Selected benzidine-congener-based dyes: Human health tier II assessment

04 July 2014

Chemicals in this assessment

Chemical Name in the Inventory	CAS Number
2,7-Naphthalenedisulfonic acid, 3,3'-[(3,3'-dimethyl[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[5-amino-4-hydroxy-, tetrasodium salt	72-57-1
1,3-Naphthalenedisulfonic acid, 6,6'-[(3,3'-dimethyl[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[4-amino-5-hydroxy-, tetrasodium salt	314-13-6
2,7-Naphthalenedisulfonic acid, 3,3'-[(3,3'-dimethyl[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[4,5-dihydroxy-, tetrasodium salt	2150-54-1
2,7-Naphthalenedisulfonic acid, 3,3'-[(3,3'-dimethoxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[5-amino-4-hydroxy-, tetrasodium salt	2429-74-5
1,3-Naphthalenedisulfonic acid, 4-amino-5-hydroxy-6-[[4'-[(2-hydroxy-1-naphthalenyl)azo]-3,3'-dimethoxy[1,1'-biphenyl]-4-yl]azo]-, disodium salt	2586-57-4

Chemical Name in the Inventory	CAS Number
1,3-Naphthalenedisulfonic acid, 6,6'-[(3,3'-dimethoxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[4-amino-5-hydroxy-, tetrasodium salt	2610-05-1
2,7-Naphthalenedisulfonic acid, 3,3'-[(3,3'-dimethoxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[4,5-dihydroxy-, tetrasodium salt	4198-19-0
1-Naphthalenesulfonic acid, 3-[[4'-[(6-amino-1-hydroxy-3-sulfo-2-naphthalenyl)azo]-3,3'-dimethoxy[1,1'-biphenyl]-4-yl]azo]-4-hydroxy-, disodium salt	6449-35-0
1,3-Naphthalenedisulfonic acid, 8-[[3,3'-dimethyl-4'-[[4-[[(4-methylphenyl)sulfonyl]oxy]phenyl]azo][1,1'-biphenyl]-4-yl]azo]-7-hydroxy-, disodium salt	6459-94-5
Benzoic acid, 5-[[4'-[[8-[(2,4-diaminophenyl)azo]-1-hydroxy-3,6-disulfo-2-naphthalenyl]azo]-3,3'-dimethyl[1,1'-biphenyl]-4-yl]azo]-2-hydroxy-, trisodium salt	6505-12-0
1,3-Naphthalenedisulfonic acid, 8-[[3,3'-dimethoxy-4'-[[4-[[(4-methylphenyl)sulfonyl]oxy]phenyl]azo][1,1'-biphenyl]-4-yl]azo]-7-hydroxy-, disodium salt	6548-30-7
Cuprate(3-), [.mu.-[7-[[3,3'-dihydroxy-4'-[[1-hydroxy-6-(phenylamino)-3-sulfo-2-naphthalenyl]azo][1,1'-biphenyl]-4-yl]azo]-8-hydroxy-1,6-naphthalenedisulfonato(7-)]]di-, trisodium	6656-03-7
Benzoic acid, 2-[[2-amino-6-[[4'-[(3-carboxy-4-hydroxyphenyl)azo]-3,3'-dimethoxy[1,1'-biphenyl]-4-yl]azo]-5-hydroxy-7-sulfo-1-naphthalenyl]azo]-5-nitro-, trisodium salt	6739-62-4
Cuprate(4-), [.mu.-[[4,4'-[(3,3'-dihydroxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[3-hydroxy-2,7-naphthalenedisulfonato]](8-)]]di-, tetrasodium	12222-00-3
C.I. Direct Blue 160	12222-02-5
Cuprate(4-), [.mu.-[[6,6'-[(3,3'-dihydroxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[4-amino-5-hydroxy-1,3-naphthalenedisulfonato]](8-)]]di-, tetrasodium	16143-79-6

Chemical Name in the Inventory	CAS Number
2,7-Naphthalenedisulfonic acid, 4-amino-3-[[4'-[(2,4-diaminophenyl)azo]-3,3'-dimethyl[1,1'-biphenyl]-4-yl]azo]-5-hydroxy-6-(phenylazo)-, disodium salt	54804-85-2
[1,1'-Biphenyl]-4,4'-bis(diazonium), 3,3'-dimethoxy-	20282-70-6
Cuprate(4-), [.mu.-[[3,3'-[(3,3'-dihydroxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[5-amino-4-hydroxy-2,7-naphthalenedisulfonato]](8-)]]di-, tetrasodium	28407-37-6
Cuprate(3-), [.mu.-[4-[[3,3'-dihydroxy-4'-[(2-hydroxy-6-sulfo-1-naphthalenyl)azo][1,1'-biphenyl]-4-yl]azo]-3-hydroxy-2,7-naphthalenedisulfonato(7-)]]di-, trihydrogen	34771-63-6
Phenol, 4,4'-[(3,3'-dichloro[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[2-methyl-	49744-32-3
2,7-Naphthalenedisulfonic acid, 4-amino-5-hydroxy-6-[[4'-[(4-hydroxyphenyl)azo]-3,3'-dimethyl[1,1'-biphenyl]-4-yl]azo]-3-[(4-nitrophenyl)azo]-	56148-97-1
Cuprate(2-), [5-[[4'-[[2,6-dihydroxy-3-[(2-hydroxy-5-sulfophenyl)azo]phenyl]azo]-3,3'-dimethyl[1,1'-biphenyl]-4-yl]azo]-2-hydroxybenzoato(4-)]-, disodium	66225-65-8
Phenol, 2,2'-[(3,3'-dimethyl[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[4-nonyl-	67990-27-6
Cuprate(3-), [.mu.-[3-[[4'-[(2,8-dihydroxy-6-sulfo-1-naphthalenyl)azo]-3,3'-dihydroxy[1,1'-biphenyl]-4-yl]azo]-4,5-dihydroxy-2,7-naphthalenedisulfonato(7-)]]di-, trisodium	68140-31-8
2,7-Naphthalenedisulfonic acid, 4-amino-3-[[4'-[(2,4-dihydroxyphenyl)azo]-3,3'-dimethyl[1,1'-biphenyl]-4-yl]azo]-5-hydroxy-6-[(4-sulfophenyl)azo]-, trisodium salt	68318-35-4
2,7-Naphthalenedisulfonic acid, 4-amino-5-hydroxy-6-[[4'-[(4-hydroxyphenyl)azo]-3,3'-dimethyl[1,1'-biphenyl]-4-yl]azo]-3-[(4-nitrophenyl)azo]-, disodium salt	68400-36-2

Chemical Name in the Inventory	CAS Number
Cuprate(3-), [.mu.-[3-[[3,3'-dihydroxy-4'-[[1-hydroxy-6-(phenylamino)-3-sulfo-2-naphthalenyl]azo][1,1'-biphenyl]-4-yl]azo]-4-hydroxy-1,5-naphthalenedisulfonato(7-)]]di-, trisodium	73287-47-5
2,7-Naphthalenedisulfonic acid, 3,3'-[(3,3'-dimethoxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[5-amino-4-hydroxy-, sodium salt	68966-50-7
1,3-Naphthalenedisulfonic acid, 6,6'-[(3,3'-dimethoxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[4-amino-5-hydroxy-, sodium salt, compound with 2,2',2''-nitrilotris[ethanol]	83763-65-9
1,3-Naphthalenedisulfonic acid, 6,6'-[(3,3'-dimethoxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[4-amino-5-hydroxy-, sodium salt	83763-66-0
2,7-Naphthalenedisulfonic acid, 3,3'-[(3,3'-dimethoxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[5-amino-4-hydroxy-, ammonium potassium sodium salt	93964-43-3
Benzoic acid, 5-[[4'-[[6-amino-5-(1H-benzotriazol-5-ylazo)-1-hydroxy-3-sulfo-2-naphthalenyl]azo]-3,3'-dimethoxy[1,1'-biphenyl]-4-yl]azo]-2-hydroxy-4-methyl-, disodium salt	70210-28-5
Benzenesulfonic acid, 3-(benzoylamino)-4-hydroxy-5-[[1-[[[4'-[[2-[[2-hydroxy-5-(methylsulfonyl)phenyl]azo]-1,3-dioxobutyl]amino]-3,3'-dimethoxy[1,1'-biphenyl]-4-yl]amino]carbonyl]-2-oxopropyl]azo]-, monosodium salt	70210-32-1
Benzoic acid, 2-[[2-amino-5-hydroxy-6-[[4'-[(2-hydroxy-6-sulfo-1-naphthalenyl)azo]-3,3'-dimethoxy[1,1'-biphenyl]-4-yl]azo]-7-sulfo-1-naphthalenyl]azo]-5-nitro-, trisodium salt	71566-41-1
Cuprate(5-), [.mu.3-[3-[[6-[[3,3'-dihydroxy-4'-[(1-hydroxy-3,6-disulfo-2-naphthalenyl)azo][1,1'-biphenyl]-4-yl]azo]-1,5-dihydroxy-7-sulfo-2-naphthalenyl]azo]-4-hydroxy-2,7-naphthalenedisulfonato(11-)]]tri-, pentasodium	71735-53-0
Cuprate(4-), [.mu.-[7-[[3,3'-dihydroxy-4'-[(4-hydroxy-2-sulfobenzo[a]phenazin-3-yl)azo][1,1'-biphenyl]-4-yl]azo]-8-hydroxy-1,3,6-naphthalenetrisulfonato(8-)]]di-, tetrasodium	71873-63-7

Chemical Name in the Inventory	CAS Number
2,7-Naphthalenedisulfonic acid, 4-amino-3-[[4'-[(2,4-diaminophenyl)azo]-3,3'-dimethyl[1,1'-biphenyl]-4-yl]azo]-5-hydroxy-6-[(4-sulfophenyl)azo]-, trisodium salt	72906-45-7
Cuprate(3-), [.mu.-[4-[[3,3'-dihydroxy-4'-[(2-hydroxy-6-sulfo-1-naphthalenyl)azo][1,1'-biphenyl]-4-yl]azo]-3-hydroxy-2,7-naphthalenedisulfonato(7-)]]di-, triammonium	72906-61-7
Cuprate(3-), [.mu.-[4-[[3,3'-dihydroxy-4'-[(2-hydroxy-6-sulfo-1-naphthalenyl)azo][1,1'-biphenyl]-4-yl]azo]-3-hydroxy-2,7-naphthalenedisulfonato(7-)]]di-, trisodium	72906-62-8
Cuprate(3-), [.mu.-[4-[[3,3'-dihydroxy-4'-[(2-hydroxy-6-sulfo-1-naphthalenyl)azo][1,1'-biphenyl]-4-yl]azo]-3-hydroxy-2,7-naphthalenedisulfonato(7-)]]di-, trilithium	72906-63-9
Cuprate(3-), [.mu.-[4-[[3,3'-dihydroxy-4'-[(2-hydroxy-6-sulfo-1-naphthalenyl)azo][1,1'-biphenyl]-4-yl]azo]-3-hydroxy-2,7-naphthalenedisulfonato(7-)]]di-, trihydrogen, compound with 2,2'-iminobis[ethanol] (1:3)	72906-64-0
Cuprate(3-), [.mu.-[7-[[3,3'-dihydroxy-4'-[(2-hydroxy-6-sulfo-1-naphthalenyl)azo][1,1'-biphenyl]-4-yl]azo]-8-hydroxy-1,6-naphthalenedisulfonato(7-)]]-, trisodium	72928-71-3
Cuprate(4-), [.mu.-[[7,7'-[(3,3'-dihydroxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[1,6-naphthalenedisulfonato]](8-)]]di-,tetrasodium	72939-55-0
Cuprate(3-), [.mu.-[7-[[3,3'-dihydroxy-4'-[(2-hydroxy-6-sulfo-1-naphthalenyl)azo][1,1'-biphenyl]-4-yl]azo]-8-hydroxy-1,6-naphthalenedisulfonato(7-)]]di-, trisodium	73507-21-8
Cuprate(3-), [.mu.-[3-[[3,3'-dihydroxy-4'-[[1-hydroxy-6-(phenylamino)-3-sulfo-2-naphthalenyl]azo][1,1'-biphenyl]-4-yl]azo]-4-hydroxy-2,7-naphthalenedisulfonato(7-)]]di-, trisodium	73507-22-9
Cuprate(4-), [.mu.-[7-[[4'-[(8-amino-1-hydroxy-3,6-disulfo-2-naphthalenyl)azo]-3,3'-dihydroxy[1,1'-biphenyl]-4-yl]azo]-8-hydroxy-1,6-naphthalenedisulfonato(8-)]]di-, tetrasodium	73507-23-0

Chemical Name in the Inventory	CAS Number
Cuprate(4-), [.mu.-3-[7-[[6-[[4'-[(4,5-dihydro-3-methyl-5-oxo-1-phenyl-1H-pyrazol-4-yl)azo]-3,3'-dihydroxy[1,1'-biphenyl]-4-yl]azo]-1,5-dihydroxy-7-sulfo-2-napthalenyl]azo]-8-hydroxy-1,3,6-naphthalenetrisulfonato(10-)]]tri-, tetrasodium	73507-24-1
Cuprate(4-), [.mu.-[[3,3'-[(3,3'-dihydroxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[4-hydroxy-6-[(3-sulfophenyl)amino]-2-naphthalenesulfonato]](8-)]]di-, tetrasodium	74432-30-7
Benzoic acid, 2-[[2-amino-6-[[4'-[[5-[(2,5-disulfophenyl)azo]-1-hydroxy-6-(phenylamino)-3-sulfo-2-naphthalenyl]azo]-3,3'-dimethoxy[1,1'-biphenyl]-4-yl]azo]-5-hydroxy-7-sulfo-1-naphthalenyl]azo]-5-nitro-, tetrasodium salt	75522-93-9
Benzoic acid, 2-[[2-amino-5-hydroxy-6-[[4'-[[1-hydroxy-8-[[(4-methylphenyl)sulfonyl]amino]-3,6-disulfo-2-naphthalenyl]azo]-3,3'-dimethoxy(1,1'-biphenyl)-4-yl]azo]-7-sulfo-1-naphthalenyl]azo]-5-nitro-, trisodium salt	75522-94-0
Cuprate(2-), [.mu.-[[3,3'-[[3,3'-dihydroxy[1,1'-biphenyl]-4,4'-diyl]bis(azo)]bis[7-[[4,6-bis[[3-(diethylamino)propyl]amino]-1,3,5-triazin-2-yl]amino]-4-hydroxy-2-naphthalenesulfonato]](6-)]]di-, dihydrogen, diacetate (salt)	79135-30-1
Cuprate(4-), [.mu.-[[4,4'-[(3,3'-dihydroxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[3-hydroxy-2,7-naphthalenedisulfonato]](8-)]]di-, tetrahydrogen	81737-16-8
Cuprate(4-), [.mu.-[[4,4'-[(3,3'-dihydroxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[3-hydroxy-2,7-naphthalenedisulfonato]](8-)]]di-, tetrahydrogen, compd. with 2,2',2''-nitrilotris[ethanol] (1:4)	81737-17-9
Cuprate(4-), [.mu.-[7-(benzoylamino)-3-[[3,3'-dihydroxy-4'-[(1-hydroxy-4,8-disulfo-2-naphthalenyl)azo][1,1'-biphenyl]-4-yl]azo]-4-hydroxy-1,5-naphthalenedisulfonato(8-)]]di-, tetrasodium	83027-55-8
Benzoic acid, 2-[[2-amino-5-hydroxy-6-[[4'-[(2-hydroxy-6-sulfo-1-naphthalenyl)azo]-3,3'-dimethoxy[1,1'-biphenyl]-4-yl]azo]-7-sulfo-1-naphthalenyl]azo]-5-nitro-, sodium salt	83221-79-8

