

HEALTH & SAFETY INFORMATION

1. IDENTIFICATION

RG DEVELOPER GLUTARALDEHYDE-FREE

Working strength photographic developer, glutaraldehyde-free, designed for rapid processing X-ray machines.

The product is packed as 2x5 litre plastic bottles in a cardboard box (Packing Code 4G).

The product is manufactured by Photosol at the above address.

In emergency, telephone +44 (0) 1277 235456 in business hours.

2. COMPOSITION

Major components are as follows. These include those defined as hazardous to health in the Control of Substances Hazardous to Health Regulations, i.e. appear in the Chemicals (Hazard Information & Packaging) (CHIP) Regulations &/or which have a maximum exposure limit or occupational exposure standard in the Health & Safety Executive document EH40. These regulations are themselves based on EC Directives of which 88/379/EEC, 67/548/EEC & 91/325/EEC are particularly relevant. Disclosure is not obligatory for constituents present at concentrations <1% if in their pure form, they are either corrosive, harmful, irritant or sensitising.

Component	CAS no.	% w/w	Symbol	Risk Phrases
Water		60		
Hydroquinone	123-31-9	<2	Xn	40, 43, 68
Potassium hydroxide	1310-58-3	<0.2		
Diethylene glycol	111-46-6	<3		

3. HAZARDS

The most likely hazard is irritation of the skin or eyes through contact. The developer is alkaline and contains hydroquinone and for both reasons will cause irritation; prolonged or repeated contact may cause sensitisation of the skin. However, the product as a whole is safer in its formulation than traditional rapid processing developers containing glutaraldehyde. The European Union has classified hydroquinone as a Category 3 mutagen and carcinogen at concentrations above 1%, but the evidence is confined to animal tests involving high doses.

The solution is largely water and contains no major environmental pollutants.

4. FIRST AID

Eye Contact: Irrigate the eyes with water for 15 minutes. Ensure all traces are washed out. Seek medical advice.

Skin Contact: Wash affected areas with soap and water as soon as possible. Seek medical advice if irritation persists.

Ingestion: Drink water to dilute. Induce vomiting. Seek medical advice.

Inhalation: Risks for this route of exposure are unlikely. If a problem occurs, move the person to fresh air.

5. FIRE-FIGHTING

The solution is water-based and non-combustible. There is no explosion hazard.

6. ACCIDENTAL RELEASE

Personal: Prevent skin and eye contact. Use respiratory and other protection as Section 8.

Environmental: In emergency the solution can be safely disposed to foul sewer by dilution with water (see Section 12).

Cleaning: Excess liquid should be absorbed with sawdust, sand or proprietary methods. Dispose of this material via waste contractor, and wash affected area with water.

7. HANDLING & STORAGE

Good general ventilation of ten or more room volume changes per hour in the work area is recommended. Storage should be at moderate temperature i.e., 5-20°C. Keep away from strong acids and alkalis.

8. PERSONAL PROTECTION

In the event of spillage, or when working in close proximity to the solutions (e.g. processor maintenance and cleaning), wear protective clothing. This should comprise an overall, rubber gloves, safety goggles to BS EN 166-3S. The developer does not emit hazardous fumes and respiratory protection is unnecessary; however, to protect against spillages and other processor fumes likely to be present, a half-mask respirator fitted with an ABEK1 filter is recommended.

9. PHYSICAL & CHEMICAL PROPERTIES

<i>Appearance</i>	clear, yellowish liquid
<i>Odour</i>	none
<i>pH</i>	10.6
<i>Boiling point</i>	>100°C
<i>Melting point</i>	<0°C
<i>Flash point</i>	none
<i>Explosive properties</i>	none
<i>Oxidising properties</i>	none
<i>Vapour pressure</i>	not determined
<i>Specific gravity</i>	1.10
<i>Water solubility</i>	complete
<i>Octanol/water partition</i>	not determined

10. STABILITY & REACTIVITY

The solution is stable and will not polymerise. It is predominantly water.

It is an alkaline reducer and so will react vigorously with strong acids and oxidisers. Strong acids will also liberate sulphur dioxide and carbon dioxide, and thermal decomposition will yield carbon dioxide, carbon monoxide, and inorganic particulates.

11. TOXICOLOGICAL

The table summarises data for the hazardous components identified in Section 2.

	Oral-rat LD₅₀	Occupational Exposure Standard
<i>Hydroquinone</i>	320mg/kg	2mg/M ³
<i>Potassium hydroxide</i>	365mg/kg	2mg/M ³
<i>Diethylene glycol</i>	12,565mg/kg	23ppmv

mg – milligram

kg – kilogram

M³ – cubic metre

ppmv – parts per million by volume

LD₅₀ – calculated dose to kill 50% of a population of rats when taken in food or drink

Hydroquinone may cause skin irritation and sensitisation by contact, and is a Category 3 mutagen and carcinogen. Potassium hydroxide in this solution may cause eye and skin irritation. Ingestion will irritate the mucous membranes; 1 gram of hydroquinone may induce tinnitus, nausea or headaches, and 5-12g can be fatal. Diethylene glycol is an eye and skin irritant, and mildly toxic by ingestion. There should be no significant inhalation risk.

