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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

METHINE YELLOW MIP 2507

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Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT

METHINE YELLOW MIP 2507

1. APPLICANT

Ciba-Geigy Australia Ltd; 140 Bungaree Road, Pendle Hill NSW 2145

2. IDENTITY OF THE CHEMICAL

Name: Methine Yellow MIP 2507

Other names: F.A.T. 40'249/BYellow 105

Trade name: Pergasol Yellow F-GN liquid
(contains 11% Methine Yellow MIP 2507)

Method of detection and determination:

High Performance Liquid Chromatography, Thin Layer Chromatography, Gas Chromatography, UV-VIS Absorption Spectroscopy, Nuclear Magnetic Resonance Spectroscopy, Infra Red Spectroscopy and barium acetate titration can all be used to determine the identity and purity of the product. Results and methods of each of these techniques were provided. Atomic absorption spectra and X-Ray fluorescence may also be used but detailed methods were not provided.

3. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20°C and 101.3 kPa:

The notifiable substance (Methine Yellow MIP 2507) is an orange powder and the sales product to be imported (Pergasol Yellow F-GN liquid) is a yellow free flowing liquid.

Based on the data provided the imported product, Pergasol Yellow F-GN, is considered to be non-hazardous. Therefore the chemical name, CAS number, molecular and structural formulae, molecular weight, spectral data and import volume have been exempted from publication in the Full Public and Summary reports

Odour: none mentioned

Melting Point: > 258°C; decomposition but no melting occurs at ≥ 258°C

Density: 1.38×10^3 kg/m^3 at 23°C

Vapour Pressure: ≥ 7.7×10^{-3} Pa at 25°C (extrapolated)

Water Solubility: > 200 g/L at 20°C

Fat Solubility: 5 mg/100 g fat at 37°C

Partition Co-efficient: (n-octanol/water) log Pow = 0.49 at pH 6.1 and 25°C.

Hydrolysis as a function of pH: $t_{1/2}$ > 1 year at pH 4 and $7_{1/2}$ = 666 d at pH 9= 25°C

Adsorption/Desorption: Not available

Dissociation Constant: Not available

Surface Tension: By Wilhelmy plate method at 20°C
.5 - 51.1 mN.m^{-1} at 10.0 g.L^{-1}
.2 - 55.3 mN.m^{-1} at 1.0 g.L^{-1}
.7 - 64.3 mN.m^{-1} at 0.1 g.L^{-1}

Flash Point: Not available

Flammability Limits: Not available

Combustion Products: Not available

Pyrolysis Products: Not available

Decomposition Temperature: The onset of decomposition was 125°C in the absence of air and 110°C in the presence of air.

Decomposition Products: Not available

Autoignition Temperature: There is no self ignition up to and including the maximum test temperature of 400°C.

Explosive Properties: The substance is not considered explosive.

Reactivity/Stability: The product shows an exothermic peak with and without air below 150°C, presumably due to chemical decomposition.

Particle size distribution: Not available

Comments on Physico-chemical products:

Data for adsorption/desorption, the dissociation constant, flammability limits and pyrolysis/combustion products were not provided.

Given the low level of entry of the substance into the soil and its stated improved fixation properties over the product that it replaces, the notifier considered the test for adsorption/desorption unnecessary. It was also not required for notification to EEC. Strong adsorption to sediment may be expected.

The high water solubility of the dye, and its presence in the salt form indicate a high degree of dissociation. The dissociation constant was not measured "as the test was not required for notification to EEC."

Information on the flammability limits was not obtained by the company on the basis of the negligible vapour pressure and a high autoignition point of > 400°C. Data on the pyrolysis products was assumed not to be applicable due to the non-flammability of the chemical.

The above reasons for omission of data are acceptable.