Chemical Name in the Inventory	CAS Number
Cuprate(4-), [.mu.-[[3,3'-[(3,3'-dihydroxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[5-ethoxy-4-hydroxy-2,7-naphthalenedisulfonato]](8-)]]di-, tetrasodium	83232-53-5
Cuprate(3-), [.mu.-[5-(acetylamino)-3-[[4'-[(1,8-dihydroxy-4-sulfo-2-naphthalenyl)azo]-3,3'-dihydroxy[1,1'-biphenyl]-4-yl]azo]-4-hydroxy-2,7-naphthalenedisulfonato(7-)]]di-, trisodium	83232-54-6
2,7-Naphthalenedisulfonic acid, 4,4'-[(3,3'-dichloro[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[3-amino-, sodium salt	83249-25-6
2,7-Naphthalenedisulfonic acid, 3,3'-[(3,3'-dimethoxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[5-amino-4-hydroxy-, lithiumsodium salt	83400-08-2
Benzoic acid, 5-[[4'-[[6-amino-5-(1H-benzotriazol-4-ylazo)-1-hydroxy-3-sulfo-2-naphthalenyl]azo]-3,3'-dimethoxy[1,1'-biphenyl]-4-yl]azo]-2-hydroxy-4-methyl-, disodium salt	85153-20-4
Cuprate(4-), [.mu.-[[3,3'-[(3,3'-dihydroxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[5-amino-4-hydroxy-2,7-naphthalenedisulfonato]](8-)]]di-, sodium	85186-17-0
Cuprate(3-), [.mu.-[4-[[3,3'-dihydroxy-4'-[[1-hydroxy-7-(phenylamino)-3-sulfo-2-naphthalenyl]azo][1,1'-biphenyl]-4-yl]azo]-3-hydroxy-2,7-naphthalenedisulfonato(7-)]]di-, trisodium	86437-49-2
Cuprate(4-), [.mu.-[[4-[[6-[[3,3'-dihydroxy-4'-[(1-hydroxy-3,8-disulfo-2-naphthalenyl)azo][1,1'-biphenyl]-4-yl]azo]-5-hydroxy-7-sulfo-2-naphthalenyl]amino]phenoxy]acetato(8-)]]di-, tetrasodium	89899-26-3
Cuprate(3-), [.mu.-[4-[[4'-[[6-(benzoylamino)-1-hydroxy-3-sulfo-2-naphthalenyl]azo]-3,3'-dihydroxy[1,1'-biphenyl]-4-yl]azo]-3-hydroxy-2,7-naphthalenedisulfonato(7-)]]di-, trisodium	89899-27-4
Cuprate(3-), [.mu.-[8-[[4'-[[6-(benzoylamino)-1-hydroxy-3-sulfo-2-naphthalenyl]azo]-3,3'-dihydroxy[1,1'-biphenyl]-4-yl]azo]-7-hydroxy-1,3-naphthalenedisulfonato(7-)]]di-, trisodium	89899-28-5

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**

Disclaimer

ACRONYMS & ABBREVIATIONS

Grouping Rationale

The critical concern for this group of chemicals and focus of this assessment relates to potential carcinogenic effects following exposure.

All the chemicals in this group are non-metalised and metalised 3,3'-disubstituted benzidine-congener-based dyes, which have the characteristic diazotised 3,3'-benzidine-congener structure. Although the other chemical groups attached at the diazo linkages differ, the linkage for all members in this group is predominantly through an aromatic group rather than the acetoacetanilide group or pyrazole group present in the pigments (NICNASa).

All the non-metalised chemicals are expected to be metabolised in vivo to either of the following benzidine-congeners:

- 3,3'-dichlorobenzidine (3,3'-DCB) (CAS No. 91-94-1);
- 3,3'-dimethoxybenzidine (3,3'-DMOB) (CAS No. 119-90-4); or
- 3,3'-dimethylbenzidine (3,3'-DMB) (CAS No. 119-93-7).

3,3'-DCB, 3,3'-DMB and 3,3'-DMOB are reasonably anticipated to be human carcinogens (NICNASb).

Whilst the metabolic pathway for the metalised dyes is not certain, data from a representative metalised dye, C.I. Direct Blue 218 (CAS No. 28407-37-6) indicates that metal chelation does not completely eliminate the carcinogenic effects (see. **Carcinogenicity**).

Internationally, the metalised and non-metalised chemicals have been assessed as a group.

The chemicals all have similar uses.

Import, Manufacture and Use

Australian

The following Australian industrial uses were reported under previous mandatory and/or voluntary calls for information for several chemicals in this group (CAS numbers 314-13-6, 2150-54-1, 2429-74-5, 2586-57-4, 2610-05-1, 4198-19-0, 6449-35-0, 6459-94-5, 6739-62-4, 54804-85-2):

The chemicals have reported commercial use including:

- textile dyeing in mills;
- wood stains and polishes;
- colour in detergents and crepe paper; and
- as identification in metal castings.

The total volume introduced into Australia, reported under previous mandatory and/or voluntary calls for information, for several chemicals in this group (CAS numbers 314-13-6, 2150-54-1, 2429-74-5, 2586-57-4, 2610-05-1, 4198-19-0, 6449-35-0, 6459-94-5, 6739-62-4, 54804-85-2), was less than one tonne in a single year.

Industrial use of 3,3'-DCB is restricted under state and territory workplace health and safety legislation (NICNASb); therefore, manufacturing dyes, based on this starting material, is not expected in Australia.

International

In general, the use of these dyes is being phased out internationally and replaced with other types of dye (see **Restrictions (international)**). However, the following potential international uses have been identified through various international assessments (IARC, 2010; US EPA, 2010; NTP, 2011; Government of Canada, 2013): the European Commission Cosmetic Ingredients and Substances (CosIng) database; and United States (US) Personal Care Product Council International Nomenclature of Cosmetic Ingredients (INCI) Dictionary.

The chemicals have reported domestic use, including in ink-jet dyes.

The chemicals have reported commercial use including in:

- dyes used to colour textiles, leather, paper, plastic and rubber;
- liquid crystal displays;

- electro-optical devices;
- colour photography; and
- tint for cinematographic film.

The chemicals have reported site-limited use, including in biological stains in laboratories.

Restrictions

Australian

No known restrictions have been identified.

International

In August 2010, the United States Environmental Protection Agency (US EPA) released an action plan for dyes derived from benzidine and its derivatives (US EPA 2010). As a result of that action plan, the US EPA intends to prepare a new proposed TSCA section 5(a)(2) significant new use rule for benzidine-congener-based dyes that will include several of the chemicals in this group (CAS Nos: 72-57-1, 314-13-6, 2150-54-1, 2429-74-5, 2586-57-4, 2610-05-1, 4198-19-0, 6449-35-0, 6459-94-5, 6739-62-4, 12222-00-3, 28407-37-6, 66225-65-8, 68140-31-8, 68966-50-7, 70210-32-1, 71566-41-1 and 71873-63-7).

The chemicals are restricted by Annex XVII to REACH Regulation as follows:

'1. Azodyes which, by reductive cleavage of one or more azo groups, may release one or more of the aromatic amines listed in Appendix 8, in detectable concentrations,

i.e. above 30 ppm in the finished articles or in the dyed parts thereof, according to the testing methods listed in Appendix 10, shall not be used in textile and leather articles which may come into direct and prolonged contact with the human skin or oral cavity, such as:

- clothing, bedding, towels, hairpieces, wigs, hats, nappies and other sanitary items, sleeping bags;
- footwear, gloves, wristwatch straps, handbags, purses/wallets, briefcases, chair covers, purses worn round the neck;
- textile or leather toys and toys which include textile or leather garments; and
- yarn and fabrics intended for use by the final consumer.

2. Furthermore, the textile and leather articles referred to in paragraph 1 above shall not be placed on the market unless they conform to the requirements set out in that paragraph.'

The chemicals 3,3'-DCB, 3,3'-DMB or 3,3-DMOB are listed in Appendix 8.

Existing Worker Health and Safety Controls

Hazard Classification

The chemicals are not listed on the Hazardous Substances Information System (HSIS) (Safe Work Australia).

Exposure Standards

Australian

No specific exposure standards are available.

International

No specific exposure standards are available.

Health Hazard Information

The critical concern for this group of chemicals and focus of this assessment relates to the potential carcinogenic effects following exposure. Local effects are considered a secondary concern for this group of chemicals and, as such, have not been considered as part of this assessment. Toxicological data are available for six of the chemicals being assessed; C.I. Direct Blue 14 (CAS No. 72-57-1), C.I. Direct Blue 53 (CAS No. 314-13-6), C.I. Direct Blue 1 (CAS No. 2610-05-1), C.I.Acid Red 114 (CAS No. 6459-94-5), C.I. Direct Blue 15 (CAS No. 2429-74-5) and C.I. Direct Blue 218 (CAS No. 28407-37-6). The data are considered representative for all chemicals in this assessment. Data for the metabolites 3,3-DCB, 3,3'-DMB and 3,3'-DMOB have also been included.

Toxicokinetics

The metabolism of various non-metalised benzidine-congener-based dyes, to release the free benzidine-congener and its metabolites, has been observed in animals. Reduction of the dyes to the respective free amine appears to be nearly complete. In rats and dogs, the amount of free benzidine-congener detected was equivalent to that observed following an equimolar dose of benzidine-congener (Morgan et. al., 1994; Government of Canada, 2013).

In vivo, azo reduction of benzidine-congener-based substances, liberating free benzidine-congener, occurs by an enzyme-mediated reaction. The intestinal microflora have been shown to be particularly active in azo dye reduction, but hepatic enzymes can also catalyse the reductive cleavage (IARC, 2010; NTP, 2011a; NTP, 2011b; Government of Canada, 2013). Bacteria on the skin have also been shown to possess azoreductase activity (Government of Canada, 2013).

The released free benzidine-congeners are absorbed readily, widely distributed and rapidly metabolised (NICNASb).

Whilst the metabolic pathway for the metalised dyes is not certain, the azo linkages in C.I. Direct Blue 218 appear to be reduced in the presence of flavin mononucleotide or rat caecal bacteria (Morgan et al., 1994).

Acute Toxicity

Oral

No data are available for the chemicals.

Dermal

No data are available for the chemicals.

Inhalation

No data are available for the chemicals.

Repeated Dose Toxicity

Oral

In general, effects observed in repeated dose studies in animals were associated with cancer, including multi-site tumours, preneoplastic changes and cancer-related mortality (see **Carcinogenicity** section for details).

The toxic effects of C.I. Direct Blue 15, C.I. Acid Red 114 or C.I. Direct Blue 218 from repeated exposure were investigated in the NTP-sponsored 13-day to two-year drinking and feeding studies. The doses tested ranged from 0–30000 ppm in F344 rats and B6C3F1 mice (for C.I. Direct Blue 218), depending on the duration of the study. The most common treatment-related effects in the shorter exposure periods (two and 13 weeks) were the decrease in the food and water consumption and changes in haematology profiles and body and organ weights (NTP, 1991; NTP, 1992; NTP, 1994). Longer exposure periods to the chemicals led to mortalities and a significant number of neoplasms was detected in the animals that survived in the mid to high dosed groups (see **Carcinogenicity** section).

Alterations in the liver and kidneys were observed in the experimental animals following the 13 weeks of exposure to Direct Blue 15, Direct Blue 218 and Acid Red 114 at doses from 0 ppm to 30000 ppm. In particular, treatment with Acid Red 114 caused regeneration and chronic inflammation of tubule epithelial cells of female rats (at doses 2500 ppm or higher) and centrilobular pallor in the liver of male rats from all dosed groups. The chemical-induced kidney lesions in females were also consistent with the findings from C.I. Direct Blue 15- and C.I. Direct Blue 218-exposed female rats. Changes in liver weights and enzyme levels were reported in both sexes in higher dose groups, although no mortality occurred. Similar findings were also reported in rats and mice fed with a diet containing C.I. Direct Blue 218 at doses from 10000–20000 ppm. Lymphoid depletion in the thymus was noted in males exposed to 30000 ppm of C.I. Direct Blue 15 (NTP, 1991; NTP, 1992; NTP, 1994).

Dermal

No data are available.

Inhalation

No data are available.

Genotoxicity

Based on the weight of evidence from the available in vitro and in vivo genotoxicity studies, the chemicals are considered to be genotoxic. The effects are considered sufficient to warrant classification for the non-metalised dyes (see **Recommendation** section).

Similar to other benzidine-based dyes, the reductive metabolism of the azo bonds determines the mutagenicity of the chemicals in *Salmonella typhimurium* strains.

C.I. Direct Blue 15 and C.I. Acid Red 114 gave negative results in the standard assays of *Salmonella typhimurium* strains TA1535 and TA1537 with or without metabolic activation. However, these chemicals in addition to Direct Blue 151 were mutagenic in strain TA1538 in the presence of metabolic activation and reductive conditions (NTP, 1991; NTP, 1992; NTP, 1994; Government of Canada, 2013). C.I. Direct Blue 218 showed negative results in all standard and modified *S. typhimurium* tests (NTP, 1994).

C.I. Direct Blue 14 and C.I. Direct Blue 15 induced chromosomal aberration, but only C.I. Direct Blue 15 tested positive for gene mutations in mouse L5178Y lymphoma cells, sister chromatid exchanges in Chinese hamster ovary (CHO) cells and unscheduled DNA synthesis in F344 rat hepatocyte cultures. Exposure to 10000 ppm of C.I. Direct Blue 218 caused a small but significant increase in the sister chromatid exchanges in CHO cells without exogenous metabolic activation (NTP, 1992;

Government of Canada, 2013). These chemicals did not induce sex-linked recessive lethal mutation in germ cells of *Drosophila melanogaster* (NTP, 1991; NTP, 1992; NTP, 1994; Government of Canada, 2013).

