Azo Dyes that Cleave to Aromatic Amines of Potential Toxicological Concern: Human health tier II assessment

01 July 2016

Chemicals in this assessment

Chemical Name in the Inventory	CAS Number
Benzenamine, 4-[(4-nitrophenyl)azo]-	730-40-5
2-Naphthalenol, 1-[(2,4-dimethylphenyl)azo]-	3118-97-6
2-Naphthalenol, 1-(phenylazo)-	842-07-9
Benzenesulfonic acid, 4-[[3-[(dimethylphenyl)azo]-2,4-dihydroxyphenyl]azo]-, monosodium salt	1320-07-6
2-Naphthalenesulfonic acid, 3-[[4-(acetylamino)phenyl]azo]-4-hydroxy-7-[[[[5-hydroxy-6-(phenylazo)-7-sulfo-2-naphthalenyl]amino]carbonyl]amino]-, disodium salt	3441-14-3
2,7-Naphthalenedisulfonic acid, 4-[(2,4-dimethylphenyl)azo]-3-hydroxy-, disodium salt	3761-53-3
1,3-Benzenediamine, 4-methyl-6-(phenylazo)-, monohydrochloride	4438-16-8
3H-Pyrazol-3-one, 4-[(2,4-dimethylphenyl)azo]-2,4-dihydro-5-methyl-2-phenyl-	6407-78-9
Phenol, 4-[[4-(phenylazo)-1-naphthalenyl]azo]-	6253-10-7
Propanenitrile, 3-[ethyl[3-methyl-4-[2-(6-nitro-2-benzothiazolyl)diazenyl]phenyl]amino]-	16586-42-8
Phenol, 4-[[2-methoxy-4-[(4-nitrophenyl)azo]phenyl]azo]-	19800-42-1
Resorcinol, bis(xylylazo)-	28514-75-2
Benzamide, N-[5-[bis[2-(acetyloxy)ethyl]amino]-2-[(4-nitrophenyl)azo]phenyl]-	29765-00-2
3-Pyridinecarbonitrile, 6-amino-4-methyl-5-[(4-nitrophenyl)azo]-2-[[3-(2-phenoxyethoxy)propyl]amino]-	85409-74-1

Preface

This assessment was carried out by staff of the National Industrial Chemicals Notification and Assessment Scheme (NICNAS) using the Inventory Multi-tiered Assessment and Prioritisation (IMAP) framework.

The IMAP framework addresses the human health and environmental impacts of previously unassessed industrial chemicals listed on the Australian Inventory of Chemical Substances (the Inventory).

The framework was developed with significant input from stakeholders and provides a more rapid, flexible and transparent approach for the assessment of chemicals listed on the Inventory.

Stage One of the implementation of this framework, which lasted four years from 1 July 2012, examined 3000 chemicals meeting characteristics identified by stakeholders as needing priority assessment. This included chemicals for which NICNAS already held exposure information, chemicals identified as a concern or for which regulatory action had been taken overseas, and chemicals detected in international studies analysing chemicals present in babies' umbilical cord blood.

Stage Two of IMAP began in July 2016. We are continuing to assess chemicals on the Inventory, including chemicals identified as a concern for which action has been taken overseas and chemicals that can be rapidly identified and assessed by using Stage One information. We are also continuing to publish information for chemicals on the Inventory that pose a low risk to human health or the environment or both. This work provides efficiencies and enables us to identify higher risk chemicals requiring assessment.

The IMAP framework is a science and risk-based model designed to align the assessment effort with the human health and environmental impacts of chemicals. It has three tiers of assessment, with the assessment effort increasing with each tier. The Tier I assessment is a high throughput approach using tabulated electronic data. The Tier II assessment is an evaluation of risk on a substance-by-substance or chemical category-by-category basis. Tier III assessments are conducted to address specific concerns that could not be resolved during the Tier II assessment.

These assessments are carried out by staff employed by the Australian Government Department of Health and the Australian Government Department of the Environment and Energy. The human health and environment risk assessments are conducted and published separately, using information available at the time, and may be undertaken at different tiers.

This chemical or group of chemicals are being assessed at Tier II because the Tier I assessment indicated that it needed further investigation.

For more detail on this program please visit:**www.nicnas.gov.au**

ACRONYMS & ABBREVIATIONS

Grouping Rationale

All the chemicals in this group are azo compounds that share a similar molecular structure (R—N=N—R). The chemicals in this group could contain one or more azo linkages, in which the attached functional groups differ for each chemical.

The significance of azo-reduction in the mutagenicity and carcinogenicity of azo dyes is well established. The chemicals in this group have the potential to undergo reductive cleavage to form one or more of the following aromatic amines, which have been identified as having potential carcinogenic and/or genotoxic concerns based on a recent study by Bruschweiler et al. (2014):

- benzenamine (CAS No. 62-53-3);
- benzenamine, 2,4-dimethyl- (CAS No. 95-68-1);
- benzenamine, 4-nitro- (CAS No. 100-01-6);
- phenol, 4-amino- (CAS No. 123-30-8); and
- 2-benzothiazolamine, 6-nitro- (CAS No. 6285-57-0; not on AICS).

The critical concern for these chemicals relates to potential carcinogenicity. Due to the range of functional groups present in the chemicals being assessed, they are not considered to be toxicologically similar for local toxicity effects, including sensitisation, and there is a lack of data to assess these effects. However, these local effects are not a high priority for assessment compared with the concerns about carcinogenicity, which, if validated, would be expected to determine appropriate risk management measures.

Import, Manufacture and Use

Australian

No specific Australian use, import, or manufacturing information has been identified.

International

The following international uses have been identified through: Galleria Chemica; the Substances and Preparations in the Nordic countries (SPIN) database; the European Commission Cosmetic Ingredients and Substances (CosIng) database; the United States (US) Personal Care Product Council International Nomenclature of Cosmetic Ingredients (INCI) Dictionary; the US Environmental Protection Agency's Aggregated Computer Toxicology Resource (ACToR); and the Canadian assessments of aromatic azo and benzidine based dyes (Government of Canada, 2013a; Government of Canada, 2013b; Government of Canada, 2014).

Some of the chemicals are listed in the US Personal Care Product Council INCI dictionary with the following identified functions:

- as colourant (CAS Nos. 1320-07-6, 3118-97-6, 3761-53-3, and 6407-78-9); and
- as hair colourant (CAS Nos. 730-40-5, 1320-07-6, 3441-14-3, and 4438-16-8).

All of the chemicals in this group have reported commercial use as synthetic dyes in textiles, although the introduction of these dyes for domestic dyeing use cannot be excluded.

Resorcinol, bis(xylylazo)- also has reported non-industrial use as a pesticide (US EPA, 2011).

The majority of the chemicals in this group have been pre-registered, but have not undergone the full registration process, specified under the European Union (EU) Registration, Evaluation and Authorisation of Chemicals (REACH) legislation (European Chemicals Agency).

Restrictions

Australian

No known restrictions have been identified.