4. PURITY OF THE CHEMICAL

Degree of purity of Methine Yellow MIP 2507: > 60 % w/w

Other non-hazardous components of Methine Yellow MIP 2507

Sodium Acetate	10-30% w/w
Water	< 10% w/w
Unknown Coloured Components	< 10% w/w
Sulphur	0.6% w/w
Calcium Sulphate	< 1% w/w
Known Coloured Component 12	0.2% w/w
Known Uncoloured Components 2I & II	0.2% w/w
Unknown Uncoloured Component 1	0.1% w/w
Unsulphonated aromatic amines	280 $\mu g.g^{-1}$
TOTAL	97 %

Toxicor hazardous impurities:

Chemical name: Acetic Acid
CAS No.: 64-19-7
Weight percentage: 7.6%
Toxic properties: Corrosive

Additives/Adjuvants:

The sales product, Pergasol Yellow F-GN (liquid) which is to be imported, is formulated with 10-30% w/w of Methine Yellow MIP 2507.

5. INDUSTRIAL USES

Methine Yellow MIP 2507 will be used solely in the colouration of paper products. It will be imported as a component of the sales product, Pergasol Yellow F-GN (liquid) which contains 10-30% w/w of the notified chemical.

6. OCCUPATIONAL EXPOSURE

Workers face potential exposure during paper manufacturing procedures, transportation and storage.

Dermal exposure is the most likely cause of entry into the body, particularly as a result of direct contact with the dye via

contact with the wet paper or during the clean-up and repair procedures. Inhalation of Methine Yellow MIP 2507 is also possible due to the production of aerosols and dusts from the wet and dry chemical respectively, but this is not expected to be in significant amounts.

7. PUBLIC EXPOSURE

Significant exposure to the public is unlikely to occur. The substance is transported in 30 kg or 800 L containers that should ensure that spillage does not occur except perhaps in the event of a major transport accident. The substance is not covered by the Dangerous Goods Act. A 24 hour toll free emergency contact number is written on all container labels.

Disposal of container residues and spillage is via secure landfill or by incineration according to State and Municipal regulations. Disposal of the coloured paper products is generally via normal land fill or in the case of tissue paper via the water treatment sediments.

The dye will not be available to the general public for home dyeing or paper making and is not recommended for use with food stuffs. The dye is reported not to migrate easily from coloured paper or tissue products, and therefore contact is unlikely. In the event of migration, penetration into the body is unlikely to occur due to the high molecular weight, low fat solubility and low octanol/water partition coefficient.

8. ENVIRONMENTAL EXPOSURE

8.1 Release

Methine Yellow MIP 2507 is claimed to have a higher affinity (fixation) to pulp than the existing dye Basic Yellow 99, and therefore will result in a decrease in the quantity of unfixed dyestuff released into the environment through paper mill effluent. Two levels of colouration, light and dark, are achieved by the use of 1 kg and 10 kg of the dye per tonne of pulp respectively. The dyeing process used is said to exhaust the dye content by 98% (dark colours) and 96% (light colours). The site carrying out dark colouration will discharge a higher concentration of unfixed residue. Approximately 2% of the quantity used will be passed to the mill effluent, half as dissolved colour and half as solid bound colour.

The notifier claims that up to 80% of the unfixed dye which enters the paper mill effluent is recovered by "save-all" and "clarifier" processes. The recovered dye is either recycled to the paper machine or disposed of to land fill as solid waste.

8.2 Fate

Unfixed residues will be pumped to large water bodies such as the ocean, lakes, or rivers and may be filtered and clarified before discharge. Discharge of unfixed dye to closed water bodies will result in increasing levels of dye with time, moderated by periodic flushing to the open sea (1). At some plants the bulk of effluent will be subjected to primary and secondary treatment prior to ultimate discharge.

Unfixed dye, discharged as effluent for sewerage treatment, is likely to bind to sludge. A study of adsorption of dyes to biomass in an activated sludge plant found that both basic and direct dyes are highly adsorbed to sludge where anaerobic degradation of the dye's substituted derivatives may occur (3).

Some residues which survive sewerage treatment may enter freshwater or marine environments in solution. Such discharges into sea will undergo large dilution, resulting in insignificant concentrations of the dye.

Hydrolysis

Hydrolytic degradation is unlikely given that tests indicate a lack of significant hydrolysis under conditions likely to be encountered in the treatment plants.