The result of an in vivo Comet assay for C.I. Direct Blue 15 indicated liver DNA damage in male mice following three hours of exposure to the chemical (Tsuda et al., 2000).

The benzidine-congener metabolites 3,3'-DCB, 3,3-DMB and 3,3'-DMOB are genotoxic in vivo and in vitro (NICNASb). The potential metabolite 3,3'-dihydroxybenzidine was mutagenic in *Salmonella typhimurium* (in the presence of metabolic activation) at doses above 1.5 µmole/plate (Morgan et al., 1994).

Carcinogenicity

Overall, the existing data provide evidence of the carcinogenic effects of the chemicals Direct Blue 15, Acid Red 114 and Direct Blue 218. Limited data are available indicating the carcinogenic potential of Direct Blue 14 (CAS No. 72-57-1) and Direct Blue 53 (CAS No. 314-13-6). The benzidine-congener metabolites 3,3'-DCB, 3,3'-DMB and 3,3'-DMOB are reasonably anticipated to be human carcinogens (NICNASb). All chemicals in this group are expected to be metabolised to the related benzidine-congener, resulting in similar carcinogenic responses. Classification is considered appropriate (see **Recommendation** section).

Evidence of carcinogenicity of the chemicals C.I. Direct Blue 15, C.I. Direct Blue 218 and C.I. Acid Red 114 were reported in the 2-year NTP-sponsored carcinogenicity studies (drinking and feeding) in F344 rats and in B6C3F1 mice (C.I. Direct Blue 218).

Compared with controls (0 ppm), exposure of rats to C.I. Direct Blue 15 in drinking water containing 630, 1250 or 2500 ppm (approximately 50, 100 and 200 mg/kg bw/day) for 22 months resulted in significant increase in mortality and reduced survival rates. Neoplastic changes in lung, liver, skin, clitoral gland, Zymbal's gland, oral cavity epithelium and intestines in the surviving animals were observed at nine and 15 months interim evaluation. Similar carcinogenic effects were observed in F344 rats exposed to 70, 150 or 300 ppm (males) (approximately 4–20 mg/kg bw/day) and 150, 300, 600 ppm (females) (approximately 9–69 mg/kg bw/day) of C.I. Acid Red 114 in a similar study. The number of neoplasms induced by the chemicals increased with the duration of exposure (NTP, 1991; NTP, 1992). When quantified, a significant percentage of malignant tumours were observed at all dose levels, for both C.I. Direct Blue 15 and C.I. Acid Red 114, with 86–96 % of animals from the high-dose groups showing malignant tumours.

In another long-term carcinogenicity study, the incidence of neoplasms in pharynx were noted in male F344 rats fed with a diet containing 10000 ppm (approximately 1520 mg/kg bw/day) of C.I. Direct Blue 218, giving some evidence of carcinogenicity. Squamous papillomas and carcinomas of the stomach were also observed, but the significance of this was not certain. Mice in this study also showed hepatocellular foci of cytological changes at 10000 ppm (approximately 2050 mg/kg bw/day) (NTP, 1994).

Subcutaneous or intraperitoneal injections of C.I. Direct Blue 14 to rats and Swiss mice produced reticulum cell sarcomas mainly in the liver and fibrosarcomas at the site of injection (IARC, 1987; Tsuda et al., 2000). Subcutaneous exposure of female mice to this chemical for 52 weeks resulted in neoplasms in the liver and occasionally in the portahepatic lymph nodes (Government of Canada, 2013). Direct Blue 53 was carcinogenic in one study in rats when administered intraperitoneally, producing sarcomas of the reticuloendothelial system in the liver (IARC, 1987).

The treatment-related carcinogenic responses of the C.I. Acid Red 114, C.I. Direct Blue 15 and to some extent C.I. Direct Blue 218 (effects in the oral mucosa) were consistent with those observed with the metabolites, 3, 3'-DMB and 3,3'-DMOB (NTP, 1991; NTP, 1992; NTP, 1994; NICNASb). The incidence of malignant tumours observed following exposure to C.I. Acid Red 114 and C.I. Direct Blue 15 was also similar to that observed following exposure to 3,3'-DMB and 3,3'-DMOB (NICNASb). These congener metabolites are considered to have similar potency to benzidine (NICNASb). Whilst metal chelation may reduce the carcinogenic potential of the chemicals—by slowing metabolism to the free benzidine congener—based on data for C.I. Direct Blue 218, chelation does not completely eliminate the carinogenic potential (US EPA, 2010).

The International Agency for Research on Cancer (IARC) has classified the chemicals C.I. Acid Red 114 and C.I. Direct Blue 15 as group 2B carcinogens (possibly carcinogenic to humans). The working group has found that while there is inadequate evidence in humans, there is sufficient evidence in experimental animals for the carcinogenicity of these chemicals (IARC,1987; IARC, 1993).

Dyes metabolised to 3,3'-DMB and 3,3'-DMOB are listed in the National Toxicology Program (NTP) Report on Carcinogens as 'reasonably anticipated to be human carcinogens' (NTP, 2011a; NTP, 2011b).

Reproductive and Developmental Toxicity

The data for reproductive and developmental toxicity for the chemicals in this group are limited. However, exposure to C.I. Direct Blue 15, C.I. Direct Blue 14, C.I. Direct Blue 53 and C.I. Direct Blue 1 (CAS No. 2610-05-1) has been shown to cause developmental defects. Following the injection of pregnant rats with 1 % of the chemicals in aqueous solution on gestation days (GD) seven, eight and nine, spontaneous malformations such as anencephaly, hydrocephaly, and spina bifida were observed in the pups of the exposed rats. Of these chemicals, Direct Blue 14 was the most potent teratogen, causing malformations in 49 % of the offspring (NTP, 1992).

Morphological alterations in the kidneys of the embryos, specifically hyperplasia of the tubular epithelial cells, were observed following subcutaneous injection of 2 mg of the metabolite 3,3'-DMB in 0.1 mL sunflower oil in female BALBc mice from GD 1–20 (NICNASb).

Risk Characterisation

Critical Health Effects

The critical health effects for risk characterisation is carcinogenicity. The chemicals are both genotoxic and carcinogenic in animals. The benzidine-congener metabolites are reasonably anticipated to be potent human carcinogens (NICNASb). This is also considered to be the case for the non-metalised dyes given that:

- the incidence of malignant tumours observed following exposure to Acid Red 114 and Direct Blue 15 was also similar to that observed following exposure to 3,3'-DMB and 3,3'-DMOB (see **Carcinogenicity** section); and
- the amount of free benzidine-congener detected in animals was equivalent to that observed following an equimolar dose of benzidine-congener (see **Toxicokinetics** section).

Whilst metal chelation appears to render the chemicals more inert towards metabolism, based on data for C.I. Direct Blue 218, this does not completely eliminate the azo reduction and carcinogenicity potential of the chemicals (see **Carcinogenicity** section).

Public Risk Characterisation

Whilst the use of benzidine-congener-based dyes is being phased out in some countries, there is no restriction in Australia; use of these chemicals in small amounts has been reported to NICNAS under previous mandatory and/or voluntary calls for information. The introduction of these dyes for home use cannot be excluded. In addition, textiles and other products manufactured with these chemicals in other countries could be imported into Australia.

Dermal exposure to benzidine-congener-based dyes could occur through prolonged contact with dyed textiles and leather. Bacteria on the skin have been shown to possess azoreductase activity, and bioavailability has been demonstrated in animals following dermal exposure. Oral ingestion could also occur in infants through the sucking or chewing of textiles.

The benzidine-congener metabolites, 3,3'-DMB and 3,3'-DMOB have been detected in textiles overseas; leaching of benzidine has been demonstrated in the presence of sweat stimulants (DTI, 1998; Zeilmaker et al., 1999; EurAzos, 2007; Kawakami 2010; RAPEX). In some cases, the concentrations of benzidine-congener in samples exceeded the European 30 mg/kg limit by more than fivefold. Recently, the Australian Competition and Consumer Commission (ACCC) conducted a survey of textiles and found potentially hazardous aromatic amines including 3,3'-DMOB, in five of 199 samples tested.

An international assessment of the risk of cancer caused by textiles and leather goods coloured with certain azo dyes concluded that, while consumer exposure is likely to be 'very low', the associated cancer risks give cause for concern. Although this assessment was not publicly available, the European Scientific Committee on Toxicity, Ecotoxicity and Environment (CSTEE) considers that the report adequately reviews the situation regarding the risk of cancer for consumers from fabrics dyed with azo compounds, and that its conclusions are, in general, acceptable. The CSTEE also supported the recommendation that using azo dyes with the potential to give rise to the 22 aromatic amines classified as Category 1 or 2 carcinogens according to

Directive 76/769/EEC (these include the benzidine congeners 3,3-DCB, 3,3'-DMB and 3,3-DMOB), should be restricted to the lowest possible levels or completely eliminated (CSTEE, 1999).

The introduction of textiles or leather articles containing benzidine-congener-based dyes is restricted in Europe and is proposed to be restricted in the United States. Currently, there are no restrictions on introducing or using these chemicals in Australia.

In the absence of any regulatory controls, the characterised critical health effects (particularly carcinogenicity) have the potential to pose an unreasonable risk under the uses identified.

Occupational Risk Characterisation

During product formulation, dermal, ocular and inhalation exposure of workers to these chemicals 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 chemicals 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.

Given the critical systemic long-term health effects, the chemical may pose an unreasonable risk to workers unless adequate control measures to minimise dermal, and inhalation exposure to these chemical are implemented. These chemicals should be appropriately classified and labelled to ensure that a person conducting a business or undertaking (PCBU) at a workplace (such as an employer) has adequate information to determine appropriate controls. *Guidance on the interpretation of workplace exposure standards for airborne contaminants* provides advice that exposure to carcinogens should be eliminated or minimised so far as is reasonably practicable (Safe Work Australia, 2013).

The data available support an amendment to the hazard classification in HSIS (refer to **Recommendation** section).

NICNAS Recommendation

Further risk management is required. Sufficient information is available to recommend that risks to public health and safety from the potential use of the chemicals by the public be managed through changes to poisons scheduling, and risks for workplace health and safety be managed through changes to classification and labelling. It is also recommended that the ACCC consider mechanisms to restrict the supply of textiles and leather articles which may come into direct and prolonged contact with the human skin that may plausibly result in human exposure to these chemicals at unacceptable levels.

Assessment of the chemicals is considered to be sufficient provided that risk management recommendations are implemented and all requirements are met under workplace health and safety and poisons legislation as adopted by the relevant state or territory.

Regulatory Control

Public Health

The chemicals are recommended for scheduling to prohibit their sale, supply and use in dyes for home use.

Work Health and Safety

The chemicals are recommended for classification and labelling under the current approved criteria and adopted GHS as below. This assessment does not consider classification of physical hazards and environmental hazards. The genotoxicity classification is recommended for the non-metalised dyes.

Hazard	Approved Criteria (HSIS)[a]	GHS Classification (HCIS)[b]

Hazard	Approved Criteria (HSIS)[a]	GHS Classification (HCIS)[b]
Genotoxicity	Muta. Cat 3 - Possible risk of irreversible effects (Xn; R68)	Suspected of causing genetic defects - Cat. 2 (H341)
Carcinogenicity	Carc. Cat 2 - May cause cancer (T; R45)	May cause cancer - Cat. 1B (H350)

[a] Approved Criteria for Classifying Hazardous Substances [NOHSC:1008(2004)].

[b] Globally Harmonized System of Classification and Labelling of Chemicals (GHS) United Nations, 2009. Third Edition.

[*] Existing Hazard Classification. No change recommended to this classification

Advice for consumers

Products containing the chemical should be used according to label instructions.

Advice for industry

Control measures

Control measures to minimise the risk from dermal and inhalation exposure to the chemicals should be implemented in accordance with the hierarchy of controls. Approaches to minimise risk include substitution, isolation and engineering controls. Measures required to eliminate or minimise risk arising from storing, handling and using a hazardous chemical depend on the physical form and the manner in which the chemical is used. Examples of control measures which may minimise the risk include, but are not limited to:

- using closed systems or isolating operations;
- using local exhaust ventilation to prevent the chemical from entering the breathing zone of any worker;
- health monitoring for any worker who is at risk of exposure to the chemical if valid techniques are available to monitor the effect on the worker's health;
- minimising manual processes and work tasks through automating processes;
- work procedures that minimise splashes and spills;
- regularly cleaning equipment and work areas; and
- using protective equipment that is designed, constructed, and operated to ensure that the worker does not come into contact with the chemical.

Guidance on managing risks from hazardous chemicals are provided in the *Managing risks of hazardous chemicals in the workplace—Code of practice* available on the Safe Work Australia website.

Personal protective equipment should not solely be relied upon to control risk and should only be used when all other reasonably practicable control measures do not eliminate or sufficiently minimise risk. Guidance in selecting personal protective equipment can be obtained from Australian, Australian/New Zealand or other approved standards.

Obligations under workplace health and safety legislation

Information in this report should be taken into account to assist with meeting obligations under workplace health and safety legislation as adopted by the relevant state or territory. This includes, but is not limited to:

- ensuring that hazardous chemicals are correctly classified and labelled;
- ensuring that (material) safety data sheets ((m)SDS) containing accurate information about the hazards (relating to both health hazards and physicochemical (physical) hazards) of the chemical are prepared; and
- managing risks arising from storing, handling and using a hazardous chemical.

Your work health and safety regulator should be contacted for information on the work health and safety laws in your jurisdiction.

Information on how to prepare an (m)SDS and how to label containers of hazardous chemicals are provided in relevant codes of practice such as the *Preparation of safety data sheets for hazardous chemicals—Code of practice* and *Labelling of workplace hazardous chemicals—Code of practice*, respectively. These codes of practice are available from the Safe Work Australia website.

A review of the physical hazards of these chemicals has not been undertaken as part of this assessment.

