactions were noted at 24 hours. Yellow coloured staining was noted at all treated skin sites throughout the test and observation period. The staining did not affect the evaluation of skin responses.
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CONCLUSION A 20% aqueous dilution of the test substance is slightly irritating to the skin.

TEST FACILITY Safepharm Laboratories (1994b).

B.3. Irritation – eye

TEST SUBSTANCE Product No. 7451/307-01 (78.5% notified chemical)

METHOD OECD TG 405 Acute Eye Irritation/Corrosion.
EC Directive 92/69/EEC B.5 Acute Toxicity (Eye Irritation).
Species/Strain Rabbit/New Zealand White
Number of Animals Three
Observation Period 72 hours
Remarks - Method No significant protocol deviation. A 20% aqueous dilution of the test substance was used.

RESULTS

<i>Lesion</i>	<i>Mean Score*</i>			<i>Maximum Value</i>	<i>Maximum Duration of Any Effect</i>	<i>Maximum Value at End of Observation Period</i>
	<i>Animal No.</i>					
	1	2	3			
<i>Conjunctiva: redness</i>	0	0	0	1	1 hour	0
<i>Conjunctiva: chemosis</i>	0	0	0	0	-	0
<i>Conjunctiva: discharge</i>	0	0	0	1	1 hour	0
<i>Corneal opacity</i>	0	0	0	0	-	0
<i>Iridial inflammation</i>	0	0	0	0	-	0

*Calculated on the basis of the scores at 24, 48, and 72 hours for EACH animal.

Remarks - Results No corneal or iridial effects were noted during the study. Minimal conjunctival irritation was noted in one treated eye one hour after treatment. All treated eyes appeared normal 24 hours after treatment.

CONCLUSION A 20% aqueous dilution of the test substance is slightly irritating to the eye.

TEST FACILITY Safepharm Laboratories (1994c).

B.4. Skin sensitisation

TEST SUBSTANCE Product No 7451/307-01 (81.5% notified chemical)

METHOD OECD TG 406 Skin Sensitisation – Magnusson & Kligman Maximisation.
Species/Strain Guinea pig/Dunkin-Hartley
PRELIMINARY STUDY Maximum Non-irritating Concentration:
intradermal: <1% (w/v) in distilled water
topical: 2% (v/v) in distilled water
MAIN STUDY
Number of Animals Test Group: 20 Control Group: 10
INDUCTION PHASE Induction Concentration:
intradermal: 20% (w/v) in distilled water (maximum concentration requested by sponsor)
topical: 20% (v/v) in distilled water
Signs of Irritation Intradermal induction.
Very slight to well defined erythema was noted at the intradermal induction sites of all test group animals at 24 hours with very slight erythema at 48 hours. No skin reactions were noted at the intradermal induction sites of control group animals at 24 hours. Due to a technical error, the 48-hour observation of the intradermal induction sites of control

groups was not performed. This deviation was considered not to affect the purpose or integrity of the study

Topical Induction

Light brown/yellow coloured staining was noted at the induction sites of all test group animals at 1 and 24 hours. The staining did not affect evaluation of skin responses. Very slight to well defined erythema was noted at the induction sites of all test groups animals at 1 hour. Very slight erythema was noted at the induction sites of nine test group animals at the 24-hour observation. Bleeding from the intradermal induction sites was noted at the 1 hour. No skin reactions were noted at the treatment sites of controls group animals at 1 and 24 hours.

CHALLENGE PHASE

1st challenge

Remarks - Method

topical: 20% and 10% (v/v)

None.

RESULTS

<i>Animal</i>	<i>Challenge Concentration</i>	<i>Number of Animals Showing Skin Reactions after: 1st challenge</i>	
		<i>24 h</i>	<i>48 h</i>
<i>Test Group</i>	20%	0/20	0/20
	10%	0/20	0/20
<i>Control Group</i>	20%	0/10	0/10
	10%	0/10	0/10

Remarks - Results

Light brown/ yellow coloured staining was noted at the challenge sites of all test and control group animals at 24 and 48 hours. The staining did not affect evaluation of skin responses. No skin reactions were noted at the challenge sites of the test and control group animals at 24 and 48 hours.