Biodegradation

Methine Yellow MIP 2507 was found not to be readily biodegradable (0 % in 28 days) when tested using the modified MITI test (4). However the BOD/COD ratio of 0.1 (BOD_5 = 135 $mg.g^{-1}$ O_2 and COD_5 = 1388 $mg.g^{-1}$ O_2) suggests that the dye may eventually degrade under natural conditions (5,6).

Bioaccumulation

The bioaccumulation potential of Methine Yellow MIP 2507 was not studied due to its low octanol/water partition coefficient (log P_{ow} 0.49) and low fat solubility (5 mg/100 g). Hydrophilic dyes with log P_{ow} < 3 have been shown not to bioaccumulate (7).

8.3 Exposure Level

Environmental exposure from the extraction of the substance during the paper recycling process is likely to be insignificant given the widespread use of the coloured paper and the current low levels of recycling in Australia.

9. EVALUATION OF TOXICOLOGICAL DATA

9.1 Acute Toxicity

Table 1. Summary of acute toxicity data of Methine Yellow MIP 2507

Test	Species	Outcome	Ref
Oral	Rat	LD_{50} > 2000 mg/kg	8
Dermal	Rat	LD_{50} > 2000 mg/kg	9
Skin Irritation	Rabbit	No irritation	10
Eye Irritation	Rabbit	Moderate irritation	11
Skin Sensitisation	Guinea Pig	Moderate sensitizer but sales product non sensitizing	12, 13

Each of the tests was conducted in compliance with methodology as recommended by the OECD (14)

9.1.1 Oral Toxicity (8)

Methine Yellow MIP 2507 was administered by a single oral gavage to 5 male and 5 female young adult KFM-Han Wistar rats at a dose of 2000 mg/kg. The powdered substance was made up in bi-distilled water and homogenized prior to use. The animals were observed for a period of 15 days during which no animal died. No clinical signs were reported and the body weights of all animals appeared

unaffected by the procedure. Upon autopsy all macroscopic examinations appeared normal. The oral LD_{50} is therefore > 2000 mg/kg.

9.1.2 Dermal Toxicity (9)

Approximately 4 mls of Methine Yellow MIP 2507 was applied at a dose of 2000 mg/kg onto the clipped skin on the back of 5 male and 5 female KFM-Han Wistar rats. The skin was then covered with a semi-occlusive dressing and bandaged for 24 hours. The dressing was removed and the skin washed with lukewarm water prior to observation for a further 15 days.

No deaths occurred and no macroscopic abnormalities were found. All animals exhibited yellowing of the skin for 15 days and scales on the back at the application site for up to 7 days. One female suffered focal erythema for 6 days, and one male general erythema for 1 day. The dermal LD_{50} is therefore > 2000 mg/kg.

9.1.3 Skin Irritation (10)

500 mg of the test substance was moistened with water and administered by semi-occlusive application to the shaved skin of three New Zealand White rabbits for four hours. Four hours post-exposure the dressing was removed and the skin flushed with lukewarm water. The skin reaction was assessed at 1, 24, 48 and 72 hours later.

The only effect observed over the entire observation period was a yellowing of the skin. This result is in contrast to that obtained during the dermal toxicity test when rats were treated with 10 x this dose on a mg/kg basis and 2/10 rats displayed erythema.

Under the conditions of this study Methine Yellow MIP 2507 was found to be non-irritating to the rabbit skin.

9.1.4 Eye Irritation (11)

100 mg of Methine Yellow MIP 2507 was placed in the conjunctival sac of the left eye of 2 male and 1 female New Zealand White rabbits. The eyes were examined 1, 24, 48 and 72 hours, and 7 days after treatment.

Each of the animals exhibited a yellow staining of the cornea, sclera, and eyelashes. Diffuse corneal opacity was observed in decreasing amounts from 1 until 24, 48 or 72 hours post treatment. No changes to the iris were observed. There was severe discharge 1 hour after application but this effect had disappeared or was only slight at 48 hours.