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Last Update 04 July 2014

Chemical Identities

Chemical Name in the Inventory and Synonyms	**2,7-Naphthalenedisulfonic acid, 3,3'-[(3,3'-dimethyl[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[5-amino-4-hydroxy-, tetrasodium salt** C.I. 23850 C.I. Direct Blue 14, tetrasodium salt Trypan Blue
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	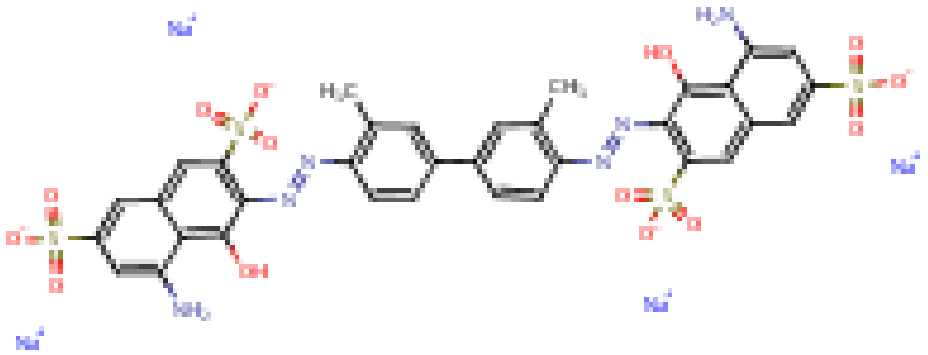
Molecular Formula	C34H28N6O14S4.4Na
Molecular Weight	964.84

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	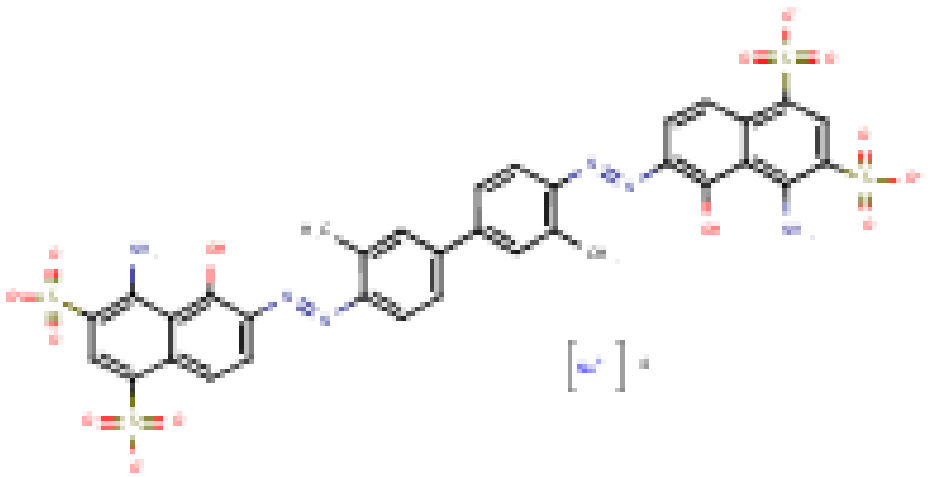
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	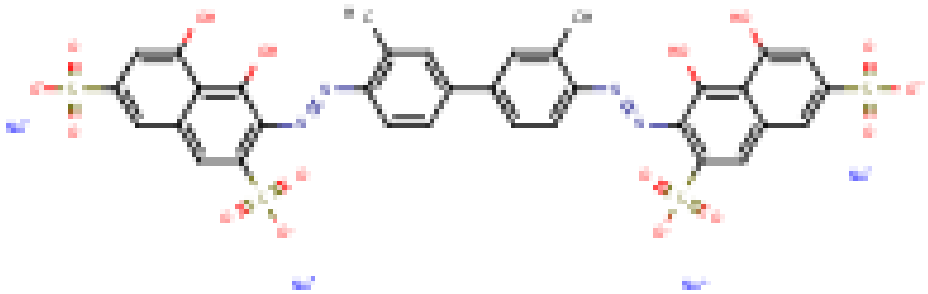
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	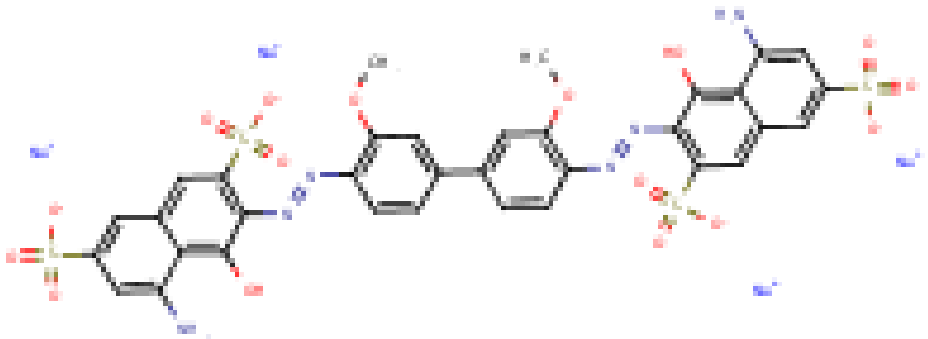
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Molecular Weight	992.80

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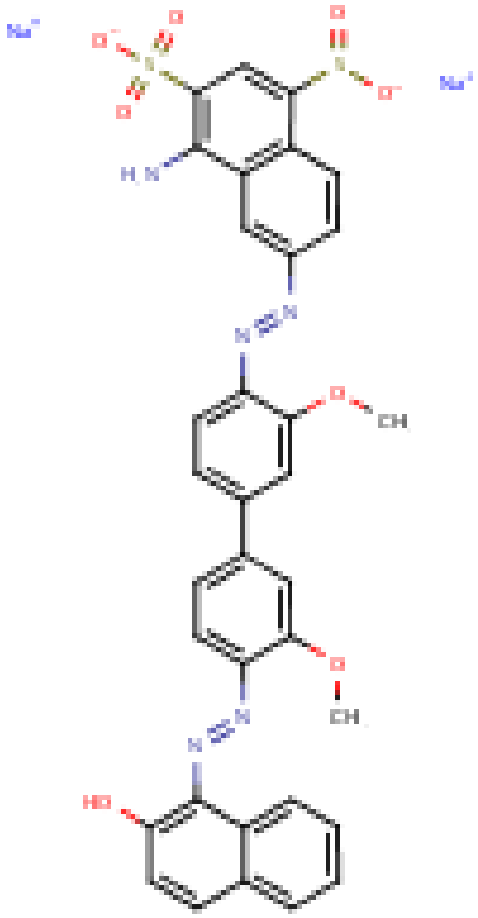

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	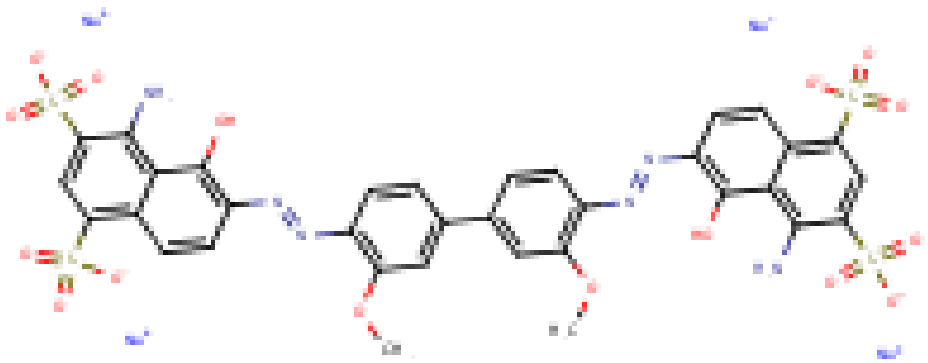
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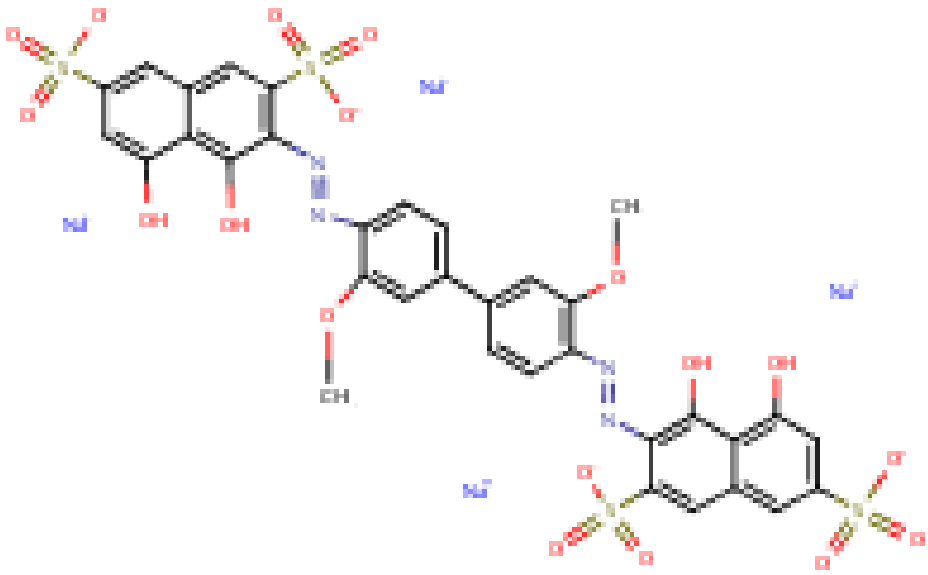
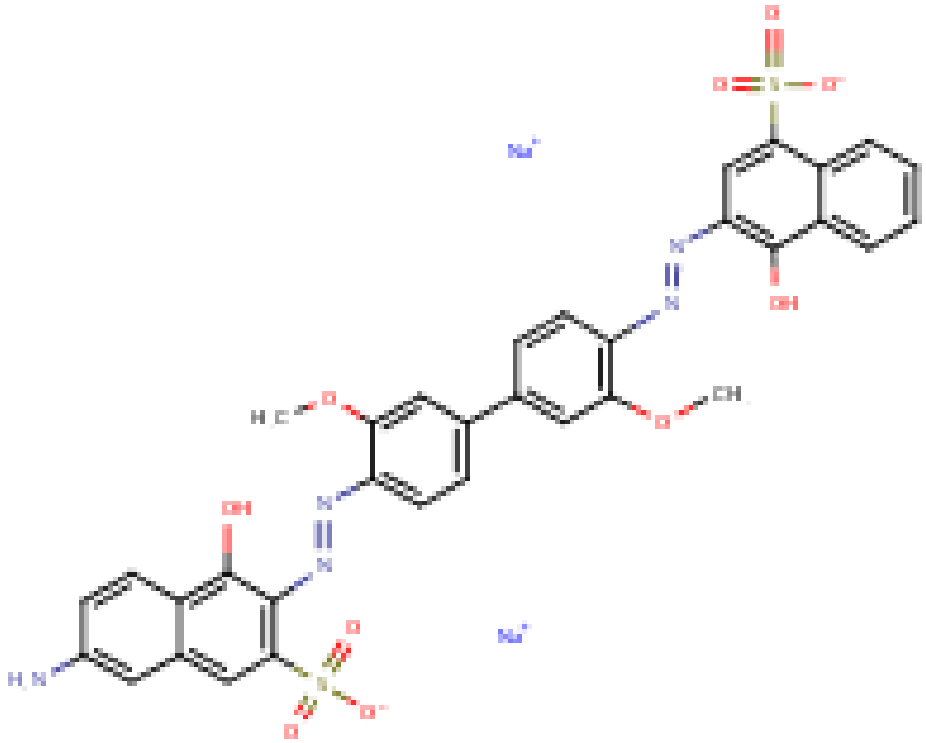
Molecular Weight	992.79

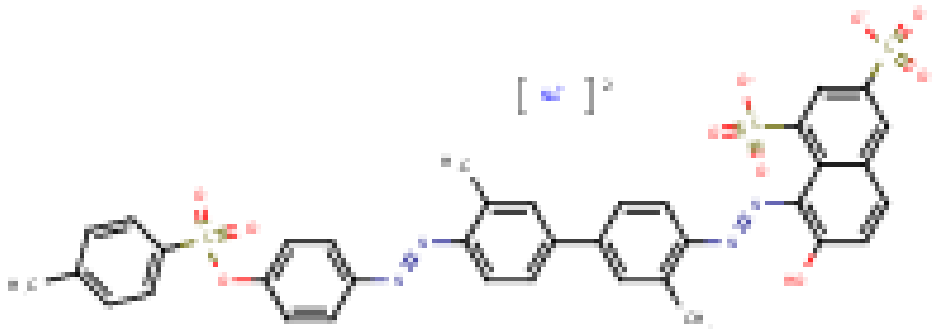
Chemical Name in the Inventory and Synonyms	**2,7-Naphthalenedisulfonic acid, 3,3'-[(3,3'-dimethoxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[4,5-dihydroxy-, tetrasodium salt** C.I. Direct Blue 10 C.I. 24304
CAS Number	4198-19-0
Structural Formula	

	
Molecular Formula	C34H26N4O18S4.4Na
Molecular Weight	994.77

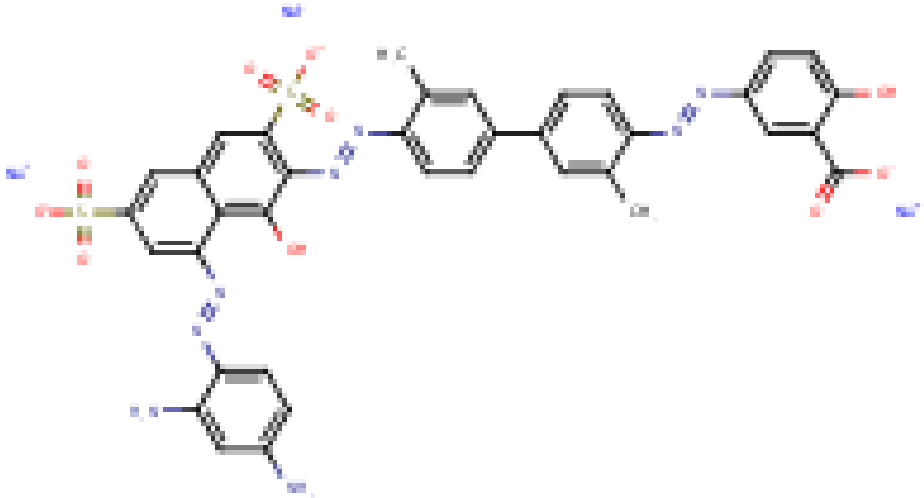
Chemical Name in the Inventory and Synonyms	**1-Naphthalenesulfonic acid, 3-[[4'-[(6-amino-1-hydroxy-3-sulfo-2-naphthalenyl)azo]-3,3'-dimethoxy[1,1'-biphenyl]-4-yl]azo]-4-hydroxy-, disodium salt** C.I. Direct Blue 151 C.I. 24175 Direct Copper Blue 2B Azine Copper Blue 2B Benzo Copper 2B
CAS Number	6449-35-0
Structural Formula	