CONCLUSION

There was no evidence of reactions indicative of skin sensitisation to the test substance under the conditions of the test.

TEST FACILITY

SafePharm Laboratories (1994d)

B.5. Repeat dose toxicity

TEST SUBSTANCE

Product 405829/307-01 (80.3% notified chemical)

METHOD

OECD TG 407 Repeated Dose 28-day Oral Toxicity Study in Rodents.

EC Directive 96/54/EC B.7 Repeated Dose (28 Days) Toxicity (Oral).

Species/Strain

Rat/Wistar Crl (WF)

Route of Administration

Oral – gavage

Exposure Information

Total exposure days: 28 days;

Dose regimen: 7 days per week;

Post-exposure observation period: none

Vehicle

Water (Milli-U)

Remarks - Method

The dose levels used were based on the results of a 5-day range finding study.

RESULTS

<i>Group</i>	<i>Number and Sex of Animals</i>	<i>Dose mg/kg bw/day</i>	<i>Mortality</i>
I (control)	5/sex	0	0/10
II (low dose)	5/sex	50	0/10
III (mid dose)	5/sex	150	0/10
IV (high dose)	5/sex	1000	0/10

Mortality and Time to Death

No mortality occurred during the study period.

Clinical Observations

There were no clinical signs of toxicity or behavioural changes over the 28-day observation period. Incidental findings observed included yellow staining of the fur, chromodacryorrhoea, a broken tail apex and alopecia on the shoulders. These incidental findings are commonly noted in rats of the age and strains used under the test conditions. No further corroborative findings and/or no dose response relationship were found and therefore these were considered of no toxicological significance.

No changes were observed in hearing ability, pupillary reflex, static righting reflex, and grip strength in the treated animals compared to control animals. There were no treatment related changes in motor activity observed.

Body weight of the treated animals remained within the same range as controls over the 4- week study period.

Statistically significant (Dunnett - test based on pooled variance significant at 1%) reductions of body weight gains in males at low and high doses until the end of the study and in males at mid dose during week 2 only were observed. The absence of a dose related reduction in weight gain and further corroborative findings in the study indicate these reductions were not of toxicological significance.

Statistically significant (Dunnett –test based on pooled variation significant at 5%) increases in body weight in females at mid dose during week 3 were considered to have occurred by chance and were not considered to be of toxicological significance.

Food consumption before and after allowance for body weight was similar between treated and control animals.

Laboratory Findings – Clinical Chemistry, Haematology, Urinalysis

Males receiving the high dose showed a reduced partial thromboplastin time. A reduction of this parameter is generally considered not to be of toxicological significance. No toxicologically relevant changes occurred in haematological parameters of the other treated rats.

There were no differences noted between control and treated rats in clinical chemistry parameters that were considered to be treatment related. The decreased mean glucose values of males treated with the low dose was within the normal range and occurred in the absence of other supportive treatment related findings. It was thus concluded that this alteration was of no toxicological significance.

Effects in Organs

No toxicologically relevant alterations were observed at necroscopy.

Incidental findings among the animals included red foci on and/or red discolouration of the thymus, dark red discolouration and/or enlargement of the mandibular lymph node, broken tails, a dark red papillary process of the liver and watery–clear fluid containing cysts on the uterus. These findings are occasionally seen among test and control animals. The absence of a treatment related distribution and/or the presence of these findings in controls as well as the treated groups, suggests these signs were not of toxicological significance. Watery fluid in the uterus, found in two high dose females, is related to the stage of the oestrous cycle and is a normal finding.

Organ weights and organ to body weight ratios of treated animals were considered similar to those of control animals.

Weight of the kidneys and spleen of females treated at mid dose showed a statistically significant increase (significance level not given). Based on the absence of the similar increases in the high dose group as well as the lack of related macroscopic or microscopic findings, these increases were considered not to be toxicologically significant.

There were no microscopic findings recorded which could be attributed to treatment with the test substance.

All microscopic findings were within the range of the background pathology encountered in rats of the age and strain used and occurred at similar incidence and severity in both control and treated rats.