The conjuctivae of all animals were diffuse and crimson coloured with poorly discernible blood vessels at one hour and remained so until either 24, 48 or 72 hour time points. Some hyperemic blood vessels persisted for up to 72 hours. Obvious swelling of the lids and nictitating membranes, with partial eversion of the eye lids, was apparent in all animals after 1 hr but in only 1 animal after 24 hours. No swelling was observed 72 hours post treatment and all symptoms had disappeared after 7 days.

Methine Yellow MIP 2507 was concluded to be a moderate eye irritant to the rabbit under the conditions of this study.

9.1.5 Skin Sensitisation (12, 13)

a) Methine Yellow MIP 2507

A Maximization Test was performed to detect the skin sensitization properties of Methine Yellow MIP 2507. Ten female albino guinea pigs (strain Dunkin-Hartley) were used for the control group and 20 for the treatment group. Preliminary experiments demonstrated that Methine MIP 2507 concentrations of 15% for the epicutaneous and 3% for the intradermal doses were irritating, and that a 10% epicutaneous dose of the same compound was non-irritating, to the skin of test animals.

Induction

Guinea pigs were treated with 3 pairs of intradermal injections into the shaved scapular region. These pairs comprised of 1) Freund's complete adjuvant 50:50 with distilled water, 2) the test article diluted to 3% distilled water, and 3) the test article at 3% emulsified in 50:50 mixture of Freund's complete adjuvant and distilled water. One week later the same region was shaved and a piece of filter paper saturated with a 15% concentration of the substance in oil was placed over the injection site, covered with aluminium foil and secured with a bandage. Control animals received the same treatments minus the test substance. The dressings were left in place for 48 hours.

After removal of the bandage each animal's skin was washed and assessed for erythema and oedema at 0, 24 and 48 hours post exposure.

Twenty-four hours after removal of the bandage erythema was slight in 10 animals and well defined in 5 animals. Slight oedema was also evident in 5 animals. Forty-eight hours after removal of the bandage 11 animals still exhibited erythema and 2, oedema. None of the control animals were reported to show any signs of irritation.

Challenge

Two and four weeks later the skin was challenged with filter paper saturated with test substance at a concentration of 10%. This was secured onto the shaved right flank for the first challenge and left flank for the second challenge, as described above. The control animals received a 10% concentration of Methine Yellow MIP 2507 to one flank for the first challenge only. The dressing was removed after 24 hours and the skin assessed 0, 24 and 48 hours later.

No symptoms of irritation were evident in the skin of any control animal during the challenge stage of the procedure.

Twenty-four hours after the first challenge 2 treated animals showed well defined erythema, which was present but slight in 3 animals 48 hours later.

Twenty-four hours after the second challenge 11 treated animals showed slight erythema which was still present in 6 animals 48 hours post-challenge

No systemic effects were observed and body weights remained normal.

Methine Yellow MIP 2507 was concluded to be a moderate sensitizer under the conditions of this study.

b) Pergasol Yellow F-GN (liquid)

A similar protocol was performed on the sales product Pergasol Yellow F-GN (liquid) using animals of the Himalayan spotted strain, except that only a single challenge test was performed. Preliminary experiments demonstrated that concentrations of 25% (epicutaneous) and 5% (intradermal) of Pergasol Yellow F-GN liquid were irritating, and that a 15% epicutaneous dose of the same compound was non-irritating, to the skin of test animals.

Induction

Animals were induced intradermally with a 5% dose and epicutaneously with a 25% concentration of Pergasol Yellow F-GN.

Challenge

After challenge with a 15 % concentration of the sales product, 4 treated animals exhibited slight erythema immediately after removal of the bandage. Twenty-four hours later no animal showed any response.

Pergasol Yellow F-GN (liquid) was concluded to be a non-sensitizer in this strain of guinea pig under the particular conditions of this study.