	
Molecular Formula	C34H27N5O10S2.2Na
Molecular Weight	773.69

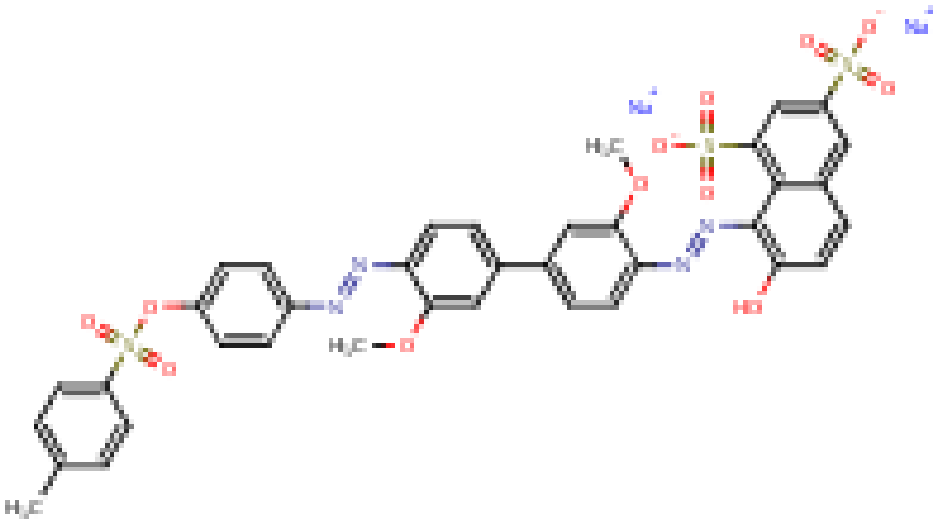
Chemical Name in the Inventory and Synonyms	**1,3-Naphthalenedisulfonic acid, 8-[[3,3'-dimethyl-4'-[[4-[[(4-methylphenyl)sulfonyl]oxy]phenyl]azo][1,1'-biphenyl]-4-yl]azo]-7-hydroxy-, disodium salt** C.I. Acid Red 114 C.I. 23635 Acid leather red BG
CAS Number	6459-94-5
Structural Formula	

	
Molecular Formula	C37H30N4O10S3.2Na
Molecular Weight	830.81

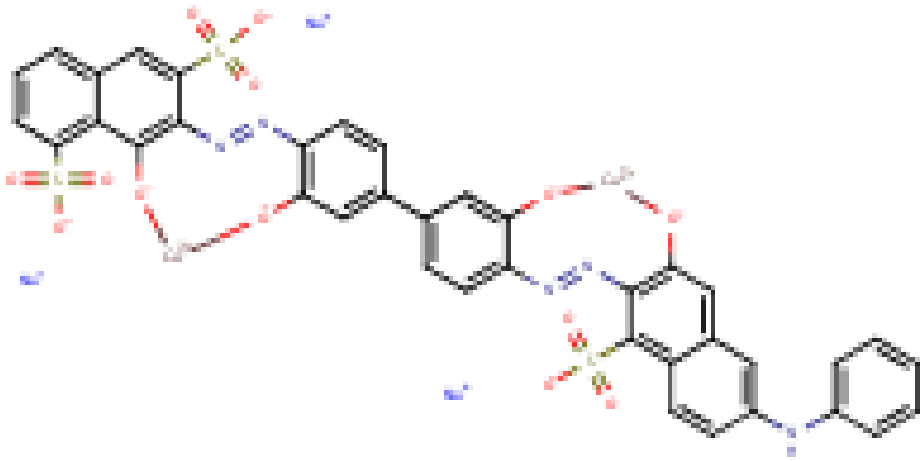
Chemical Name in the Inventory and Synonyms	**Benzoic acid, 5-[[4'-[[8-[(2,4-diaminophenyl)azo]-1-hydroxy-3,6-disulfo-2-naphthalenyl]azo]-3,3'-dimethyl[1,1'-biphenyl]-4-yl]azo]-2-hydroxy-, trisodium salt** C.I. Direct Brown 52, trisodium salt
CAS Number	6505-12-0
Structural Formula	

	
Molecular Formula	C37H30N8O10S2.3Na
Molecular Weight	876.768

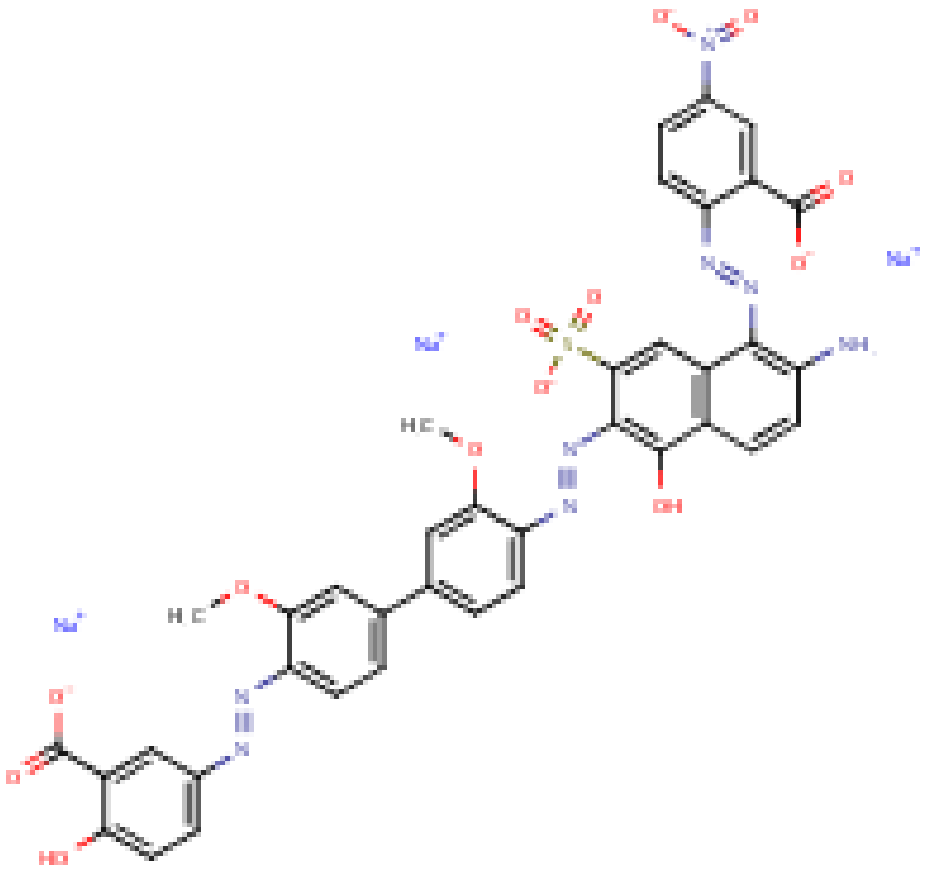
Chemical Name in the Inventory and Synonyms	**1,3-Naphthalenedisulfonic acid, 8-[[3,3'-dimethoxy-4'-[[4-[[(4-methylphenyl)sulfonyl]oxy]phenyl]azo][1,1'-biphenyl]-4-yl]azo]-7-hydroxy-, disodium salt** Acid red 128
CAS Number	6548-30-7
Structural Formula	

	
Molecular Formula	C37H30N4O12S3.2Na
Molecular Weight	862.82

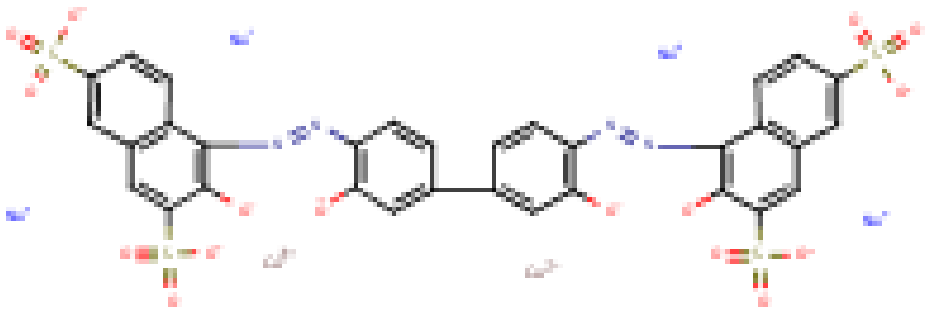
Chemical Name in the Inventory and Synonyms	**Cuprate(3-), [.mu.-[7-[[3,3'-dihydroxy-4'-[[1-hydroxy-6-(phenylamino)-3-sulfo-2-naphthalenyl]azo][1,1'-biphenyl]-4-yl]azo]-8-hydroxy-1,6-naphthalenedisulfonato(7-)]]di-, trisodium** C.I. Direct Blue 98
CAS Number	6656-03-7
Structural Formula	

	
Molecular Formula	C38H20Cu2N5O13S3.3Na
Molecular Weight	1046.86

Chemical Name in the Inventory and Synonyms	**Benzoic acid, 2-[[2-amino-6-[[4'-[(3-carboxy-4-hydroxyphenyl)azo]-3,3'-dimethoxy[1,1'-biphenyl]-4-yl]azo]-5-hydroxy-7-sulfo-1-naphthalenyl]azo]-5-nitro-, trisodium salt** C.I. Direct Black 91 C.I. 30400
CAS Number	6739-62-4
Structural Formula	

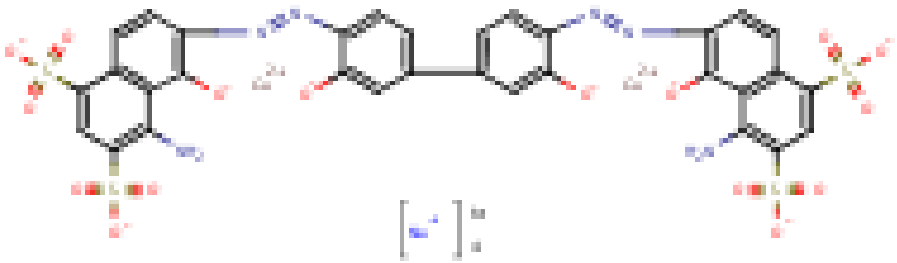
	
Molecular Formula	C38H28N8O13S.3Na
Molecular Weight	905.72

Chemical Name in the Inventory and Synonyms	**Cuprate(4-), [.mu.-[[4,4'-[(3,3'-dihydroxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[3-hydroxy-2,7-naphthalenedisulfonato]](8-)]]di-, tetrasodium** C.I. Direct Blue 80 C.I. 24315 Fast Blue 2RLL
CAS Number	12222-00-3
Structural Formula	

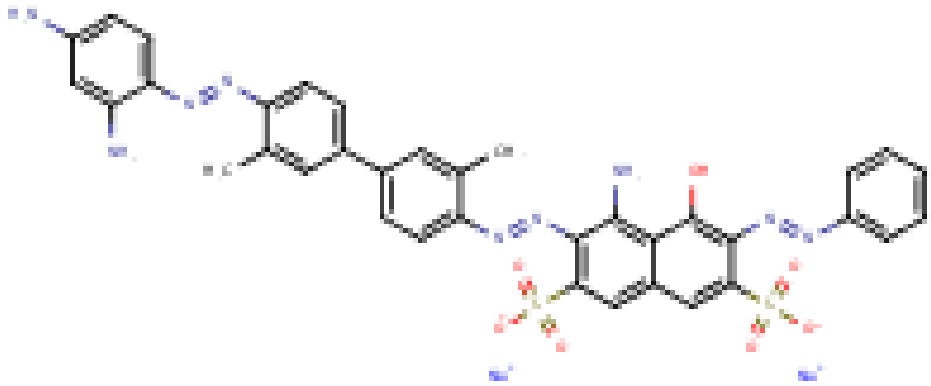
	
Molecular Formula	C32H14Cu2N4O16S4.4Na
Molecular Weight	962.78

Chemical Name in the Inventory and Synonyms	**C.I. Direct Blue 160** Cuprofix Navy CGRL Cuprophenyl Navy Blue RL Direct Copper Navy Blue RL
CAS Number	12222-02-5
Structural Formula	**No Structural Diagram Available**

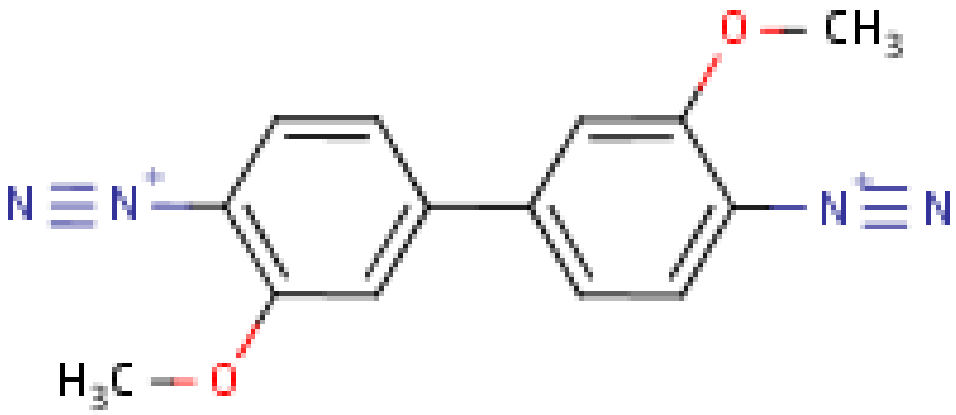
Molecular Formula	Unspecified
Molecular Weight	

Chemical Name in the Inventory and Synonyms	**Cuprate(4-), [.mu.-[[6,6'-[(3,3'-dihydroxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[4-amino-5-hydroxy-1,3-naphthalenedisulfonato]](8-)]]di-, tetrasodium** C.I. Direct Blue 76, tetrasodium salt
CAS Number	16143-79-6
Structural Formula	
Molecular Formula	C32H16Cu2N6O16S4.4Na
Molecular Weight	1087.82