Remarks – Results

There were no changes in clinical appearance, performance of functional observation, body weight and food consumption measurements, or alteration during clinical laboratory investigations, macroscopic examination, organ weight determination, and microscopic examination that were considered to be treatment related.

CONCLUSION

The No Observed Effect Level (NOEL) was established as 1000 mg/kg bw/day in this study, due to absence of any toxicologically significant effects at this dose and lower doses.

TEST FACILITY

NOTOX (2003j).

B.6. Repeat Application Dermal Irritation

TEST SUBSTANCE Product No.7451/307-01 (81.5% notified chemical)

METHOD SafePharm Standard Protocol Number SPL 50.

Remarks - Method

Three male and three female albino Dunkin-Hartley guinea pigs had both flanks clipped with veterinary clippers and shaved using an electric razor. Fifty microlitres (µL) of a 20% (v/v) aqueous solution of the test substance was spread evenly over an approximately 2 cm x 2 cm area of the clipped skin on the left flank of each animal. The test site remained non-occluded. 0.05 mL of sterile distilled water (control substance) was applied to the right flank. The animals were returned to their cages. Approximately twenty-four hours after the first exposure, the test and control substances were re-applied to the appropriate sites. This was repeated over fourteen days. To prevent excessive staining by the test substance, the treatment sites were swabbed with cotton wool soaked in water to remove excessive residual test substance approximately two hours prior to reapplication. The control sites were treated in a similar manner. Shortly before each daily application and approximately 24 hours after the fourteenth application the test sites were examined for evidence of primary irritation and scored using the Draize scheme.

RESULTS

Remarks - Results

There was no evidence of erythema or oedema at the test or control sites throughout the study period. There were no abnormal clinical observations made during the study period. All animals showed a bodyweight increase over the study period. Brown coloured staining was noted at the test sites throughout the study period. The staining did not affect the evaluation of the skin reactions.

CONCLUSION

A 20% (v/v) aqueous solution of the test substance was considered non irritant to guinea pig skin under the conditions of the study.

TEST FACILITY

SafePharm Laboratories (1995a).

B.7. Phototoxic and Photoallergic Potential

TEST SUBSTANCE Product No 7451/307-01 (81.5% notified chemical)

METHOD SafePharm Standard Method Number SPL 205

Remarks - Method

Fifteen female albino Dunkin-Hartley guinea pigs were used for the main study. Five animals were allocated to the phototoxicity group (Group I), five to the photoallergy group (Group II) and five to the positive photoallergy group (Group III).

In order to assess the phototoxic potential of the test substance, the Group I

animals received single topical applications of test substance at concentrations of 20% (v/v) in distilled water, with or without subsequent irradiation with ultraviolet light (UVA; 320-400 nm). The dosage of UVA was approximately 10Joules/cm² skin. These animals similarly received single topical applications of 0.005% (w/v) 8-methoxypsoralen in 95% aqueous ethanol (positive phototoxic substance) with and without subsequent UVA irradiation. Skin reactions were recorded 4, 24, and 48 hours after irradiation.

To assess the photoallergenic potential of the test substance, Group II animals received single topical applications of the test substance at a concentration of 20% (v/v) in distilled water, followed by exposure to UVA (approximately 10 Joules/cm² skin) on days 7, 8, 9, 10, and 11. This formed the induction phase of the photoallergenicity determination. On day 35 the same animals received topical applications of the test substance at concentrations of 20% and 10% (v/v) in distilled water followed by exposure to UVA (10 Joules/cm² skin). This formed the challenge phase of photoallergenicity determination. The challenge reactions were evaluated approximately 24 and 48 hours after irradiation.

Group III animals were used to validate the photoallergenicity phase. Group III animals were treated in a similar manner to the Group II animals but were treated topically with a 5% aqueous solution of the known photallergen 6-methylcoumarin.

RESULTS

Remarks - Results

No evidence of erythema or oedema was noted in any Group I animal following treatment with 20% (v/v) of the test substance in distilled water. No skin reactions were apparent in the Group II animals after treatment with the test substance at concentrations of 20% and 10% (v/v) in distilled water during the photoallergenicity phase of the study. The positive controls used in test produced phototoxic and photoallergic reactions in animals under the conditions of the test.