9.2 Repeated Dose Toxicity

a) 5-day repeated dose study (15)

A 5 day oral (gavage) toxicity study was performed to provide a rational basis for the longer 28-day study. Three male and 3 female young adult KFM-Han Wistar rats were treated with 0, 200, or 1000 mg/kg of Methine Yellow MIP 2507. Food consumption decreased slightly but not significantly in rats of both sexes at the highest dose between days 3 and 5 only. Organ:body weight ratios for the adrenals of females treated with the highest dose were slightly elevated compared to those of control animals. No macroscopic changes were observed. From this study it was decided that 0, 50, 200 and 1000 mg/kg were suitable doses for the 28-day study.

b) 28-day repeated dose study (16)

Following the preliminary 5 day study a 28 day oral (gavage) study was performed on the rat to test the cumulative toxicity of Methine Yellow MIP 2507. Two groups of 20 young adult KFM-Han Wistar rats (10 male and 10 female) were treated with distilled water or 1000 mg/kg of dissolved test substance while 2 groups of 10 animals (5 male and 5 female) were treated with 50 or 200 mg/kg, daily by oral gavage. 5 animals of each sex and dose were sacrificed on termination of the experiment while the remainder were killed after a further 14 days recovery period. Animals were observed and assessed for mortality, clinical abnormalities (including haematology, clinical chemistry and urinalysis), food consumption and ophthalmic changes. Necrospy and histopathology were performed upon the completion of the study.

Gastrointestinal discolouration was present in animals in the higher dose group but not the recovery group. There were no other treatment related statistically significant effects on any of the parameters studied. Slight statistically insignificant trends towards lower body weights and body weight gains occurred in males of the highest treatment group.

9.3 Genotoxicity

Each of the tests was conducted in compliance with methodology as recommended by the OECD (14)

9.3.1 Ames *Salmonella typhimurium* reverse mutation assay (17)

Methine Yellow MIP 2507 was assessed for genotoxicity using the Ames *Salmonella typhimurium* reverse mutation assay. Bacterium strains TA 1535, TA 1537, TA 1538, TA 98 and TA 100 were employed in two independent experiments, both with and without liver S9 microsomal activation, at concentrations of 10.0, 100.0, 333.3, 1000.0 and 5000.0 µg/plate. Solvent, negative, and positive controls were included in this assay.

Toxic effects of the test substance were observed in the presence and absence of S9 activation at 5000 µg/plate in TA 1537, TA 1538 and TA 100. TA 1535 also showed toxicity at 1000 µg/plate while there was no apparent toxicity to TA 98.

When bacteria of the TA 1538 strain were treated with 1000 µg/plate of Methine Yellow MIP 2507 without S9 mixture,

revertant numbers were increased from 18 per plate for the controls to 70 per plate (3.7 fold). With the addition of the S9 mixture the number of revertants increased from 25 for the controls to 108 (4.4 fold). The revertants numbers were increased from 333 and 100 µg/plate without and with S9 activation respectively. When this experiment was repeated similar results were obtained.

When bacteria of the TA 98 strain were treated with 5000 µg/plate of the test substance without S9 mixture, revertant numbers increased from 20 per plate for the controls to 30 per plate (1.5 fold). With the addition of the S9 mixture the number of revertants increased from 40 for the controls to 96 (2.4 fold). The revertants numbers were increased from 100 and 333 µg/plate without and with S9 activation respectively. Similar results were obtained when this experiment was repeated.

A significant increase in the number of revertants occurred in TA 1537 at 1000 µg/plate only in the presence of S9 activation and only in one experiment. No statistically significant or reproducible dose dependent increases in revertant colonies was observed in strains TA 1535 or TA 100.

Under the conditions of this study Methine Yellow MIP 2507 is considered to be genotoxic in this assay system.

9.3.2 Chromosome Aberration assay in Chinese Hamster V79 cells (18)

Chinese Hamster V79 cells were exposed to Methine Yellow MIP 2507 in the presence and absence of S9 liver fraction at various concentrations for 4 hours. The test substance was evaluated at the following concentrations and time points (between the beginning of exposure and cell fixation for microscopic examination): 200 µg/ml for 7h; 5, 100, and 200 µg/ml for 18h and 300 µg/ml for 28h. Cytotoxicity became evident at concentrations greater than 200 µg/ml. Positive and solvent controls were used. In each culture, 100 metaphases were scored for structural chromosomal aberrations including breaks, fragments, deletions, exchanges, and disintegrations.