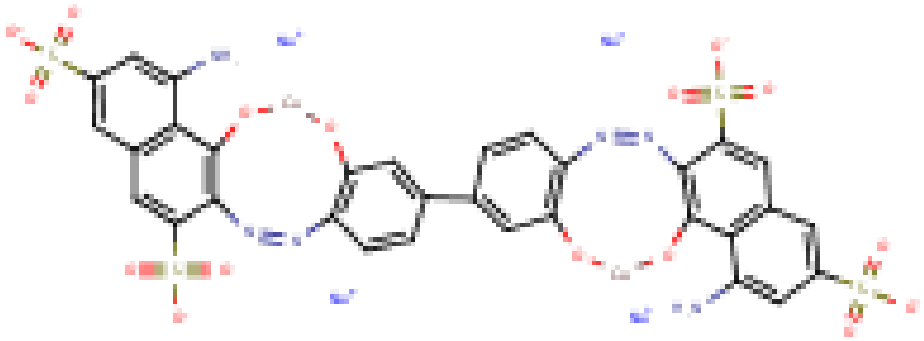
Chemical Name in the Inventory and Synonyms	**2,7-Naphthalenedisulfonic acid, 4-amino-3-[[4'-[(2,4-diaminophenyl)azo]-3,3'-dimethyl[1,1'-biphenyl]-4-yl]azo]-5-hydroxy-6-(phenylazo)-, disodium salt**

	C.I. 303865 C.I. Direct Black 154
CAS Number	54804-85-2
Structural Formula	
Molecular Formula	C36H31N9O7S2.2Na
Molecular Weight	809.78

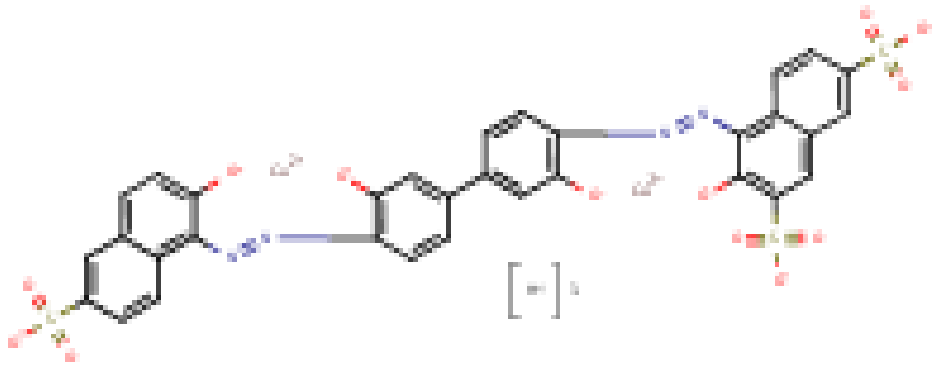
Chemical Name in the Inventory and Synonyms	**[1,1'-Biphenyl]-4,4'-bis(diazonium), 3,3'-dimethoxy-** C.I. Azoic Diazo Component 48 3,3'-Dimethoxy(1,1'-biphenyl)-4,4'-bis(diazonium) 4,4'-Biphenylbis(diazonium), 3,3'-dimethoxy-
CAS Number	20282-70-6
Structural Formula	

	
Molecular Formula	C14H12N4O2
Molecular Weight	268.27

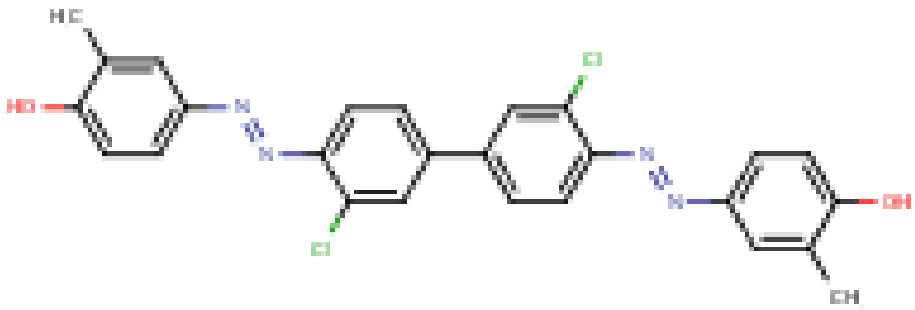
Chemical Name in the Inventory and Synonyms	**Cuprate(4-), [.mu.-[[3,3'-[(3,3'-dihydroxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[5-amino-4-hydroxy-2,7-naphthalenedisulfonato]] (8-)]]di-, tetrasodium** C.I. Direct Blue 218 C.I. 24401
CAS Number	28407-37-6
Structural Formula	

	
Molecular Formula	C32H16Cu2N6O16S4.4Na
Molecular Weight	

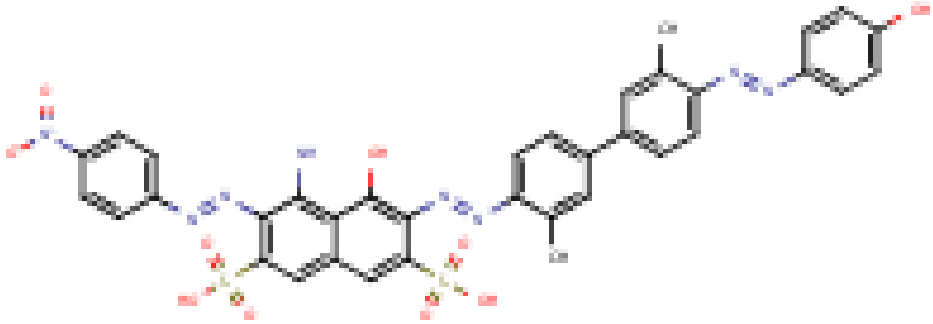
Chemical Name in the Inventory and Synonyms	**Cuprate(3-), [.mu.-[4-[[3,3'-dihydroxy-4'-[(2-hydroxy-6-sulfo-1-naphthalenyl)azo][1,1'-biphenyl]-4-yl]azo]-3-hydroxy-2,7-naphthalenedisulfonato(7-)]]di-, trihydrogen**
CAS Number	34771-63-6
Structural Formula	

	
Molecular Formula	C32H15Cu2N4O13S3.3H
Molecular Weight	889.80

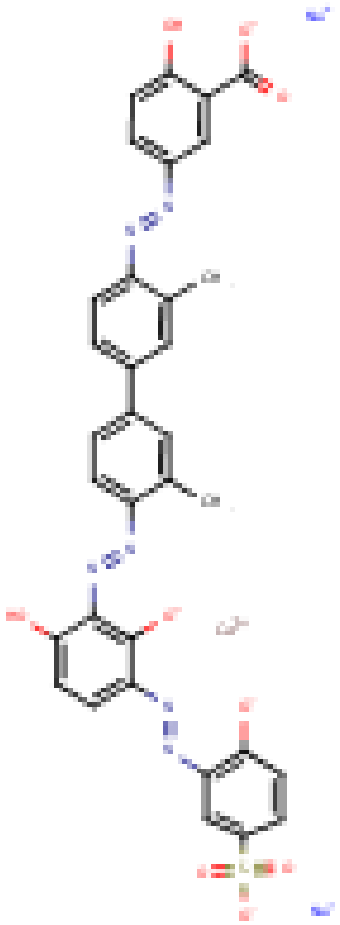
Chemical Name in the Inventory and Synonyms	**Phenol, 4,4'-[(3,3'-dichloro[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[2-methyl-** 4,4-(3,3-Dichloro[1,1-biphenyl Phenol, 4,4'-((3,3'-dichloro(1,1'-biphenyl)-4,4'-diyl)bis(2,1-diazenediyl))bis(2-methyl- 4,4'-((3,3'-Dichloro(1,1'-biphenyl)-4,4'-diyl)bis(azo))bis(o-cresol)
CAS Number	49744-32-3
Structural Formula	

	
Molecular Formula	C26H20Cl2N4O2
Molecular Weight	491.38

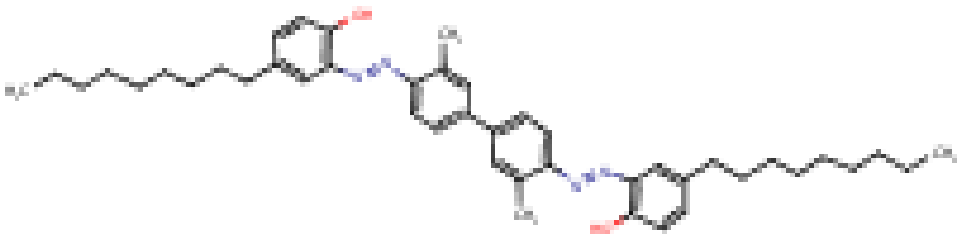
Chemical Name in the Inventory and Synonyms	**2,7-Naphthalenedisulfonic acid, 4-amino-5-hydroxy-6-[[4'-[(4-hydroxyphenyl)azo]-3,3'-dimethyl[1,1'-biphenyl]-4-yl]azo]-3-[(4-nitrophenyl)azo]-** 4-Amino-5-hydroxy-6-((4'-((4-hydroxyphenyl)azo)-3,3'-dimethyl(1,1'-biphenyl)-4-yl)azo)-3-((4-nitrophenyl)azo)naphthalene-2,7-disulphonic acid
CAS Number	56148-97-1
Structural Formula	

	
Molecular Formula	C36H28N8O10S2
Molecular Weight	796.80

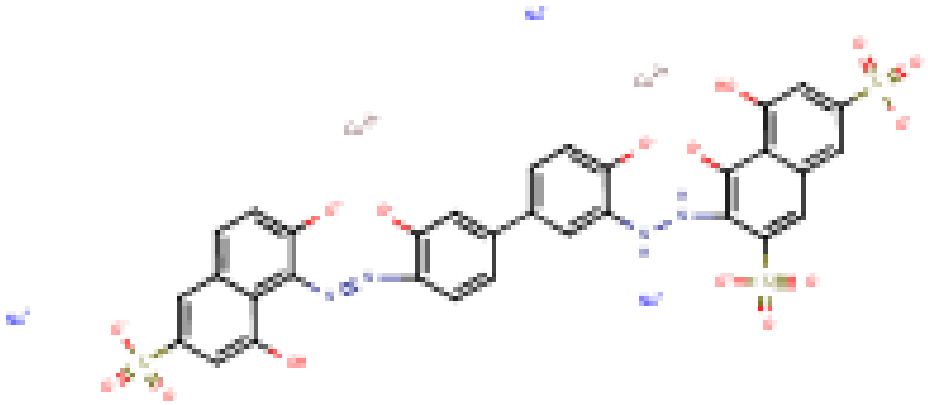
Chemical Name in the Inventory and Synonyms	**Cuprate(2-), [5-[[4'-[[2,6-dihydroxy-3-[(2-hydroxy-5-sulfophenyl)azo]phenyl]azo]-3,3'-dimethyl[1,1'-biphenyl]-4-yl]azo]-2-hydroxybenzoato(4-)]-, disodium**
CAS Number	66225-65-8
Structural Formula	

	
Molecular Formula	C33H22CuN6O9S.2Na
Molecular Weight	788.15

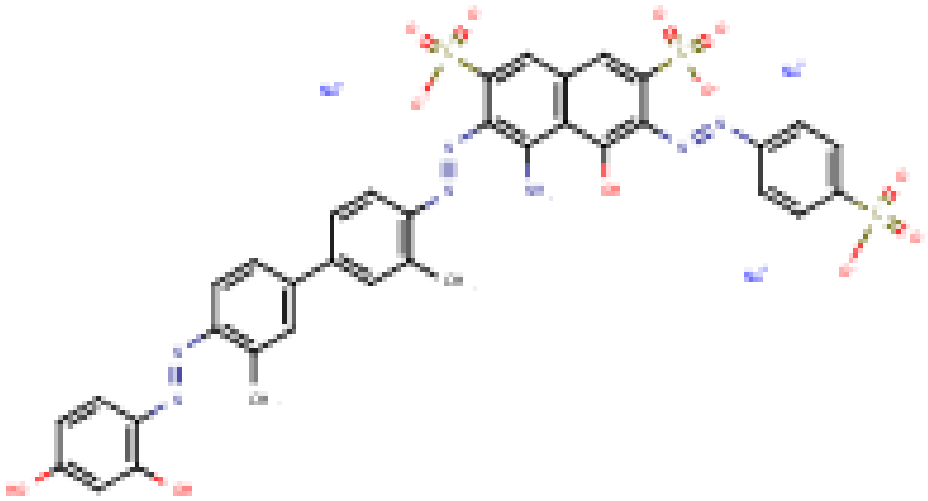
Chemical Name in the Inventory and Synonyms	**Phenol, 2,2'-[(3,3'-dimethyl[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[4-nonyl-** C.I. Solvent Yellow 107
CAS Number	67990-27-6
Structural Formula	

	
Molecular Formula	C44H58N4O2
Molecular Weight	674.97

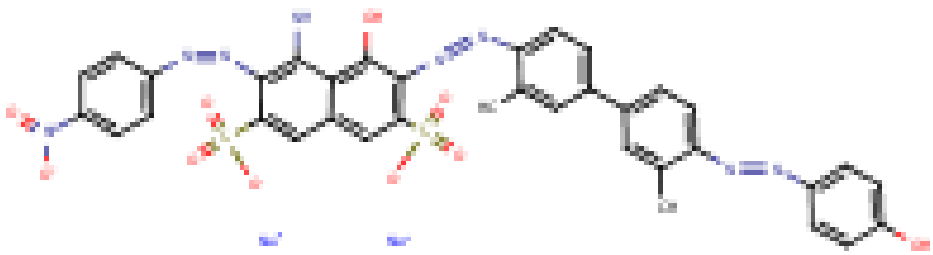
Chemical Name in the Inventory and Synonyms	**Cuprate(3-), [.mu.-[3-[[4'-[(2,8-dihydroxy-6-sulfo-1-naphthalenyl)azo]-3,3'-dihydroxy[1,1'-biphenyl]-4-yl]azo]-4,5-dihydroxy-2,7-naphthalenedisulfonato(7-)]]di-, trisodium** C.I. Direct Blue 214 C.I. 23158
CAS Number	68140-31-8
Structural Formula	

	
Molecular Formula	C32H15Cu2N4O15S3.3Na
Molecular Weight	987.75

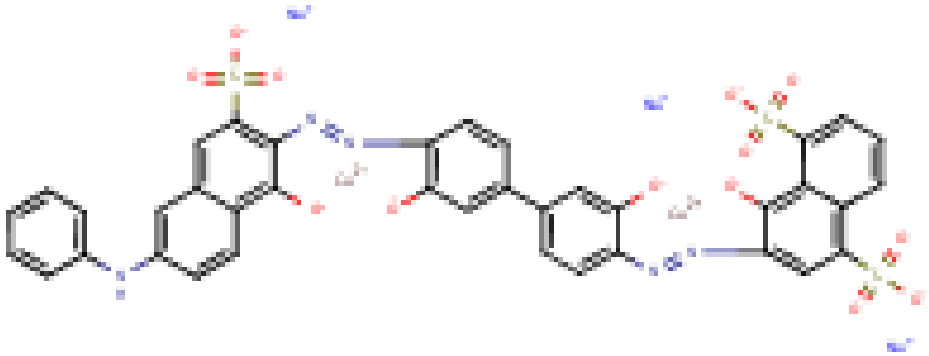
Chemical Name in the Inventory and Synonyms	**2,7-Naphthalenedisulfonic acid, 4-amino-3-[[4'-[(2,4-dihydroxyphenyl)azo]-3,3'-dimethyl[1,1'-biphenyl]-4-yl]azo]-5-hydroxy-6-[(4-sulfophenyl)azo]-, trisodium salt**
CAS Number	68318-35-4
Structural Formula	