CONCLUSION

The test substance when applied at concentrations of up to 20%(v/v) in distilled water produced no evidence of phototoxicity or photoallergenicity under the conditions of the test.

TEST FACILITY

SafePharm Laboratories (1995b).

B.8. Genotoxicity – bacteria

TEST SUBSTANCE

Product No 7451/307-01 (81.5% notified chemical)

METHOD

OECD TG 471 Bacterial Reverse Mutation Test.
EC Directive 2000/32/EC B.13/14 Mutagenicity – Reverse Mutation Test using Bacteria.

Plate incorporation procedure.

Species/Strain

S. typhimurium: TA1535, TA1537, TA98, TA100.

E. coli: WP2uvrA.

Metabolic Activation System

S9 fraction from Aroclor 1254 induced rat liver.

Concentration Range in

a) With metabolic activation: 0, 50, 150, 500, 1500, 5000 µg/plate.

Main Test

b) Without metabolic activation: 0, 50, 150, 500, 1500, 5000 µg/plate.

Vehicle

Distilled water.

Remarks - Method

No significant deviation in protocol.

RESULTS

Metabolic

Test Substance Concentration (µg/plate) Resulting in:

<i>Activation</i>	<i>Cytotoxicity in Preliminary Test</i>	<i>Cytotoxicity in Main Test</i>	<i>Precipitation</i>	<i>Genotoxic Effect</i>
<i>Absent</i>				
Test 1	>5000	>5000	>5000	Negative
Test 2	>5000	>5000	>5000	Negative
<i>Present</i>				
Test 1	>5000	>5000	>5000	Negative
Test 2	>5000	>5000	>5000	Negative

Remarks – Results

No toxicity was exhibited in any of the strains of bacteria used. No significant increases in the numbers of revertant colonies of bacteria were recorded for any of the strains of bacteria used, at any dose level, either with or without metabolic activation.

The positive control substances all produced marked increases in the number of revertant colonies and the activity of the S9 fraction was found to be satisfactory.

CONCLUSION

The test substance was not mutagenic to bacteria under the conditions of the test.

TEST FACILITY

Safepharm Laboratories (1995c).

B.9. Genotoxicity – in vitro

TEST SUBSTANCE

Erythrulose (Batch 401089/307-01) (78.8% notified chemical)

METHOD

Cell Type/Cell Line

OECD TG 473 In vitro Mammalian Chromosome Aberration Test.
EC Directive 2000/32/EC B.10 Mutagenicity - In vitro Mammalian
Chinese Hamster/V79

Metabolic Activation System

S9 from β Naphthoflavone and Phenobarbital induced rat liver.

Vehicle

Distilled water.

Remarks – Method

<i>Metabolic Activation</i>	<i>Test Substance Concentration ($\mu\text{g/mL}$)</i>	<i>Exposure Period</i>	<i>Harvest Time</i>
<i>Absent</i>			
Test 1	500*, 1000*, 2500*, 5000*	4	20
Test 2	500*, 1000*, 1500*, 2500*, 5000*	20	20
<i>Present</i>			
Test 1	500*, 1000*, 2500*, 5000*	4	20

*Cultures selected for metaphase analysis.

RESULTS

Remarks - Results

In Test 1, a clear and dose-dependent reduction of mitotic index and of the cell density was observed without metabolic activation (5000 $\mu\text{g/mL}$: mitotic index 12%, cell density 51% compared to control values). With metabolic activation, a reduction in only cell density was seen (5000 $\mu\text{g/mL}$: cell density 45% compared to control values). This differed to the pre experiment in which no toxicity occurred up to 5000 $\mu\text{g/mL}$.

In Test 2, reductions of mitotic index and cell density were seen (5000 $\mu\text{g/mL}$: mitotic index 38%, cell density 57% compared to control values). These reductions were not as severe as in Test 1 and may be attributable to experimental conditions. In Test 1, treatment with test substance was performed with serum free medium while Test 2 was undertaken in serum complete medium. This suggests that the reactive molecule(s) leading to cell toxicity are partially bound by serum proteins.