International

The chemicals identified by the CAS Nos. 730-40-5, 842-07-9, 1320-07-6, 3118-97-6, 3441-14-3, and 4438-16-8 are listed on one or more of the following lists (Galleria Chemica):

- Association of South East Asian Nations (ASEAN) Cosmetic Directive Annex II Part 1: List of substances which must not form part of the composition of cosmetic products;
- EU Cosmetics Regulation 1223/2009 Annex II—List of substances prohibited in cosmetic products;
- New Zealand Cosmetic Products Group Standard—Schedule 4: Components cosmetic products must not contain; and
- Health Canada List of prohibited and restricted cosmetic ingredients (The Cosmetic Ingredient 'Hotlist').

Existing Worker Health and Safety Controls

Hazard Classification

The chemical 2-naphthalenol, 1-(phenylazo)- (CAS No. 842-07-9) is classified as hazardous, with the following risk phrases for human health in the Hazardous Substances Information System (HSIS) (Safe Work Australia):

- Xi; R43 (sensitisation);
- R68 Mut. Cat 3 (mutagenicity); and
- R40 Carc. Cat 3 (carcinogenicity).

All the other chemicals are not listed on HSIS (Safe Work Australia).

Exposure Standards

Australian

No specific exposure standards are available for the chemicals.

International

No specific exposure standards are available for the chemicals.

Health Hazard Information

Based on a review of publicly available hazard information in accordance with the IMAP Framework (NICNAS, 2013), limited toxicological data were identified for the majority of the chemicals in this group.

The toxicokinetics of this group is expected to be influenced by varying molecular weight and polarity (Bafana et al., 2011; Government of Canada, 2014). The chemicals in this group belong to one the following types of dyes: disperse, direct, reactive, solvent, basic and acidic dyes. Whilst the reported levels of solubility and bioavailability of the dye molecules appear to vary, available data on similar chemicals and empirical data suggest a potential for azo reduction to bioavailable amines (SCCNFP, 2002; SCCP, 2005; SCCS, 2011; Government of Canada, 2011; Government of Canada, 2013a; Government of Canada, 2013b; Government of Canada, 2014).

Azo bond reduction and cleavage occurs by an enzyme-mediated metabolism in the liver, skin and intestines. In the liver, metabolism is facilitated by cytosolic and microsomal enzymes (Platzek et al., 1999), including NADH cytochrome P450 reductase, NAD(P)H quinone oxidoreductase, and cytochrome P450s (OEHHA, 2012). Bacterial strains in human faeces have been shown to cleave azo dyes, suggesting an important role of intestinal microflora in azo reduction (Platzek et al., 1999).

Although azo reduction occurs favourably in anaerobic conditions, several in vitro and in vivo studies indicated that this process could also occur aerobically when azo dyes are applied to the skin (SCCP, 2005). In vitro, the skin microflora of mice, guinea pigs and humans caused reductive cleavage of the azo dyes, followed by percutaneous absorption of the resulting amines (SCCNFP, 2002). In addition, non-biological processes, such as thermal and photochemical degradation, have also been reported to break azo linkages (Engel et al., 2009).

The critical concern for this group of chemicals relates to potential carcinogenic effects following exposure. Sudan I (CAS No. 842-07-9) and Sudan II (CAS No. 3118-97-6) are considered to have genotoxic and carcinogenic potential (Government of Canada, 2013a). Ponceau MX (CAS No. 3761-53-3) and Sudan I (CAS No. 842-07-9) have been evaluated by the International Agency for Research on Cancer (IARC) and classified the chemicals as Group 2B (possibly carcinogenic to humans) and 3 (not classifiable as to its carcinogenicity to humans), respectively (IARC, 1975).

The chemicals in this group have the potential to undergo reductive cleavage of the azo linkage that would likely result in the formation of potential carcinogenic and/or genotoxic aromatic amines (see **Grouping Rationale**). The carcinogenicity and/or genotoxicity of three of these amines have been assessed by NICNAS for the following chemicals:

- benzenamine, 2,4-dimethyl- (CAS No. 95-68-1) (NICNASb);
- benzenamine (CAS No. 62-53-3) (NICNASa); and
- phenol, 4-amino- (CAS No. 123-30-8) (NICNASc).

These aromatic amine cleavage products are expected to have greater absorption than the dye from which they are derived (Platzek et al., 1999).

Risk Characterisation

Critical Health Effects

The critical health effects for risk characterisation of these chemicals are genotoxicity and carcinogenicity following breakdown of these chemicals to genotoxic and/or carcinogenic aromatic amines.

Public Risk Characterisation

Cosmetic and domestic

The chemicals identified by the CAS Nos. 730-40-5, 1320-07-6, 3118-97-6, 3441-14-3, 3761-53-3, 4438-16-8, and 6407-78-9 have been identified as having potential cosmetic use. Several of the chemicals are banned or restricted internationally, particularly for use in cosmetics (see **Restrictions: International**). The Scientific Committee on Cosmetic Products and Non-Food Products intended for Consumers (SCCNFP) (2002) concluded that 'azo dyes which may release one or more carcinogenic aromatic amines, poses a risk to the health of the consumer'.

All of the chemicals have potential use as synthetic dyes. Based on the available data, widespread domestic use is not expected; however, the introduction of these dyes for home use cannot be excluded. The margins between the upper-bounding estimates of exposure of the chemicals identified by the CAS Nos. 842-07-9 and 6407-78-9 from their use in consumer products and their critical health effect levels were estimated by the Government of Canada (2013a). Whilst quantitative risk calculations for these chemicals were considered adequate, in the absence of Australian specific use data, it is not possible to extrapolate this finding for Australia.

Overall, there is sufficient uncertainty regarding the safety of these chemicals in cosmetic and domestic products and therefore, a Tier III assessment is required (see **NICNAS Recommendation**).

Dyed textiles and leather

The public could also be exposed to potential carcinogenic aromatic amines as impurities, or through the release of these aromatic amines derived from the chemicals in this group through:

- prolonged exposure to articles of clothing and leathergoods containing the dyes; and
- young children exposed by sucking the materials containing the dye.

The Australian Competition and Consumer Commission (ACCC) has published guidance on the safe concentrations of particular chemicals in consumer goods (ACCC, 2014b). The guidance prescribes concentrations of chemicals in clothing, textiles and leather articles in direct and prolonged contact with the human skin or oral cavity, below which a safety concern does not exist. It also includes a list of hazardous aromatic amines classified as carcinogens in the EU and identified in the REACH list of 22 aromatic amines in Annex XVII Appendix 8 (European Commission, 2006).

In considering the NICNAS recommendation for previously assessed azo dyes, the ACCC conducted a market survey to determine if any dyes of concern had been used in manufacturing consumer goods supplied in Australia. The ACCC has negotiated several recalls of products based on the results of the surveys (ACCC, 2014a). The ACCC is considering mechanisms to restrict the supply of textiles and leather articles that could come into direct and prolonged contact with the human skin that might plausibly result in human exposure to certain aromatic amines at unacceptable levels. Although the ACCC is only considering restriction mechanisms for azo dyes that cleave to the 22 carcinogenic aromatic amines (European Commission, 2006), the options identified may also be relevant for the chemicals in this group.

Further assessment at Tier III is required to determine whether there are similar concerns to those associated with the 22 carcinogenic aromatic amines (see **NICNAS Recommendation**).