A small but statistically significant increase in chromosome aberrations was noted in the presence of metabolic activation with 200 µg/ml at 18 hr ($p < 0.05$) and with 300 µg/ml at 28 hr (p

< 0.025). The significance was due to the extremely low spontaneous aberration rates of the corresponding control groups. The test results were therefore considered a statistical artefact and not biologically relevant because they were within the range of both the control values in this study and the historical controls (0.00 - 4.00 %). However, it is noteworthy that in both instances only the S9 activated cells produced a significant increase in aberrations, suggesting that some biological significance may be attributed to these results.

It is not possible to make a definite conclusion as to whether or not Methine Yellow MIP 2507 is genotoxic under the conditions present in this study.

9.3.3 Micronucleus Assay in Bone Marrow Cells of the Mouse (19)

After preliminary toxicity testing Methine Yellow MIP 2507 was administered in a single application by oral gavage at 5000 mg/kg (20 ml/kg in 1% carboxymethylcellulose) to 18 male and 18 female NMRI strain mice. At 24, 48 and 72 hours post-exposure 5 animals of each sex were killed and 1000 polychromatic erythrocytes (PCE) from the bone marrow cells of each animal were scored for micronuclei.

No cytotoxicity was observed and there was no significant increase in micronuclei. Methine Yellow MIP 2507 is therefore considered to be non-genotoxic in this assay system.

9.3.4 Gene Mutation Assay in Chinese Hamster Ovary (CHO) Cells in vitro. (20)

Chinese hamster ovary cells (CHO cells) were exposed to the Methine Yellow MIP 2507 *in vitro* at concentrations of 0, 3.0, 10.0, 30.0, and 100.0 µg/ml for a duration of 4 hours without S9 metabolic activation and at concentrations 0, 10.0, 30.0, 60.0, 100.0, and 300.0 µg/ml with S9 metabolic activation. Forward gene mutations were estimated by calculating the loss of function of the HGPRT enzyme as only cells with mutations in the HGPRT locus were able to survive on the selective media containing 6-thioguanine. The cells were given a 7 day period for expression prior to plating.

At the highest concentration of the test substance, with and without S9 activation, there was greatly reduced plating

efficiency due to cell toxicity. No reproducible increase in mutant colony numbers were observed in cells exposed to Methine Yellow MIP 2507.

It can be concluded that under the test conditions utilized that Methine Yellow MIP 2507 does not cause point mutations at the HGPRT locus in CHO cells.

9.4 Overall Assessment of Toxicological Data

Methine Yellow MIP 2507 has low acute oral and dermal toxicity in rats. No skin irritation was observed in the rabbit but the substance was moderately irritating to the eye in the same species. The notifiable substance is a mild to moderate skin sensitizer in the guinea pig but the sales product Pergasol Yellow F-GN (liquid) was found not to be a sensitizer . No inhalation data was provided but based on eye irritation and skin sensitization studies Methine Yellow MIP 2507 may be expected to be an irritant or sensitizer of the upper respiratory tract. A 28 day oral repeated dose study at 1000 mg/kg caused no treatment related mortality or clinical effects.

Methine Yellow MIP 2507 was found to cause frame-shift mutations in strains TA 1538 and TA 98 of *Salmonella typhimurium* in the reverse mutation assay. It also caused chromosome aberrations in the V79 cell line of the Chinese hamster but these results were equivocal due to the unusually low control values. This study would need to be repeated in order to obtain more convincing results. Methine Yellow MIP 2507 did not cause point mutations in the HGPRT locus *in vitro* in the Chinese hamster ovary cells and does not appear to be clastogenic as judged by the *in vivo* micronucleus assay in the bone marrow of the mouse.