12. ECOLOGICAL

Background

Freshwater ecotoxicity is assessed from the effects of the substance on fish (typically rainbow trout for cold water and bluegill sunfish for warm), invertebrates (Daphnia or waterflea) and algae (especially *Selenastrum capricornutum*). The effects are expressed as 96hrLC₅₀, 48hrEC₅₀ and 72hrIC₅₀ values respectively (L=lethal, E=effect, I=inhibition – referring to C=concentration at which there is 50% inhibition of growth or 50% of the organisms are affected or dead after the specified interval). Units are usually milligrams per litre and any value of 100mg/l or less indicates a toxic substance.

Toxic effects are lessened if the substance degrades rapidly. Biodegradability is considered rapid if the ratio BOD₅/COD is >0.5. (BOD₅ is the biological oxygen demand imposed by the substance on natural water as it degrades over 5 days. COD is the chemical oxygen demand during complete laboratory oxidation with dichromate. High BOD or COD means a polluting substance likely to kill organisms by depleting oxygen.) Rapid degradation is also assumed if 70% of dissolved organic carbon (DOC) disappears, or if 60% of the theoretical maximum oxygen depletion (OD) or carbon dioxide generation (COG) is achieved, over a 28 day period. Abiotic degradation is also possible, e.g. photolysis.

Toxic effects are accentuated if organisms accumulate the contaminant through either the food chain or absorption from ambient media like water. Bioaccumulation potential is related to the partition of the substance between water and lipids. A useful indicator is the octanol/water partition coefficient expressed as its logarithm (logPow). If logPow ≥3.0 the substance is considered bioaccumulative unless the measured bioconcentration factor (BCF) is ≤100. (The BCF is the ratio of the concentration inside the organism compared to that in the ambient environment).

Data

The table summarises information for constituents with ecotoxicities ≤100mg/l:

		Environmental Pollutant
		<u>hydroquinone</u>
toxicity (mg/l)	- LC ₅₀ (fish)	0.10
	- EC ₅₀ (Daphnia)	0.16
	- IC ₅₀ (algae)	1.0
	- interpretation	very toxic
degradability	- BOD ₅ /COD	0.53
	- DOC	no data
	- OD/COG	no data
	- abiotic	rapid
	- interpretation	rapid
bioaccumulation	- logPow	0.59
	- BCF	40
	- interpretation	none

The theoretical oxygen demand of the developer is **97,000mg/litre**.

Comment

Hydroquinone is toxic but its effects vary by a factor of 1000 between species. It degrades rapidly and so does not persist; nor does it accumulate.

Other constituents are not environmentally dangerous. Although strong acids and alkalis appear toxic from tables, this is derived from their pH effects in laboratory tests rather than inherent toxicity. These effects are swamped in the environment by dilution and natural buffering. Similarly, sulphite imposes a local oxygen demand but this has little effect on the wider environment. Inorganic constituents (unless they contain a toxic metal) are non-toxic, very soluble and fully dissociated in solution. Remaining organic constituents, even if environmentally dangerous in their pure form, are present in such low concentrations as to pose little risk.

13. DISPOSAL

Heavy dilution with water will reduce the COD and moderate the pH to the extent it can be discharged to sewer and meet any likely trade effluent consent. Disposal by waste contractor is also possible; the developer is classified as 'Special Waste' because it releases a toxic gas (sulphur dioxide) in contact with strong acid, as may accidentally occur in a waste treatment plant. Empty bottles should be rinsed for safety and to facilitate recycling.

Incineration is not energy efficient as the solution comprises 60% water, but otherwise is a satisfactory method of disposal yielding oxides of carbon and inorganic particulates.

14. TRANSPORT

The product is classified non-hazardous for conveyance under the UK Carriage of Dangerous Goods by Road & Rail (Classification, packaging & labelling) Regulations and is unrestricted for international conveyance by sea (IMDG), air (ICAO), road (ADR) & rail (RID). No UN number is required.

15. REGULATORY INFORMATION

Labelling is in accordance with the Code of Practice for Classification, Packaging and Labelling of Photographic and Lithographic Processing Chemicals (European Photochemical Industry, Sector Group of CEFIC) which complies with but extends the regulations listed in Section 2 above.

Symbol	Dangerous Substance	Risk Phrases	Safety Phrases
Xi	Hydroquinone	40, 43, 68	24-37

16. OTHER INFORMATION

Relevant risk and safety phrases are as follows:

Risk – **40** Limited evidence of carcinogenic effect
43 May cause sensitisation by skin contact
68 Possible risk of irreversible effect

Safety – **24** Avoid contact with skin
– **37** Wear suitable gloves.

The symbol '**Xn**' means 'harmful'.