Occupational Risk Characterisation

During product formulation, oral, dermal, ocular and inhalation exposure of workers to the chemical may occur, particularly where manual or open processes are used. These may include transfer and blending activities, quality control analysis, and cleaning and maintaining equipment. Worker exposure to the chemical at lower concentrations may also occur while using formulated products containing the chemical. The level and route of exposure will vary depending on the method of application and work practices employed.

Overall, there is sufficient uncertainty regarding the hazards of these chemicals in the workplace, and therefore, a Tier III assessment is required (see **NICNAS Recommendation**) to determine the appropriate occupational controls.

NICNAS Recommendation

The chemicals in this group and their potentially genotoxic and/or carcinogenic amine cleavage products are recommended for Tier III assessment to determine whether:

- risk management controls for domestic and cosmetic use are required;
- similar concerns to those associated with the 22 amines subject to restrictions in textiles in Europe exist; and
- there are additional azo dye chemicals in the Australian Inventory of Chemical Substances (AICS) which may break down to aromatic amines identified as potentially carcinogenic and/or genotoxic by Bruschweiler et al. (2014) that may require further assessment.

Regulatory Control

References

ACCC 2014a. Product Safety Recall on 'Pillow Talk Pty Ltd—Pillow Talk 50/50 Poly/Cotton 225 Thread Count Plain Dye Range - Red Only'. Accessed February 2015 at **http://www.recalls.gov.au/content/index.phtml/itemId/1056169**

ACCC 2014b. Safety guidance on concentrations of particular chemicals in certain consumer goods. Accessed February 2015 at **http://www.productsafety.gov.au/content/index.phtml/itemId/1009938**

Bafana, A., Devi, S. S.,& Chakrabarti, T. (2011). Azo dyes: past, present and the future. Environmental Reviews, 19(NA), 350-371.

Bruschweiler BJ, Kung S, Burgi D, Muralt L, Nyfeler E (2014) Identification of non-regulated aromatic amines of toxicological concern which can be cleaved from azo dyes used in clothing textiles. Regulatory Toxicology and Pharmacology 69 pp. 263-272.

CosIng. Cosmetic Ingredients and Substances. Accessed February 2015 at **http://ec.europa.eu/consumers/cosmetics/cosing/**

Engel E, Vasold R, Santarelli F, Maisch T, Gopee N, Howard P, Landthaler M, Baumler W (2009) Tattooing of skin results in transportation and light-induced decomposition of tattoo pigments – a first quantification in vivo using a mouse model. Experimental Dermatology 19 pp. 54-60.

European Chemicals Agency. Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) legislation. Accessed February 2015 at **http://echa.europa.eu/regulations/reach/legislation**

European Commission 2006. Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH). Accessed February 2015 at **http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006R1907:20090627:EN:PDF**

Galleria Chemica. Accessed January 2015 at **http://jr.chemwatch.net/galleria/**

Government of Canada (2011) Screening assessment for the challenge: 2-naphthalenol, 1-[[4-(phenylazo)phenyl]azo]- Solvent Red 23 CAS No. 85-86-9. Accessed February 2015 at **http://www.ec.gc.ca/eseees/5B828E08-3266-4189-B32B-39B5D773040A/Batch%206_85-86-9_EN.pdf**

Government of Canada (2013a). Draft Screening Assessment of Aromatic Azo and Benzidine-based Substance Grouping. Certain Azo Disperse Dyes. Accessed February 2015 at **http://www.ec.gc.ca/ese-ees/default.asp?lang=En&n=E86C5AFA-1**

Government of Canada (2013b) Draft Screening Assessement Aromatic Azo and Benzidine-based SubstanceGrouping Certain Azo Disperse Dyes. Accessed February 2015 at **http://www.ec.gc.ca/ese-ees/default.asp?lang=En&n=E86C5AFA-1**

Government of Canada (2014) Draft Screening Assessement Aromatic Azo and Benzidine-based SubstanceGrouping Certain Azo Direct Dyes and Azo Reactive Dyes. Accessed February 2015 at **http://www.ec.gc.ca/eseees/default.asp?lang=En&n=899CF15C-1**

International Agency for Research on Cancer (IARC) (1975) Some Aromatic and Azo Compounds. IARC Monographs Volume 8. Accessed February 2015 at **http://monographs.iarc.fr/ENG/Monographs/vol1-42/mono8.pdf**

National Industrial Chemicals Notification and Assessment Scheme (NICNASa). Tier II human health assessment for benzenamine (CAS No. 62-53-3). Australian Government Department of Health. Accessed February 2015 at **http://www.nicnas.gov.au**

National Industrial Chemicals Notification and Assessment Scheme (NICNASb). Tier II human health assessment for benzenamine, 2,4-dimethyl- (CAS No. 95-68-1). Australian Government Department of Health. Accessed February 2015 at **http://www.nicnas.gov.au**

National Industrial Chemicals Notification and Assessment Scheme (NICNASc). Tier II human health assessment for phenol, 4-amino- (CAS No. 123-30-8). Australian Government Department of Health. Accessed February 2015 at **http://www.nicnas.gov.au**

Office of Environmental Health Hazard Assessment (OEHHA) 2012. Evidence on the carcinogenicity of C.I. Disperse Yellow 3. Accessed January 2015 at **http://www.oehha.ca.gov/Prop65/hazard_ident/pdf_zip/081012CIYHID.pdf**

Platzek T, Lang C, Grohmann G, Gi US, Baltes W. (1999) Formation of a carcinogenic aromatic amine from an azo dye by human skin bacteria in vitro. Human and Experimental Toxicology 18 pp. 552-559.

REACH Dossiers. Accessed January 2015 at **http://echa.europa.eu/web/guest/information-on-chemicals/registered-substances**

Safe Work Australia (SWA). Hazardous Substances Information System (HSIS). Accessed January 2015 at **http://hsis.safeworkaustralia.gov.au/HazardousSubstance**

Scientific Committee on Consumer Products (SCCP) (2005) Opinion on the use of CI 26100 (CI Solvent Red 23) as a colorant in cosmetic products. Adopted by the SCCP during the 4th plenary of 21 June 2005. Accessed February 2015 at **http://ec.europa.eu/health/ph_risk/committees/04_sccp/docs/sccp_o_013.pdf**

Scientific Committee on Consumer Safety (SCCS) (2011) Opinion on Basic Red 76. COLIPA No. C8. Accessed February 2015 at **http://ec.europa.eu/health/scientific_committees/consumer_safety/docs/sccs_o_051.pdf**

Substances in Preparations in Nordic Countries (SPIN). Accessed Feburary 2015 at **http://188.183.47.4/dotnetnuke/Home/tabid/58/Default.aspx**

The Scientific Committee on Cosmetic Products and Non-Food Products intended for Consumers (SCCNFP) (2002) Opinion on the Safety Review of the Use of Certain Azo-Dyes in Cosmetics Products. SCCNFP/0495/01, final. Accessed February 2015 at **http://ec.europa.eu/health/archive/ph_risk/committees/sccp/documents/out155_en.pdf**

United States (US) Personal Care Product Council International Nomenclature of Cosmetic Ingredients (INCI) dictionary. Accessed February 2015 at **http://gov.personalcarecouncil.org/jsp/gov/GovHomePage.jsp**