In Test 1 without metabolic activation, the test substance increased the frequency of cells with chromosomal aberrations in a biologically relevant and dose related manner. At the 2500 µg/mL concentration, 4.5% aberrant cells were found. At 5000 µg/mL, 18.5% aberrant cells were found in 130 metaphases scored. The aberration rates of the cells after treatment with the test item in Test 1 with metabolic activation and in Test 2 without metabolic activation were near the range of the negative control value and within the historical control range. These results indicate a strong correlation between cytotoxicity of the test item and clastogenic activity. Due to the clear effects observed without metabolic activation at 4 hours a delayed fixation time was not performed.

Positive controls used in the tests showed a distinct and biologically relevant increase in cells with structural chromosomal aberrations above the historical control data.

The testing laboratory after reviewing the same data have concluded that the notified chemical is non clastogenic. The laboratory noted that increases in chromosomal aberrations only occurred at the highest concentration. At this concentration the mitotic index was 12% and the testing laboratory suggested that it shouldn't be considered. The laboratory noted also that all concentrations which showed an acceptable mitotic index and cell density showed no increase in numbers of aberrations above the negative controls and historical data.

CONCLUSION	The test substance was clastogenic to Chinese Hamster V79 cells treated in vitro under the conditions of the test.
TEST FACILITY	Bioservice (2001).

B.10. Dermal Drug Delivery and Percutaneous Absorption

TEST SUBSTANCE	Product 402303/307-01 (79.2% notified chemical)
METHOD	OECD Draft – New proposal “Dermal Delivery and Percutaneous Absorption: <i>in vitro</i> Method” May 1996. ECETOC, Percutaneous Absorption, Monograph No 20, 1993. CTFA Safety Testing Guidelines – <i>In vitro</i> penetration methods: summary of key literature and critical elements of design. COLIPA – Cosmetic Ingredients: Guidelines for Percutaneous Absorption/Penetration, 1995. Opinion concerning basic criteria for the in vitro assessment of percutaneous absorption of cosmetic ingredients - Adopted by Scientific Committee on Cosmetic Products and Non-Food Products intended for Consumers during plenary sessions of 23 June 1999.
Remarks - Method	After equilibration of the skin membranes (450 µm thickness, 10 mm diameter consisting of the <i>stratum corneum</i> , epidermis and part of dermis from the human female abdomen) for at least 1 hour (adjustment for flow and temperature ($32 \pm 1^\circ\text{C}$)). Forty µL of the test formulation corresponding to 2.22 mg test substance was applied to the skin surface and collecting of the acceptor fluid was started. The collection vessels were changed each 6 hours for a period of 48 hours. At the end of the exposure period excess test formulation and skin were collected in a vial and extracted with 2 mL PBS (pH 3.2). The amount of test item in the acceptor solution and in the extract of the quantitatively collected excess test substance and skin was analysed using a HPLC method with UV detection.

RESULTS

Remarks - Results	According to the results of the validation procedure the limit of quantitation of erythrulose in aqueous solution was 0.25 µg/mL. This reflects a detection limit of 0.04% of the applied dose during each time interval of the sample collection. The test item was not detected in receptor fluid in concentration higher than the threshold value. With the scope of limitation of quantitation, the test substance did not penetrate human skin <i>in vitro</i> within 48 hours. On the basis of the calculated applied amount of the test substance, the average recovery rate of the test substance and excessive formulation after 48 hours of penetration cell perfusion was 112.2% with a coefficient of variation (CV) of 11.1 (n=6). The CV which is mainly based on variable volumes during application of the gel and reflects the historical data and the validity of the experiment.
CONCLUSION	The test substance did not penetrate human skin <i>in vitro</i> within 48 hours.
TEST FACILITY	Bioservice (2000).

B.11. Irritative Potential in Humans

TEST SUBSTANCE	Erythrulose (78.5% notified chemical)
METHOD	
Remarks - Method	A 20% solution of the test substance was applied under occlusive plastic test chambers for 48 hours on the backs of volunteers. After 48 hours the chambers were removed and the first inspections of reactions were done. A second inspection was done after 72 hours.
RESULTS	
Remarks - Results	No results were provided
CONCLUSION	It was concluded that applied under regular conditions, the potency of test substance to act as an irritant is extremely low.
TEST FACILITY	Derma Consult (1993).