	
Molecular Formula	C36H29N7O12S3.3Na
Molecular Weight	913.81

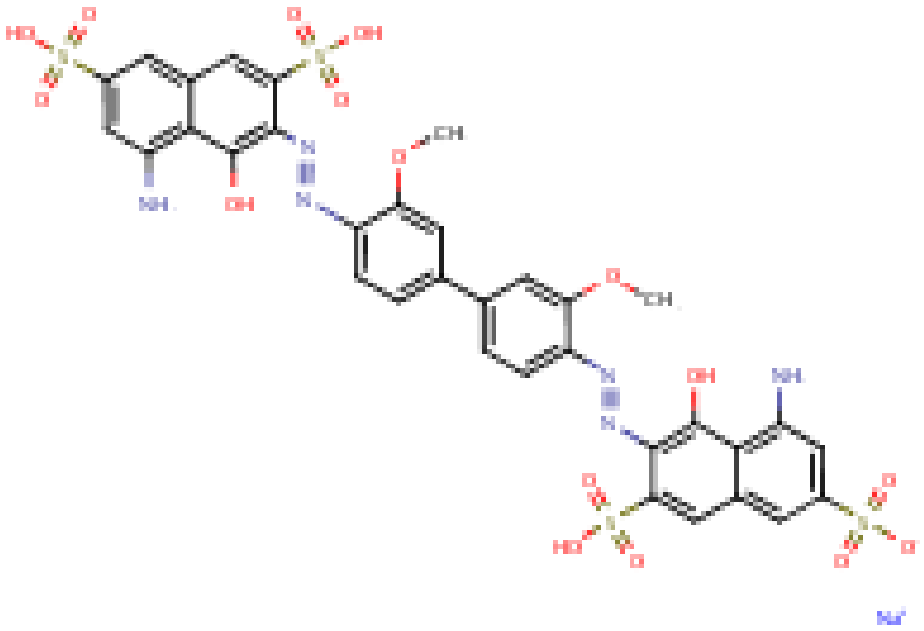
Chemical Name in the Inventory and Synonyms	**2,7-Naphthalenedisulfonic acid, 4-amino-5-hydroxy-6-[[4'-[(4-hydroxyphenyl)azo]-3,3'-dimethyl[1,1'-biphenyl]-4-yl]azo]-3-[(4-nitrophenyl)azo]-, disodium salt**
CAS Number	68400-36-2
Structural Formula	

	
Molecular Formula	C36H28N8O10S2.2Na
Molecular Weight	840.76

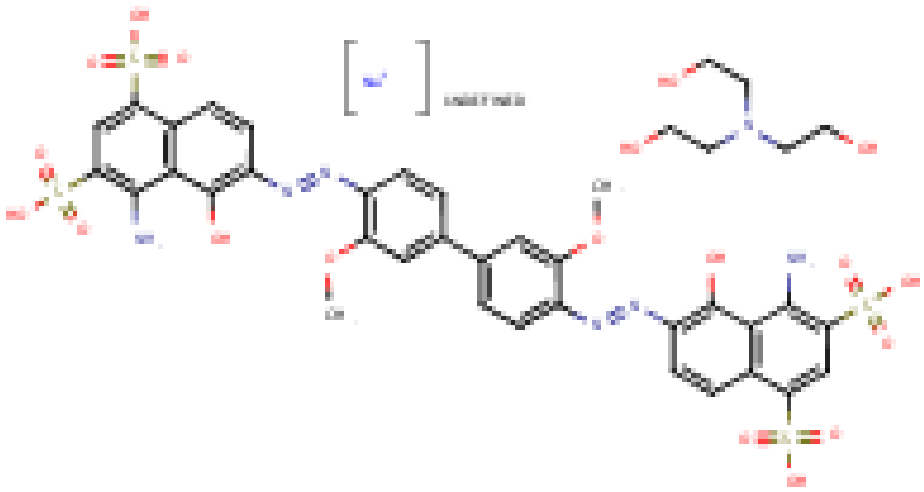
Chemical Name in the Inventory and Synonyms	**Cuprate(3-), [.mu.-[3-[[3,3'-dihydroxy-4'-[[1-hydroxy-6-(phenylamino)-3-sulfo-2-naphthalenyl]azo][1,1'-biphenyl]-4-yl]azo]-4-hydroxy-1,5-naphthalenedisulfonato(7-)]]di-, trisodium**
CAS Number	73287-47-5
Structural Formula	

	
Molecular Formula	C38H20Cu2N5O13S3.3Na
Molecular Weight	1046.86

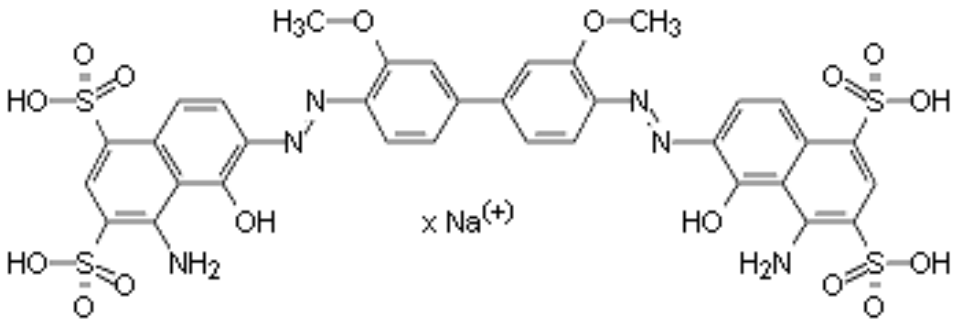
Chemical Name in the Inventory and Synonyms	**2,7-Naphthalenedisulfonic acid, 3,3'-[(3,3'-dimethoxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[5-amino-4-hydroxy-, sodium salt**
CAS Number	68966-50-7
Structural Formula	

	
Molecular Formula	C34H28N6O16S4.xNa
Molecular Weight	926.86

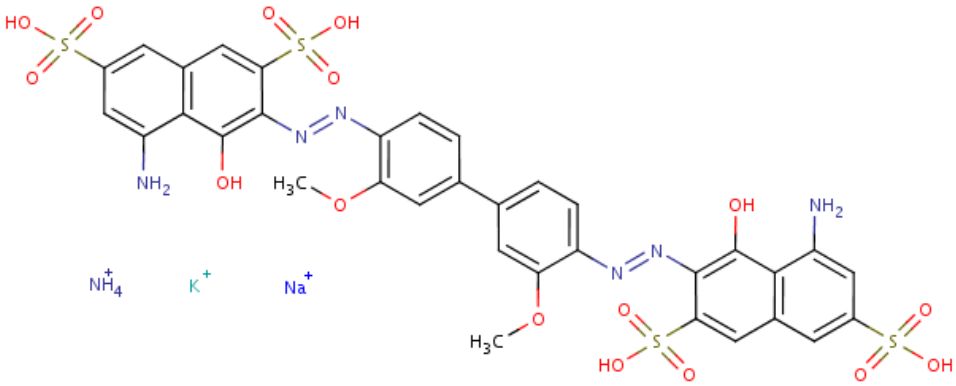
Chemical Name in the Inventory and Synonyms	**1,3-Naphthalenedisulfonic acid, 6,6'-[(3,3'-dimethoxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[4-amino-5-hydroxy-, sodium salt, compound with 2,2',2''-nitrilotris[ethanol]** 6,6'-((3,3'-Dimethoxy(1,1'-biphenyl)-4,4'-diyl)diazo)bis(4-amino-5-hydroxynaphthalene-1,3-disulphonic) acid, sodium salt, compound with 2,2',2''-nitrilotriethanol
CAS Number	83763-65-9
Structural Formula	

	
Molecular Formula	C34H28N6O16S4.xC6H15NO3.xNa
Molecular Weight	

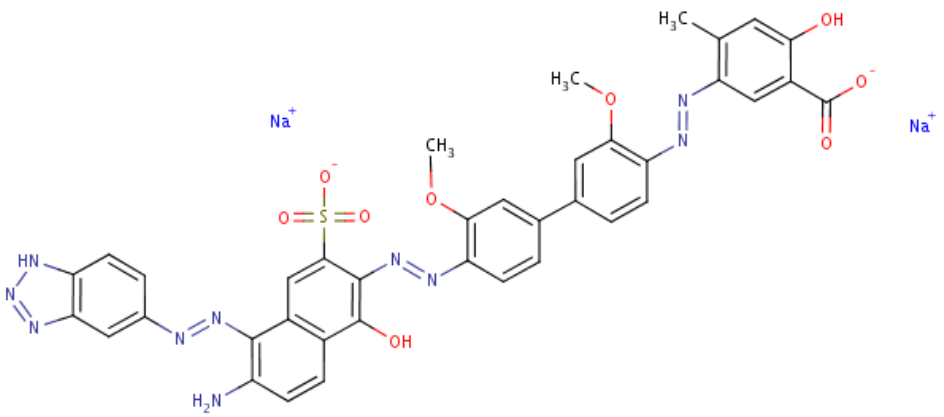
Chemical Name in the Inventory and Synonyms	**1,3-Naphthalenedisulfonic acid, 6,6'-[(3,3'-dimethoxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[4-amino-5-hydroxy-, sodium salt** C.I. Direct Blue 1 Chicago sky blue 6B
CAS Number	83763-66-0
Structural Formula	

	
Molecular Formula	C34H28N6O16S4.xNa
Molecular Weight	992.82

Chemical Name in the Inventory and Synonyms	**2,7-Naphthalenedisulfonic acid, 3,3'-[(3,3'-dimethoxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[5-amino-4-hydroxy-, ammonium potassium sodium salt**
CAS Number	93964-43-3
Structural Formula	

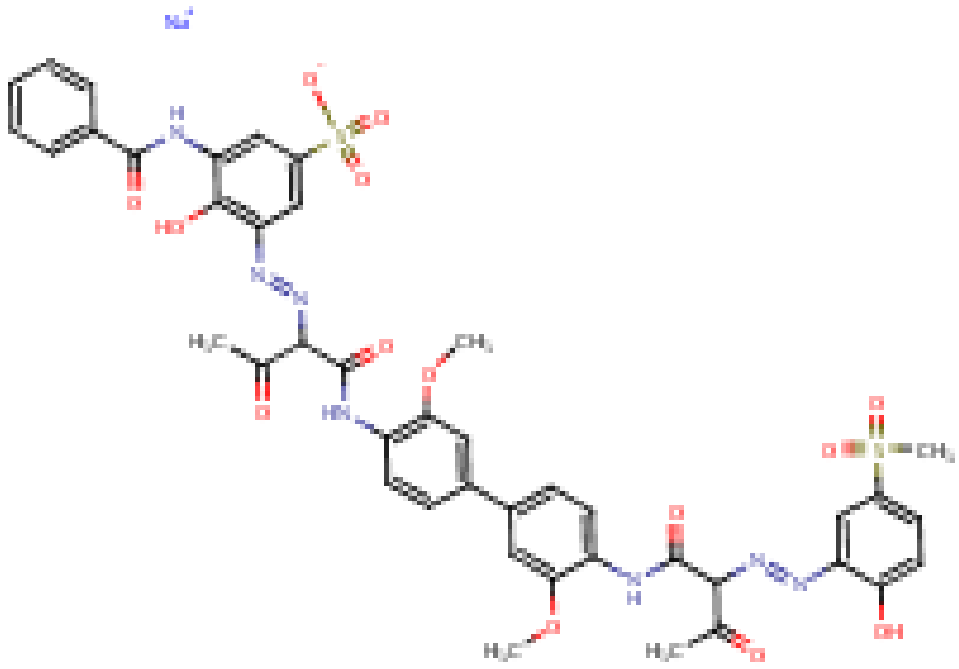
	
Molecular Formula	C34H28N6O16S4.xH3N.xK.xNa
Molecular Weight	985.01

Chemical Name in the Inventory and Synonyms	**Benzoic acid, 5-[[4'-[[6-amino-5-(1H-benzotriazol-5-ylazo)-1-hydroxy-3-sulfo-2-naphthalenyl]azo]-3,3'-dimethoxy[1,1'-biphenyl]-4-yl]azo]-2-hydroxy-4-methyl-, disodium salt**
CAS Number	70210-28-5
Structural Formula	

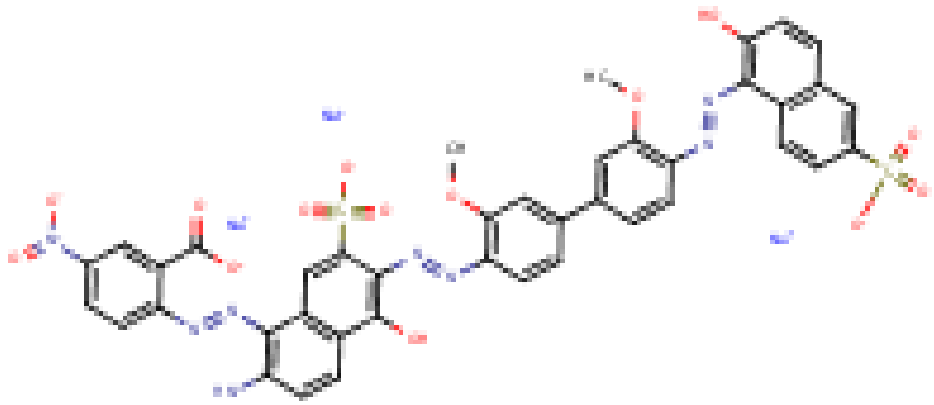


Molecular Formula	C38H30N10O9S.2Na
Molecular Weight	846.75

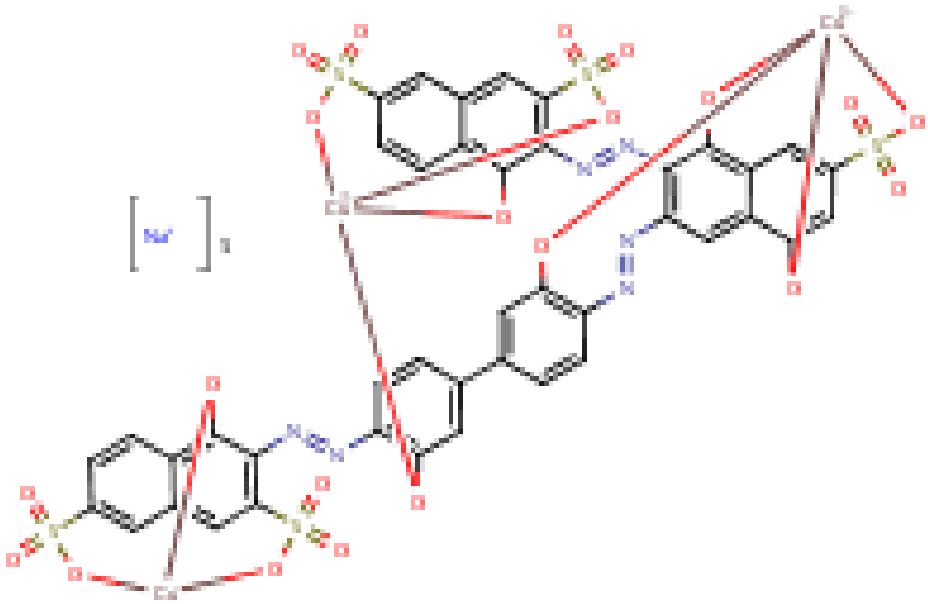
Chemical Name in the Inventory and Synonyms	**Benzenesulfonic acid, 3-(benzoylamino)-4-hydroxy-5-[[1-[[[4'-[[2-[[2-hydroxy-5-(methylsulfonyl)phenyl]azo]-1,3-dioxobutyl]amino]-3,3'-dimethoxy[1,1'-biphenyl]-4-yl]amino]carbonyl]-2-oxopropyl]azo]-, monosodium salt**
CAS Number	70210-32-1
Structural Formula	