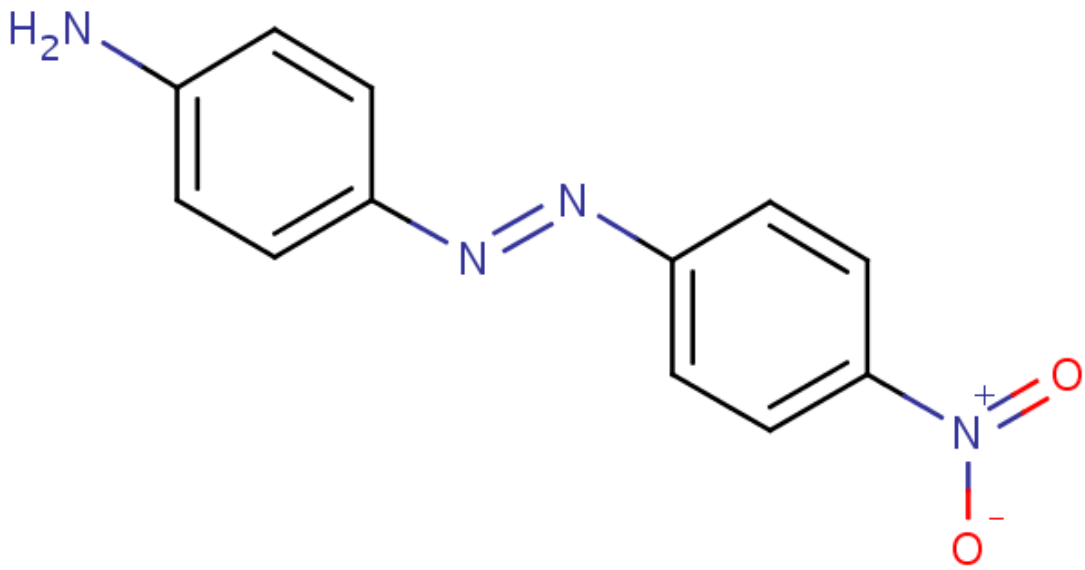
US Environmental Protection Agency's Aggregated Computational Toxicology Resource (ACToR). Accessed January 2015 at **http://actor.epa.gov/actor/faces/ACToRHome.jsp**

US EPA (2011) Inert ingredients permitted for use in nonfood use pesticide products. Accessed June 2016 from **http://www.agriculturedefensecoalition.org/sites/default/files/file/toxic_toys_148/148E_2011_U.S._EPA_Inert_Ingredients_Permiteed_for_Use_in_NonFood_Use_Pesticide_Products**

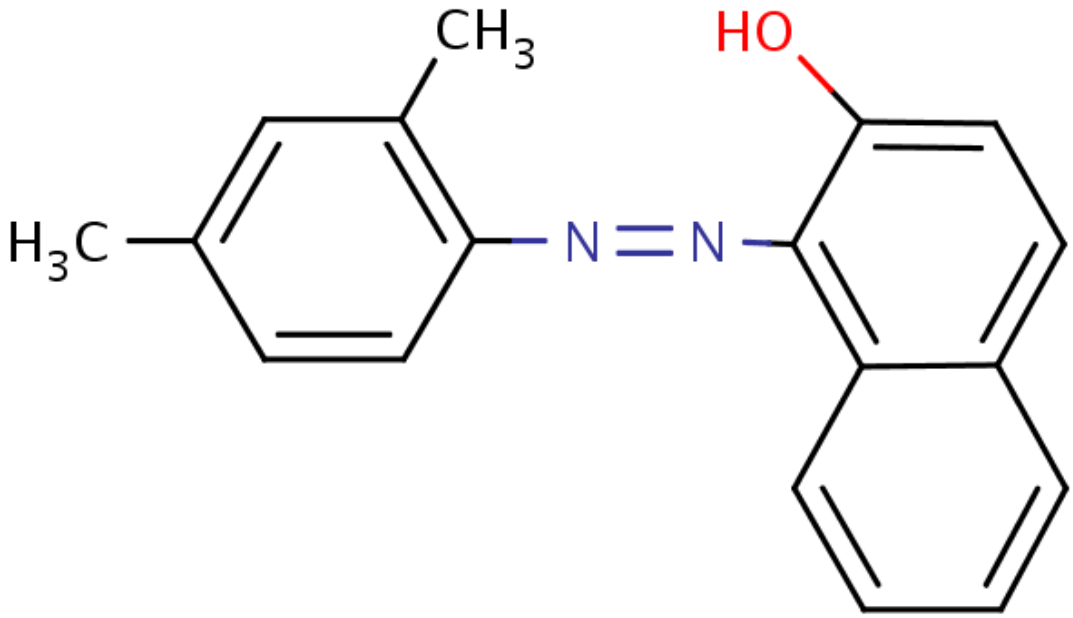
Last Update 01 July 2016

Chemical Identities

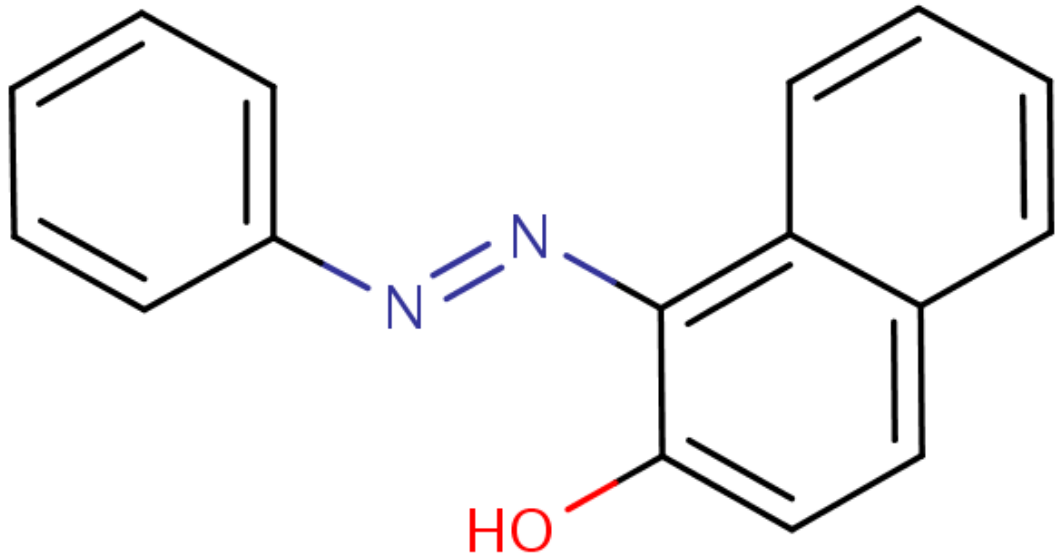
Chemical Name in the Inventory and Synonyms	**Benzenamine, 4-[(4-nitrophenyl)azo]-** C.I. 11005 Solvent Orange 9 Disperse Orange 3
CAS Number	730-40-5
Structural Formula	