As a result of the skin sensitization and eye irritation effects, as well as the genotoxicity results, every attempt must be made to avoid contact with this chemical.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

Table 2: Summary of ecotoxicity results of Methine Yellow MIP 2507

Test type	Species	Outcome	Ref.
Acute toxicity	Zebrafish *Brachdanio rerio*	96 hr LC_{50} = 1.9 ppm	21
Accute Immobilisation	*Daphnia magna*	24 hr EC_{50}=39.6 mg/L 24 hr NOEC=1.2 mg/L	22
Algal toxicity Biomass inhibition	*Scenedesmus subspicatus*	72 hr EC_0=1.0 mg/L	23
Algal toxicity Growth Rate	*Scenedesmus subspicatus*	72 hr EC_{50}=2.3 mg/L	23
Activated sludge Respiration Inhibitory test	microorganisms	3 hr IC_{50} > 100 mg/L	24
Acute toxicity	Earthworm *Eisenia foetida*	> 1000 mg/L	25

Each of the tests was conducted in compliance with methodology as recommended by the OECD (14).

The results (21) indicate that Methine Yellow MIP 2507 is moderately toxic to fish. A feature of the result was the sharp curve, with all fish surviving at 1.78 ppm, but all dying at 3.2 ppm after 48 hr.

Fish toxicity may arise due to quaternary ammonium compound readily binding to gills at concentrations between 0.5 and 10 mg/L, causing reduction of oxygen transfer across damaged membranes or through effects on ionic balance (26). However, the toxicity may be greatly reduced in the environment because of preferential binding to dissolved organic compounds in surface water (27). Spread of sludge containing the substance is unlikely to harm earthworms as suggested by lack of toxicity to this species.

The dye is less toxic to Daphnids (22). While reproduction tests for Daphnids were not conducted, the lack of acute toxicity to the organism, the low predicted environmental concentration (worst case is 2 ppb) and the probability that the dye may not

undergo cellular absorption indicate that reproductive effects are unlikely.

The substance has exhibited a steep concentration-effect relationship on algal growth, indicating algal toxicity (23). Note that the algal species tested *(Scenedesmus subspicatus*) is considered to be relatively insensitive (28). The observed inhibition may be caused by a toxic effect on the algal cells, or may be due to the indirect affect of reduced light intensity and change of quality of light.

The influence of the substance on the growth of the green algae is supported by the finding that algal growth inhibition tests on 56 dyestuffs shows close parallels with fish toxicity (7).

Respiratory inhibition of microorganisms in activated sewage sludge was tested (24). The LC50 (3 hr) exceeded the highest concentration tested (100 mg/L), indicating that the dye is practically non toxic to microorganisms.

11. ASSESSMENT OF ENVIRONMENTAL HAZARDS

The main hazard arising from the use of Methine Yellow MIP 2507 will be associated with direct discharge from paper mills or release from sewage treatment works of unfixed residues into the aquatic environment. Due to its poor biodegradability, Methine Yellow MIP 2507 is likely to remain unchanged upon release to the environment, and in the longer term would tend to bind to sediment. If released to the ocean or to a river, dilution may be expected to swiftly reduce the environmental concentration to undetectable levels, unless low flow conditions prevail.

Calculations for the worst case receiving water concentrations

Case 1: Light colours (2 ML per day - backwater outflow)
unfixed dyestuff = 0.056 kg/day/site
into sewer after "save all" recovery 0.028 kg/day/site

$$0.028 \times \frac{1}{2 \times 10^6} \times \frac{1\text{L}}{1\text{kg}} = 14 \text{ ppb}$$

after dilution 2.8 ppb
(5 times) upon discharge to river

Case 2: Dark colours (2 ML per day - backwater outflow)
unfixed dyestuff = 0.3 kg/day/site
to sewer after "save-all" recovery 0.15 kg/day/site

$$0.15 \times \frac{1}{\text{ppb } 2 \times 10^6} \times \frac{1\text{L}}{1\text{ kg}} = 75$$

after dilution 15 ppb
(5 times) upon discharge to river

dilution of at least 10 times of the receiving water concentration where the dark colouration will be used is expected and would result in a final concentration of 1.5 ppb (29).