APPENDIX C: ENVIRONMENTAL FATE AND ECOTOXICOLOGICAL INVESTIGATIONS

C.1. Environmental Fate

C.1.1. Ready biodegradability

TEST SUBSTANCE	Erythrulose
METHOD	OECD TG 301 D Ready Biodegradability: Closed Bottle Test.
Inoculum	Secondary effluent organisms from municipal sewage treatment plant.
Exposure Period	28 days
Auxiliary Solvent	None.
Analytical Monitoring	WTW inolab Oxi Level 2 with WTW CelloX 325 oxygen electrode
Remarks - Method	Reference substance – sodium acetate Treatments: - test concentrations – notified chemical and inoculum - inoculum blank – inoculum only - positive control – reference substance and inoculum - toxicity control – notified chemical, reference substance and inoculum
	Oxygen concentrations measured at start, 7, 14, 21 and 28 days.

RESULTS

<i>Test substance 2 mg/L</i>		<i>Test substance 5 mg/L</i>		<i>Sodium acetate 2 mg/L</i>	
<i>Day</i>	<i>% degradation</i>	<i>Day</i>	<i>% degradation</i>	<i>Day</i>	<i>% degradation</i>
0	0	0	0	0	0
7	63	7	62	7	60
14	65	14	61	14	58
21	50	21	60	21	70
28	78	28	70	28	73

Remarks - Results By day 7 both test samples reached 60% degradation, therefore, the notified chemical meets the criteria for ready biodegradability.

In the positive control, the reference substance reached 60% degradation within 7 days indicating that the test conditions were acceptable.

In the toxicity control degradation reached 25% within 14 days, indicating that the test substance did not inhibit microbial activity.

CONCLUSION Under the study conditions, the notified chemical can be classified readily biodegradable.

TEST FACILITY NOTOX (2003k)

C.2.1. Acute toxicity to fish

TEST SUBSTANCE	Erythrulose
METHOD	OECD TG 203 Fish, Acute Toxicity Test - static. EC Directive 92/69/EEC C.1 Acute Toxicity for Fish – static.
Species	Carp (<i>Cyprinus carpio</i>)
Exposure Period	96 hours
Auxiliary Solvent	None.
Water Hardness	250 mg CaCO ₃ /L
Analytical Monitoring	HPLC
Remarks – Method	A 16-hour photoperiod was maintained throughout the study with aeration commencing at 24 hours. Temperature, dissolved oxygen and pH

were measured daily in the blank control and 100 mg/L. Fish were not fed during the study. Analysis samples were taken from the blank control and the 100 mg/L sample at 0, 24, and 96 hours.

The pH ranged from 7.3 to 8.0 in the blank control and 7.3 to 7.8 in the 100 mg/L sample. In both vessels the dissolved oxygen started at 8.6 mg/L but dropped to 6.4 mg/L on day 1 therefore aeration commenced, after which dissolved oxygen ranged from 8.0 to 8.7. Temperature ranged from 20.5 to 21.4°C in the blank control and 100 mg/L vessels.

Pentachlorophenol was used as a reference substance at 0.06, 0.10, 0.15, 0.22 and 0.32 mg/L.

RESULTS

Concentration mg/L		Number of Fish	Mortality				
Nominal	Actual		2.5 h	24 h	48 h	72 h	96 h
Blank control	0	7	0	0	0	0	0
0.1	-	3	0	0	0	0	0
1.0	-	3	0	0	0	0	0
10	-	3	0	0	0	0	0
100	97.9 (av 96 h)	7	0	0	0	0	0

LC50 >100 mg/L at 96 hours.

NOEC 100 mg/L at 96 hours.

Remarks – Results No mortality or abnormal behaviour was observed at any of the concentrations. While the dissolved oxygen level dropped on day 1 it remained above 60% saturation therefore did not invalidate the study.

The 96 h LC₅₀ for the reference substance was 0.21 mg/L, which is within recorded 96 h LC₅₀ values for this species of Carp and validates the test conditions.