	
Molecular Formula	C12H10N4O2
Molecular Weight	242.23

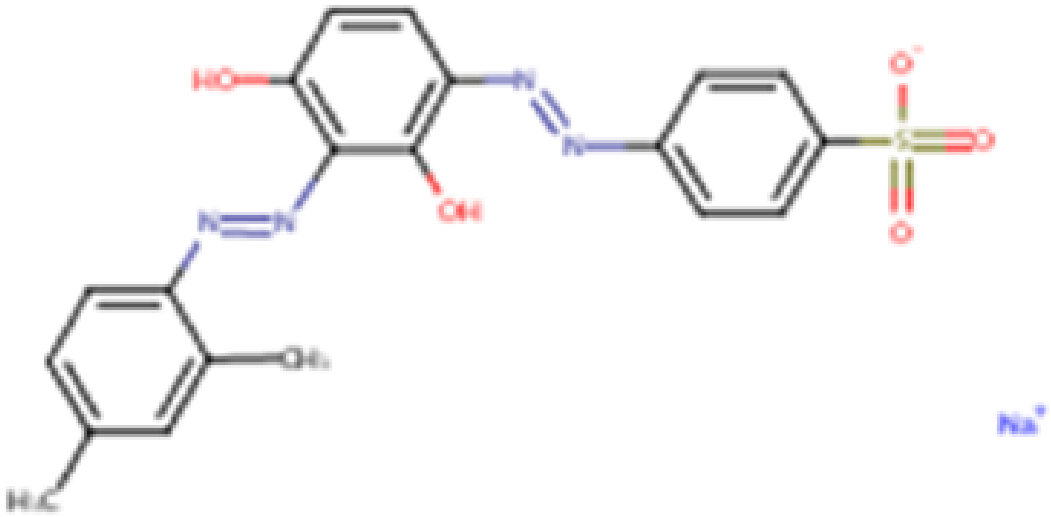
Chemical Name in the Inventory and Synonyms	**2-Naphthalenol, 1-[(2,4-dimethylphenyl)azo]-** C.I. Solvent Orange 7 Sudan II C.I. 12140
CAS Number	3118-97-6
Structural Formula	

	
Molecular Formula	C18H16N2O
Molecular Weight	276.33

Chemical Name in the Inventory and Synonyms	**2-Naphthalenol, 1-(phenylazo)-** C.I. Solvent Yellow 14 C.I. 12055 Disperse yellow 97 Sudan I
CAS Number	842-07-9
Structural Formula	

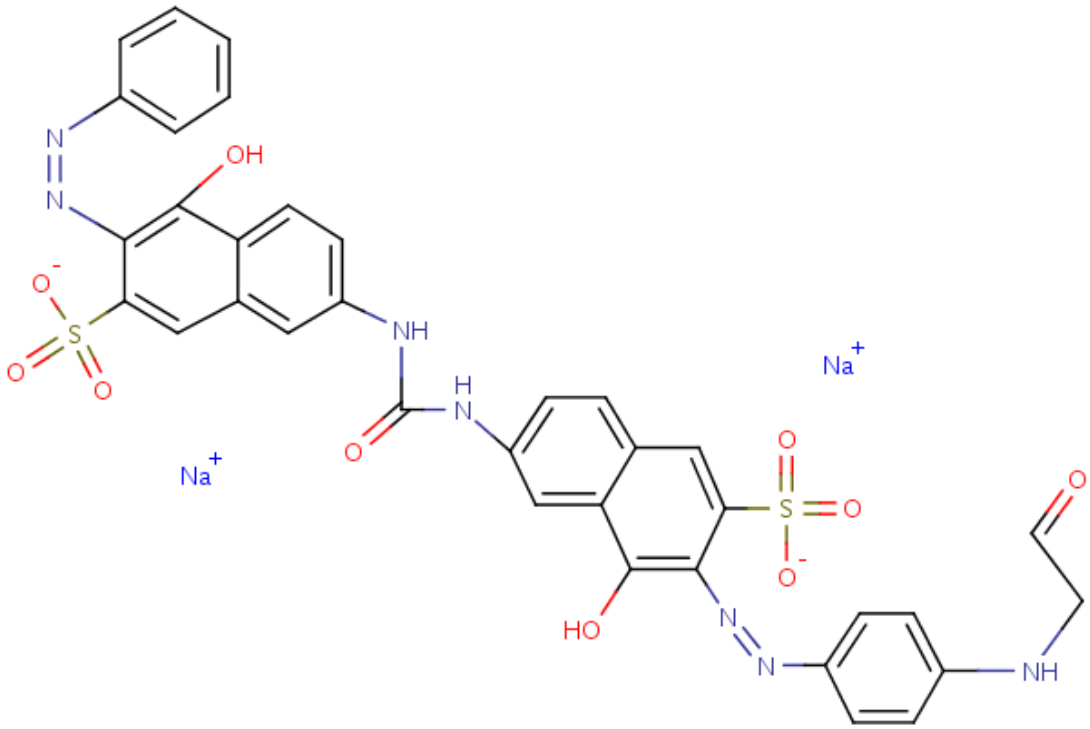
	
Molecular Formula	C16H12N2O
Molecular Weight	248.28

Chemical Name in the Inventory and Synonyms	**Benzenesulfonic acid, 4-[[3-[(dimethylphenyl)azo]-2,4-dihydroxyphenyl]azo]-, monosodium salt** D and C Brown No. 1 CI Acid Orange 24 CI 20170 4-[[3-[(2,4-dimethylphenyl)azo]-2,4-dihydroxyphenyl]azo]benzenesulfonic acid, 4-[[3-[(2,4-dimethylphenyl)azo]-2,4-dihydroxyphenyl]azo]benzenesulfonic acid, Monosodium Salt
CAS Number	1320-07-6
Structural Formula	



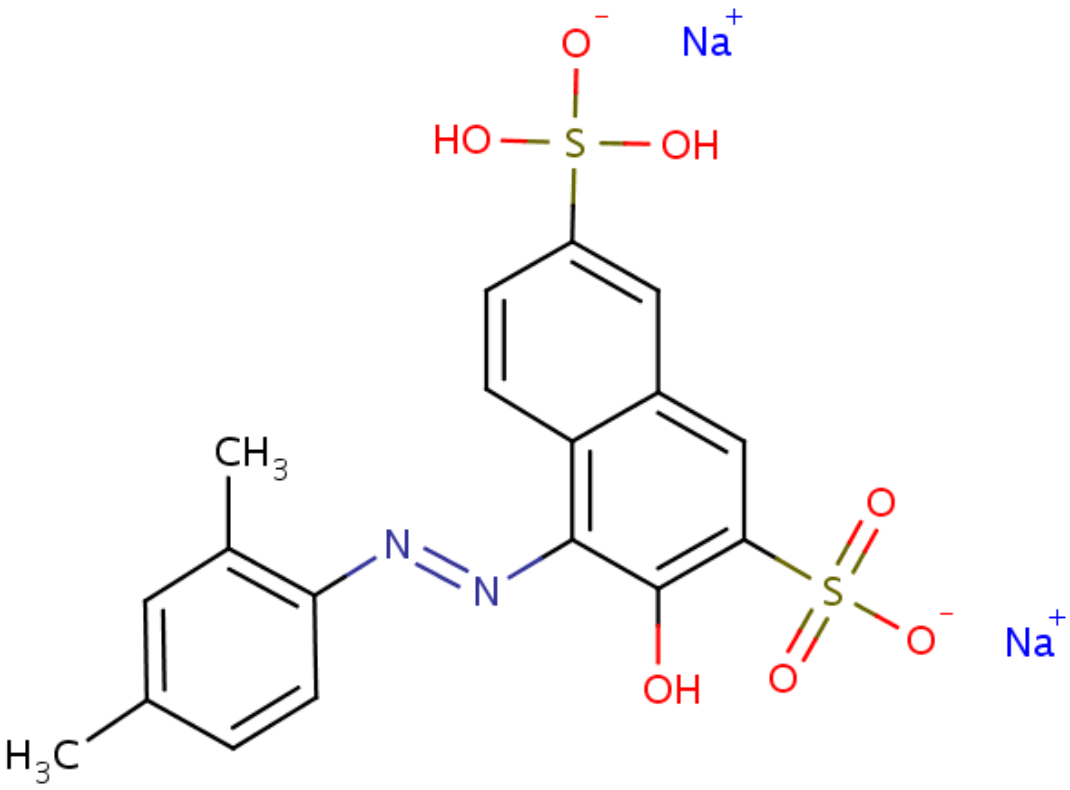
Molecular Formula	C20H18N4O5S.Na
Molecular Weight	