The worst case predicted environmental concentration for light and dark colouration are 3 orders of magnitude less than acute fish, algal and Daphnia toxicity results indicating a sufficient safety margin. However, this may not be the case should dark colouration be proposed at another site at a later date.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY

As a result of the substance's eye irritation and skin sensitization effects, and the genotoxicity results, care should be taken with this dye. The molecule is of a low enough molecular weight that penetration across biological membranes is possible and subsequent respiratory effects may occur. However, its low partition coefficient and fat solubility suggest minimal bioaccumulation.

Once fixed, the dye is unlikely to transfer out of the paper products, but as recommended by the notifier the colour products should not be used where food contact can occur.

Significant risk is not anticipated from accidental spillage during transport or from discharge of unfixed dye in effluent to the municipal water treatment system. In cases of spillage into agricultural or drinking water, the dye would be detected by intense yellow colouration.

Provided that the safety recommendations are strictly adhered to it is unlikely that Methine Yellow MIP 2507 in the sales product Pergasol Yellow F-GN (liquid) will cause a significant hazard to those of the general public or occupational health and safety.

13. RECOMMENDATIONS FOR THE CONTROL OF PUBLIC AND WORKER EXPOSURE

To minimise public and worker exposure to Methine Yellow MIP 2507 the following guide-lines and precautions should be observed:

* Good personal hygiene should be practised. Any skin contact should be followed by immediate and thorough cleaning of the skin;

* The work place should be well ventilated;

* Good work practices should be followed including practices to avoid spills and splashing. All spills are to be soaked up with an absorbent as recommended by the MSDS;

* Storage should be in secure and robust containers.

* Enclosed and automatic systems should be utilized whenever possible. However if not practicable contact should be avoided by the use of:

* -elbow length PVC gloves (AS 2161) - *Industrial Safety Gloves and Mittens (excluding Electrical and Medical Gloves)* (30);

-respiratory protection (AS 1716) - *Respiratory Protective Devices*, if ventilation is inadequate (31);

-safety goggles (AS 1337) - *Eye Protectors for Industrial Applications* when facial contact with the dye is possible (32);

-appropriate protective clothing (AS 3765) - *Clothing for Protection Against Hazardous Chemicals* (33);

* A copy of the MSDS should be readily available to the users of the notified chemical and products containing it.

14. MATERIAL SAFETY DATA SHEET(S)

The Material Safety Data Sheet (MSDS) for Pergasol Yellow F-GN liquid (Attachment 1) was provided in Worksafe format (34). This MSDS was provided by Ciba Geigy as part of their notification statement. It is reproduced here as a matter of public record.

The accuracy of this information remains the responsibility of Ciba Geigy.

15. REQUIREMENTS FOR SECONDARY NOTIFICATION

Under the *Industrial Chemicals (Notification and Assessment) Act 1989* (the Act), secondary notification of Methine Yellow MIP 2507 shall be required if any of the circumstances stipulated under subsection 64(2) of the Act arise. In addition, if dark colouration is proposed to be used at another site advice should be given as further assessment of aquatic environmental data may be required. No other specific conditions are prescribed.

16. REFERENCES

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(17) *Salmonella Typhimurium* reverse mutation assay with FAT 40'249/B. Data on file CIBA GEIGY, Switzerland. Report-CCR Project 159210, 1989.

(18) Chromosome Aberration Assay in Chinese Hamster V79 cells *in vitro* with FAT 40'249/B. Data on file CIBA GEIGY, Switzerland. Report-CCR Project 159221, 1990.

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(21) Report on the acute toxicity (96h) - OECD 203 - of FAT 40'249/B to Zebrafish. Data on file CIBA GEIGY, Switzerland. Report G 062-04 1990.

(22) 24-hour acute toxicity of FAT-40'249/B to *Daphnia magna* (OECD-immobolization test). Data on file CIBA GEIGY, Switzerland. Report-RRC Project 247263, 1990.

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