CONCLUSION

Under the test conditions the notified chemical is not toxic to Carp.

TEST FACILITY

NOTOX (20031)

C.2.2. Acute toxicity to aquatic invertebrates

TEST SUBSTANCE

Erythrulose

METHOD

OECD TG 202 Daphnia sp. Acute Immobilisation Test and Reproduction Test - Static.

EC Directive 92/69/EEC C.2 Acute Toxicity for Daphnia - static.

Species *Daphnia magna*

Exposure Period 48 hours

Auxiliary Solvent None

Water Hardness 250 mg CaCO₃/L

Analytical Monitoring HPLC

Remarks - Method A 16 hour photoperiod was maintained throughout the study with no aeration. Daphnia were not fed during the study and immobility was observations were made at 24 and 48 hours. Temperature, dissolved oxygen and pH were measured daily in the blank control and 100 mg/L. Analysis samples were taken from the blank control and 100 mg/L at 0 and 48 hours.

For the blank control and 100 mg/L these were 4 replicate, while for the other concentrations there were only two replicates. Each replicate had 5

daphnia.

The chemical analysis indicated that the nominal concentrations were within 97-99% of the actual concentrations. The pH ranged from 7.7 to 8.0, while the dissolved oxygen started at 8.6 but dropped to 8.0 and temperature ranged from 20.2 to 20.7°C.

Potassium dichromate was used as a reference substance at 0.10, 0.18, 0.32, 0.56, 1.0 and 1.8 mg/L.

RESULTS

Concentration mg/L		Number of <i>D. magna</i>	Number Immobilised	
Nominal	Actual		24 h	48 h
Blank control	0	20	0	0
0.1	-	10	0	0
1.0	-	10	0	0
10	-	10	0	0
100	96.9 (av 48 h)	20	0	0

LC50 > 100 mg/L at 48 hours

NOEC 100 mg/L at 48 hours

Remarks – Results In one of the control and 0.1 mg/L replicates there were daphnia trapped at the medium surface. These were not counted as immobile individuals. No other abnormal behaviour or immobility was observed in any of the concentrations.

The 96 h LC₅₀ for the reference substance was 0.60 mg/L, this validated the study conditions.

CONCLUSION

Under the study conditions, the notified chemical is not toxic to daphnia.

TEST FACILITY

NOTOX (2003m).

C.2.3. Algal growth inhibition test

TEST SUBSTANCE

Erythrulose

METHOD

OECD TG 201 Alga, Growth Inhibition Test.

EC Directive 92/69/EEC C.3 Algal Inhibition Test.

Species *Selenastrum capricornutum*

Exposure Period 72 hours

Concentration Range

Nominal 0, 0.1, 10 and 100 mg/L

Actual at 72 h 0, -, - and 79.8 mg/L

Auxiliary Solvent

None

Water Hardness

24 mg CaCO₃/L

Analytical Monitoring

HPLC

Remarks - Method

Initial cell density – 1 x 10⁴ cells/mL.

This study was a combined limit and range finding test.

Continuous illumination was maintained throughout the study. Temperature was monitored continuously, while pH was measured at the beginning and end of the study in the blank control and 100 mg/L samples. Samples for analysis were taken from the blank control and 100 mg/L vessels at 0, 24 and 72 hours.

The pH ranged from 8.3 to 9.3 in the control and 8.4 to 9.0 in 100 mg/L sample and temperature ranged from 22.1 to 24.1°C.

Potassium dichromate was used as a reference substance at 0.18, 0.32, 0.56, 1.0, 1.8 and 3.2 mg/L.

RESULTS

<i>Biomass</i>		<i>Growth</i>	
E_bC_{50} mg/L at 72 h	NOEC mg/L	E_rC_{50} mg/L at 72 h	NOEC mg/L
>100	100	>100	100

Remarks - Results

The E_bC_{50} for the reference substance was 0.73 mg/L and the E_rC_{50} was 1.2 mg/L. Both of these values were in the expected range and validated the study conditions.

CONCLUSION

Under the conditions of the study, the notified chemical is not toxic to freshwater algae.

TEST FACILITY

NOTOX (2003n)

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