Chemical Name in the Inventory and Synonyms	**2-Naphthalenesulfonic acid, 3-[[4-(acetylamino)phenyl]azo]-4-hydroxy-7-[[[[5-hydroxy-6-(phenylazo)-7-sulfo-2-naphthalenyl]amino]carbonyl]amino]-, disodium salt** C.I. Direct Red 23 C.I. 29160
CAS Number	3441-14-3
Structural Formula	



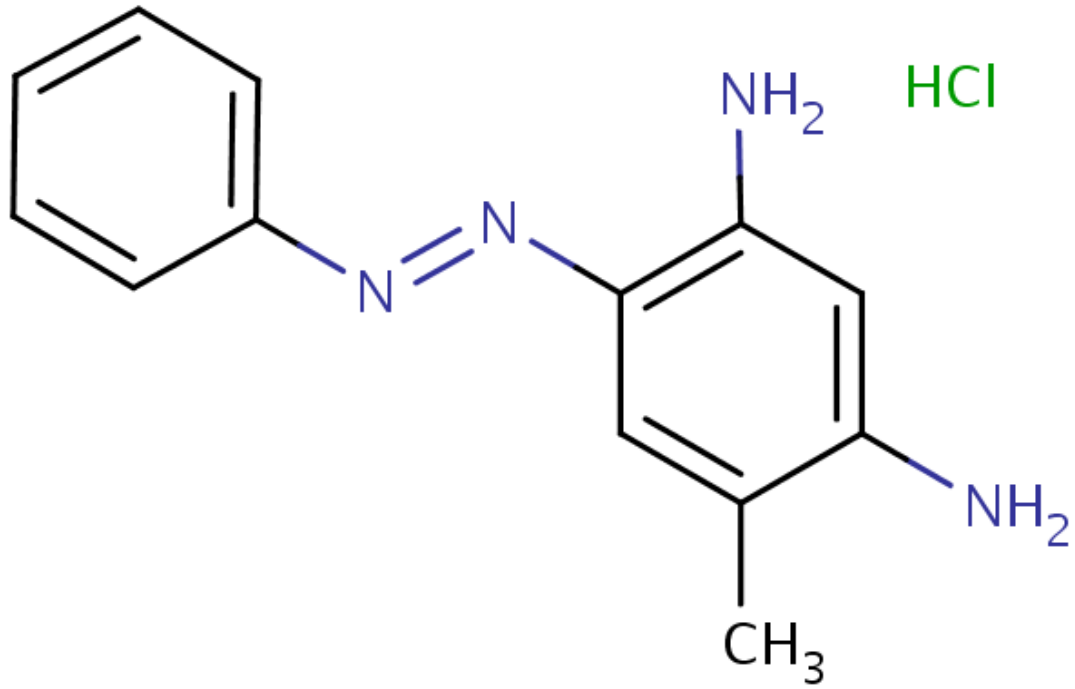
Molecular Formula	C35H27N7O10S2.2Na
Molecular Weight	

Chemical Name in the Inventory and Synonyms	**2,7-Naphthalenedisulfonic acid, 4-[(2,4-dimethylphenyl)azo]-3-hydroxy-, disodium salt** C.I. Acid Red 26 Ponceau MX C.I. Food Red 5
CAS Number	3761-53-3
Structural Formula	

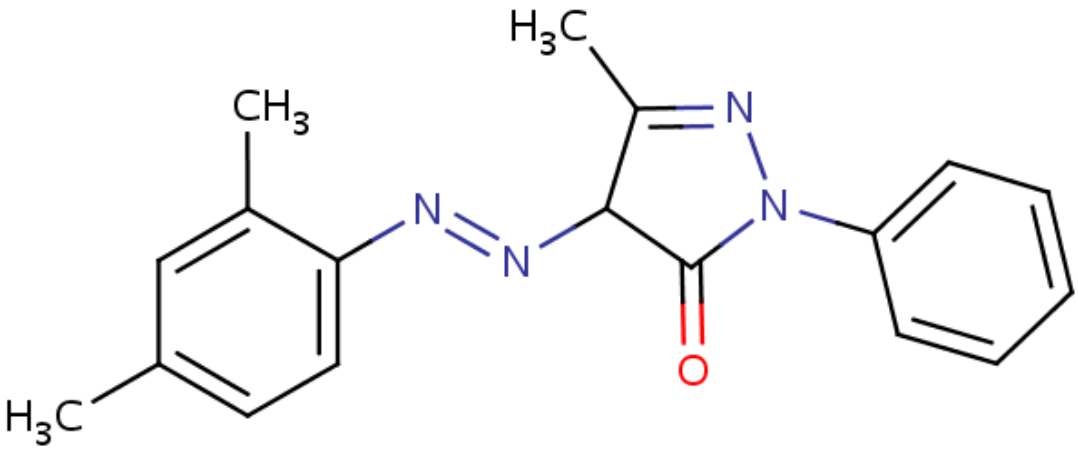


Molecular Formula	C18H16N2O7S2.2Na
Molecular Weight	480.42

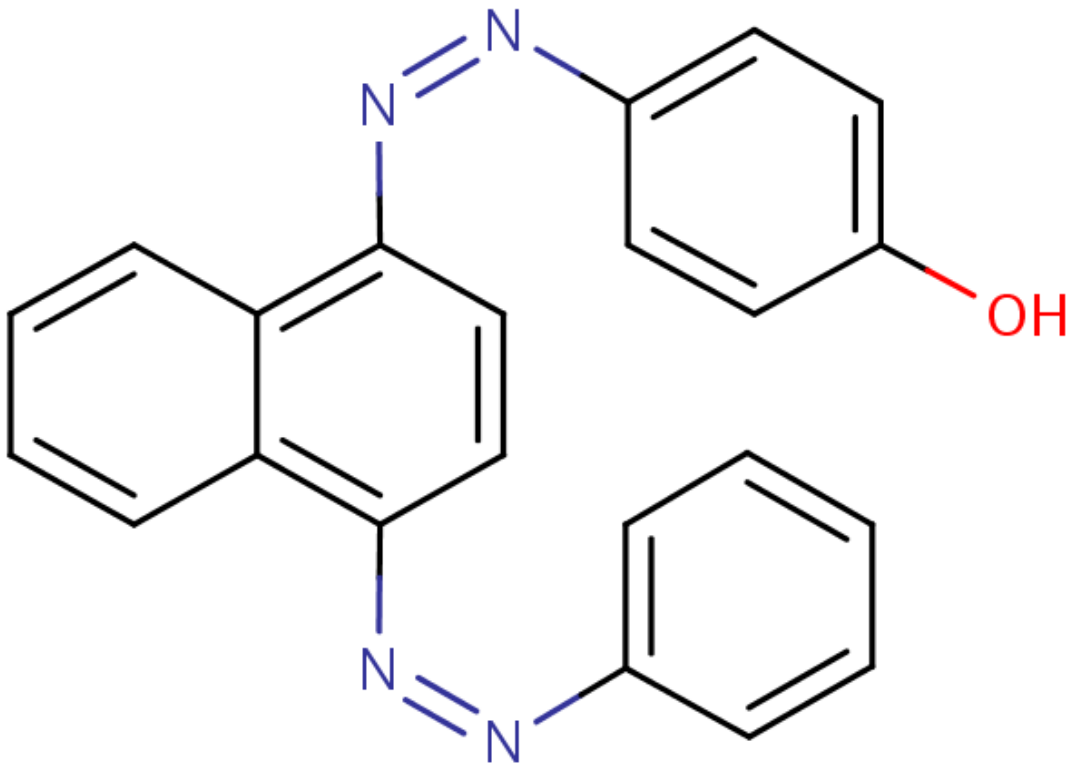
Chemical Name in the Inventory and Synonyms	**1,3-Benzenediamine, 4-methyl-6-(phenylazo)-, monohydrochloride** C.I. Basic Orange 1 C.I. 11320 Chrysoidine R
CAS Number	4438-16-8
Structural Formula	

	
Molecular Formula	C13H14N4.ClH
Molecular Weight	262.74

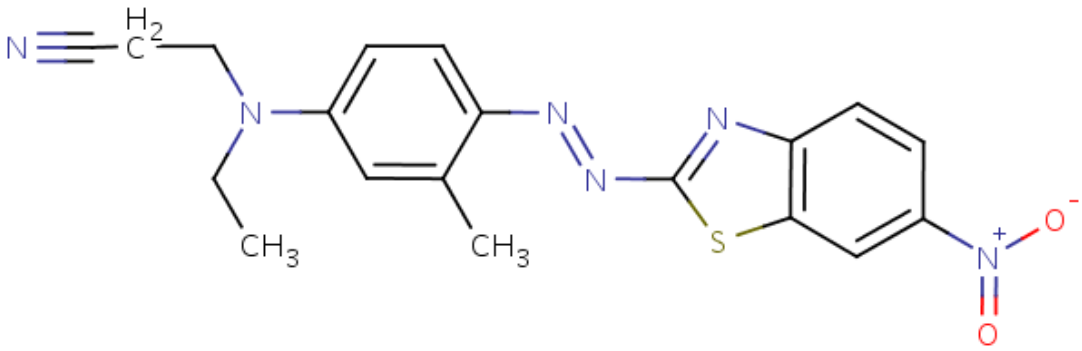
Chemical Name in the Inventory and Synonyms	**3H-Pyrazol-3-one, 4-[(2,4-dimethylphenyl)azo]-2,4-dihydro-5-methyl-2-phenyl-** C.I. Solvent Yellow 18 C.I. 12740
CAS Number	6407-78-9
Structural Formula	

	
Molecular Formula	C18H18N4O
Molecular Weight	

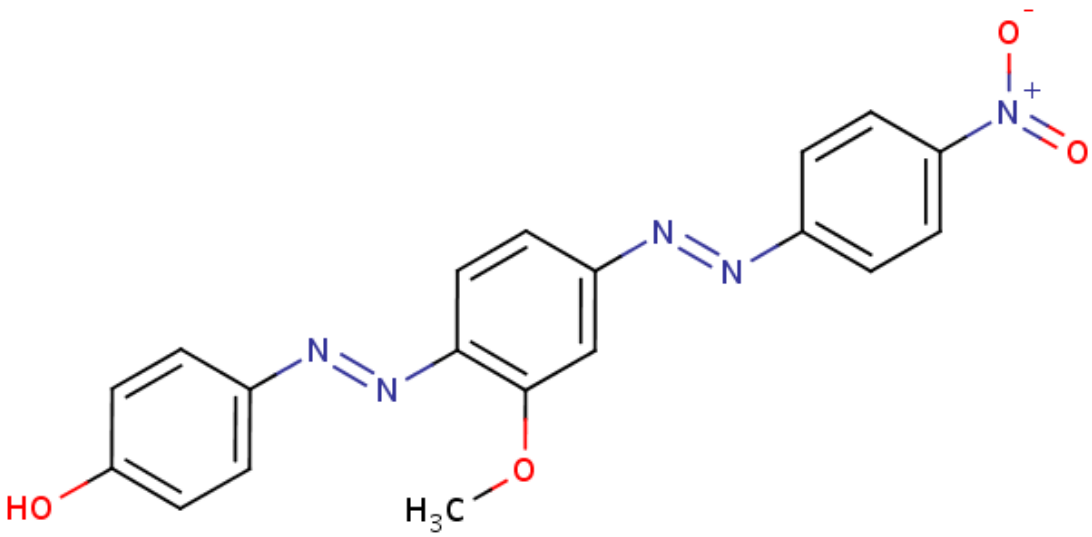
Chemical Name in the Inventory and Synonyms	**Phenol, 4-[[4-(phenylazo)-1-naphthalenyl]azo]-** C.I. Disperse Orange 13 C.I. 26080
CAS Number	6253-10-7
Structural Formula	

	
Molecular Formula	C22H16N4O
Molecular Weight	352.39

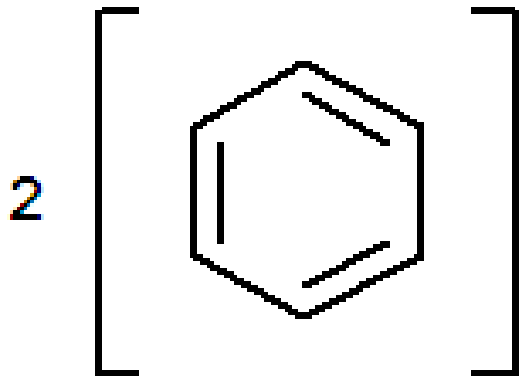
Chemical Name in the Inventory and Synonyms	**Propanenitrile, 3-[ethyl[3-methyl-4-[2-(6-nitro-2-benzothiazolyl)diazenyl]phenyl]amino]-** 3-[N-ethyl-4-[(6-nitro-2-benzothiazolyl)azo C.I. Disperse Red 179 C.I. 112290
CAS Number	16586-42-8
Structural Formula	

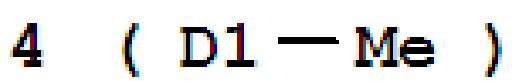
	
Molecular Formula	C19H18N6O2S
Molecular Weight	

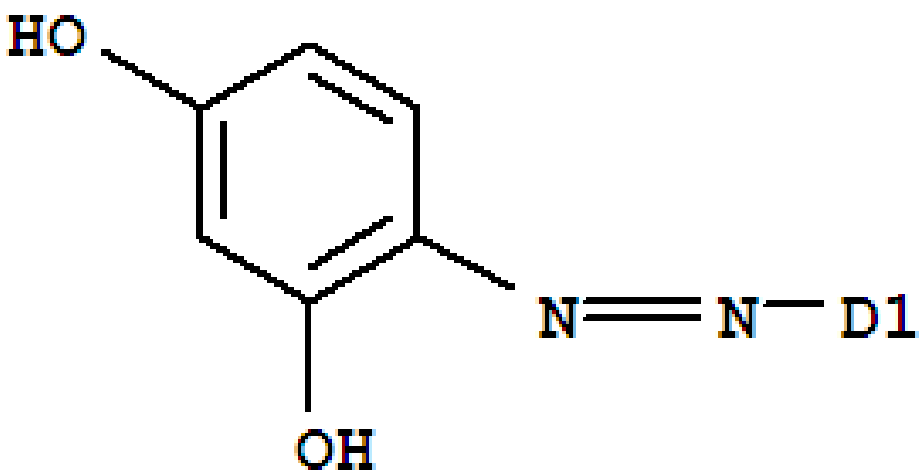
Chemical Name in the Inventory and Synonyms	**Phenol, 4-[[2-methoxy-4-[(4-nitrophenyl)azo]phenyl]azo]-** 4-[[2-methoxy-4-[(4-nitrophenyl)azo
CAS Number	19800-42-1
Structural Formula	

	
Molecular Formula	C19H15N5O4
Molecular Weight	

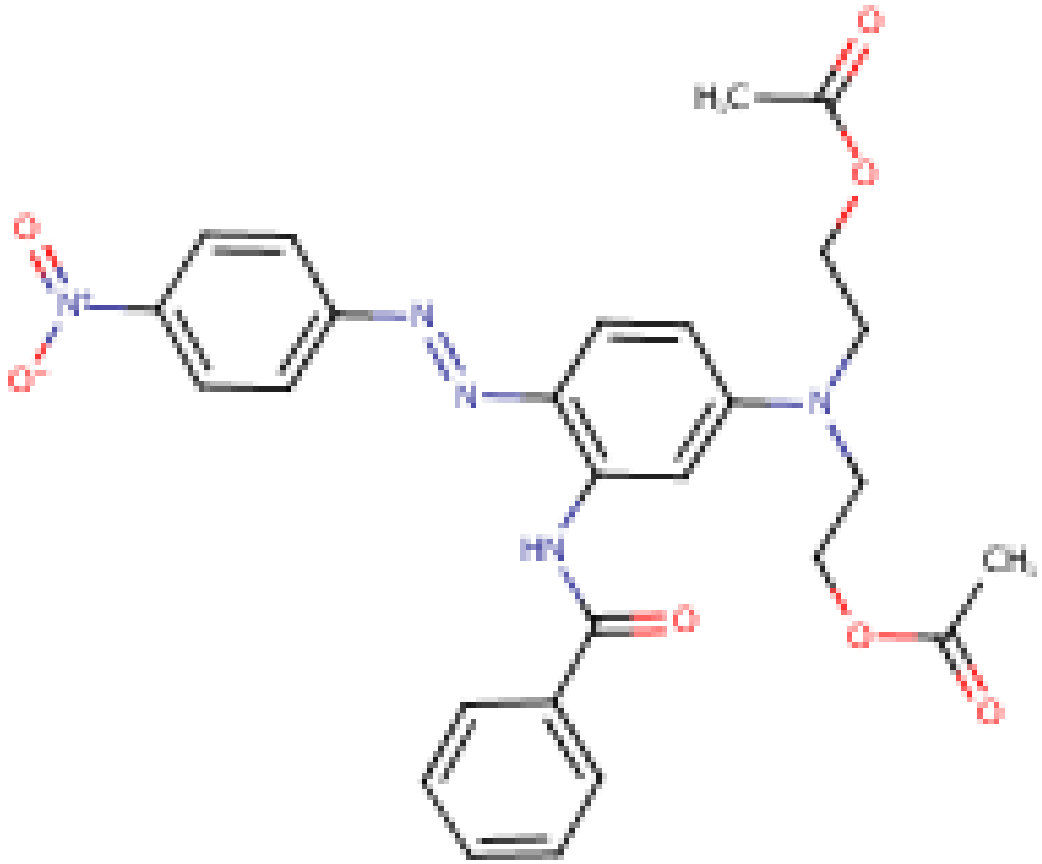
Chemical Name in the Inventory and Synonyms	**Resorcinol, bis(xylylazo)-** bis(xylylazo)resorcinol
CAS Number	28514-75-2
Structural Formula	



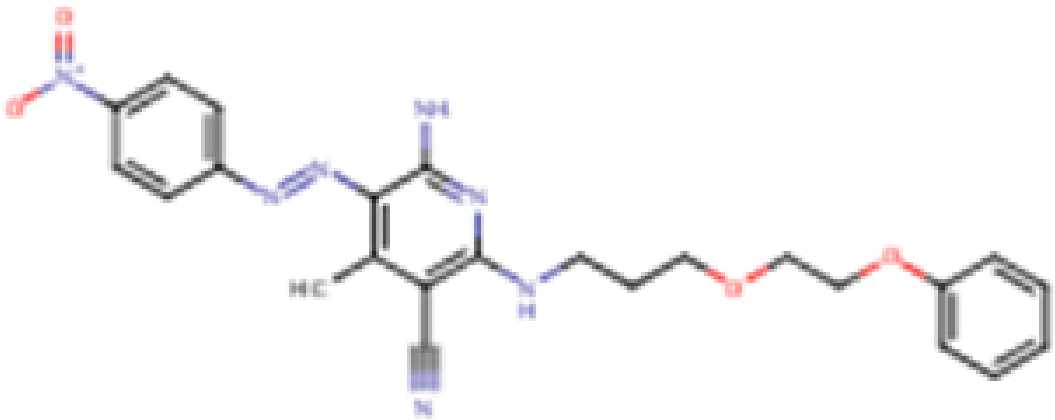




Molecular Formula	C22H22N4O2
Molecular Weight	374.48

Chemical Name in the Inventory and Synonyms	**Benzamide, N-[5-[bis[2-(acetyloxy)ethyl]amino]-2-[(4-nitrophenyl)azo]phenyl]-** 5'-[bis(2-hydroxymethyl)amino]-2'-[(p-nitrophenyl)azo]benzanilide, diacetate
CAS Number	29765-00-2
Structural Formula	
Molecular Formula	C27H27N5O7
Molecular Weight	

Chemical Name in the Inventory and Synonyms	**3-Pyridinecarbonitrile, 6-amino-4-methyl-5-[(4-nitrophenyl)azo]-2-[[3-(2-phenoxyethoxy)propyl]amino]-** 6-amino-4-methyl-5-[(4-nitrophenyl)azo]-2-[[3-(2-phenoxyethoxy)propyl]amino]nicotinonitrile
CAS Number	85409-74-1
Structural Formula	

	
Molecular Formula	C24H25N7O4
Molecular Weight	

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