	
Molecular Formula	C42H39N7O14S2.Na
Molecular Weight	951.92

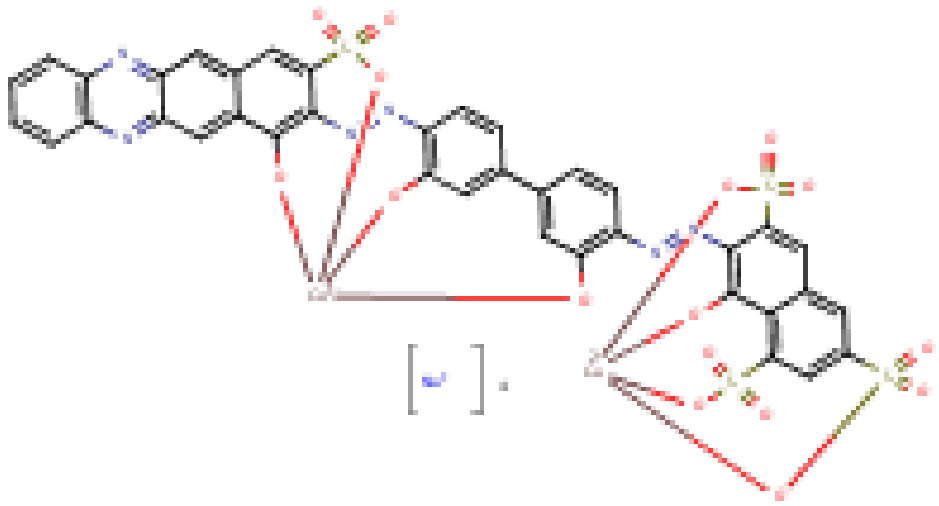
Chemical Name in the Inventory and Synonyms	**Benzoic acid, 2-[[2-amino-5-hydroxy-6-[[4'-[(2-hydroxy-6-sulfo-1-naphthalenyl)azo]-3,3'-dimethoxy[1,1'-biphenyl]-4-yl]azo]-7-sulfo-1-naphthalenyl]azo]-5-nitro-, trisodium salt**
CAS Number	71566-41-1
Structural Formula	

	
Molecular Formula	C41H30N8O14S2.3Na
Molecular Weight	988.79

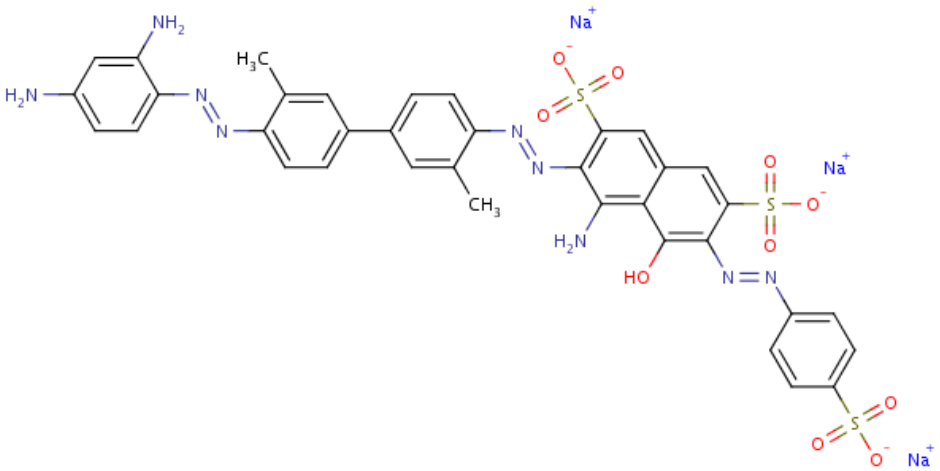
Chemical Name in the Inventory and Synonyms	**Cuprate(5-), [.mu.3-[3-[[6-[[3,3'-dihydroxy-4'-[(1-hydroxy-3,6-disulfo-2-naphthalenyl)azo][1,1'-biphenyl]-4-yl]azo]-1,5-dihydroxy-7-sulfo-2-naphthalenyl]azo]-4-hydroxy-2,7-naphthalenedisulfonato(11-)]]tri-, pentasodium**
CAS Number	71735-53-0
Structural Formula	

	
Molecular Formula	C42H17Cu3N6O21S5.5Na
Molecular Weight	1407.52

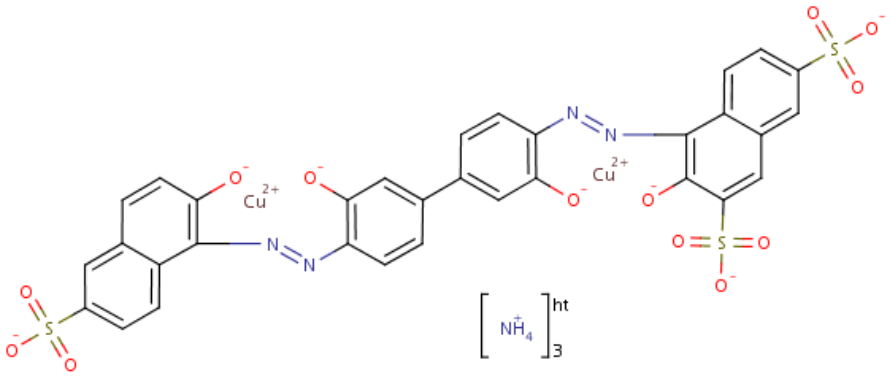
Chemical Name in the Inventory and Synonyms	**Cuprate(4-), [.mu.-[7-[[3,3'-dihydroxy-4'-[(4-hydroxy-2-sulfobenzo[a]phenazin-3-yl)azo][1,1'-biphenyl]-4-yl]azo]-8-hydroxy-1,3,6-naphthalenetrisulfonato(8-)]]di-, tetrasodium** C.I. Direct Blue 90 C.I. 231560
CAS Number	71873-63-7
Structural Formula	

	
Molecular Formula	C38H16Cu2N6O16S4.4Na
Molecular Weight	1036.82

Chemical Name in the Inventory and Synonyms	**2,7-Naphthalenedisulfonic acid, 4-amino-3-[[4'-[(2,4-diaminophenyl)azo]-3,3'-dimethyl[1,1'-biphenyl]-4-yl]azo]-5-hydroxy-6-[(4-sulfophenyl)azo]-, trisodium salt**
CAS Number	72906-45-7
Structural Formula	

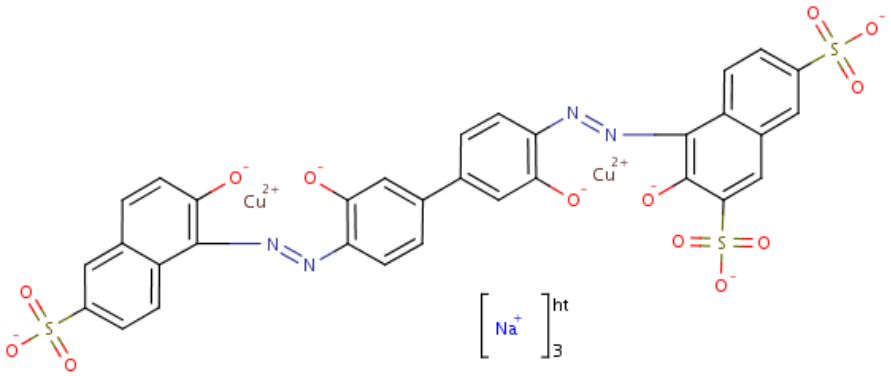
	
Molecular Formula	C36H31N9O10S3.3Na
Molecular Weight	911.84

Chemical Name in the Inventory and Synonyms	**Cuprate(3-), [.mu.-[4-[[3,3'-dihydroxy-4'-[(2-hydroxy-6-sulfo-1-naphthalenyl)azo][1,1'-biphenyl]-4-yl]azo]-3-hydroxy-2,7-naphthalenedisulfonato(7-)]]di-, triammonium**
CAS Number	72906-61-7
Structural Formula	

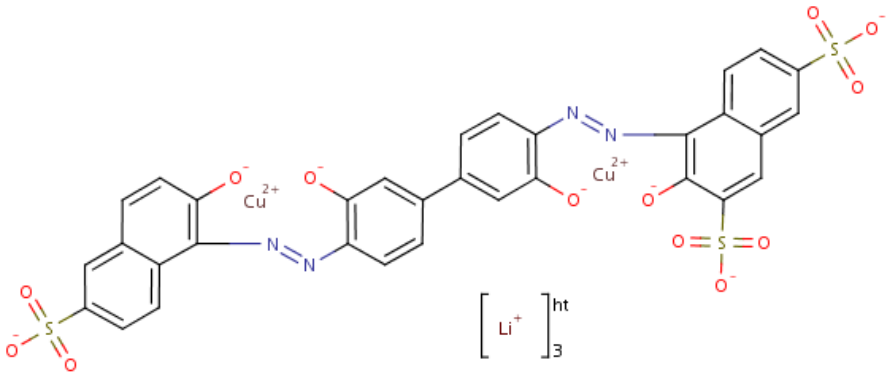


Molecular Formula	C32H15Cu2N4O13S3.3H4N
Molecular Weight	940.89

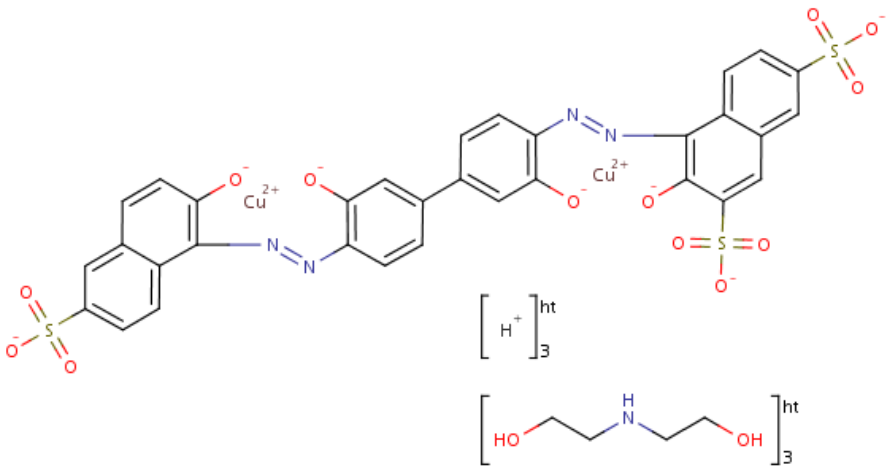
Chemical Name in the Inventory and Synonyms	**Cuprate(3-), [.mu.-[4-[[3,3'-dihydroxy-4'-[(2-hydroxy-6-sulfo-1-naphthalenyl)azo][1,1'-biphenyl]-4-yl]azo]-3-hydroxy-2,7-naphthalenedisulfonato(7-)]]di-, trisodium**
CAS Number	72906-62-8
Structural Formula	

	
Molecular Formula	C32H15Cu2N4O13S3.3Na
Molecular Weight	955.75

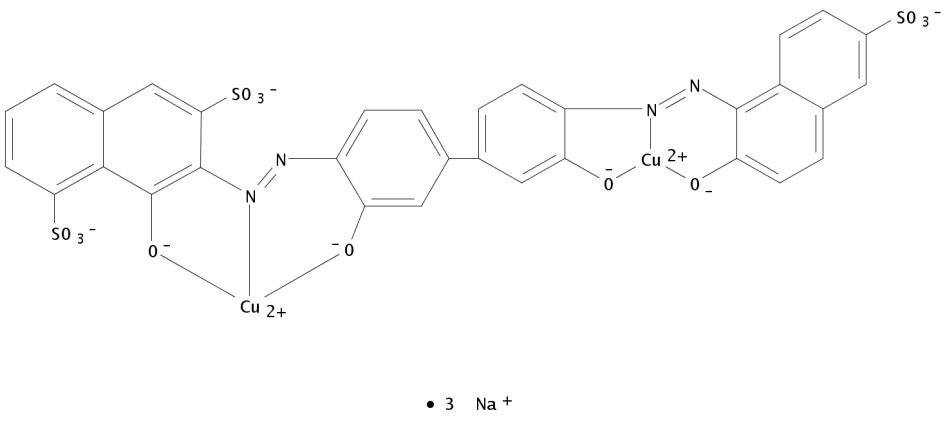
Chemical Name in the Inventory and Synonyms	**Cuprate(3-), [.mu.-[4-[[3,3'-dihydroxy-4'-[(2-hydroxy-6-sulfo-1-naphthalenyl)azo][1,1'-biphenyl]-4-yl]azo]-3-hydroxy-2,7-naphthalenedisulfonato(7-)]]di-, trilithium**
CAS Number	72906-63-9
Structural Formula	

	
Molecular Formula	C32H15Cu2N4O13S3.3Li
Molecular Weight	907.60

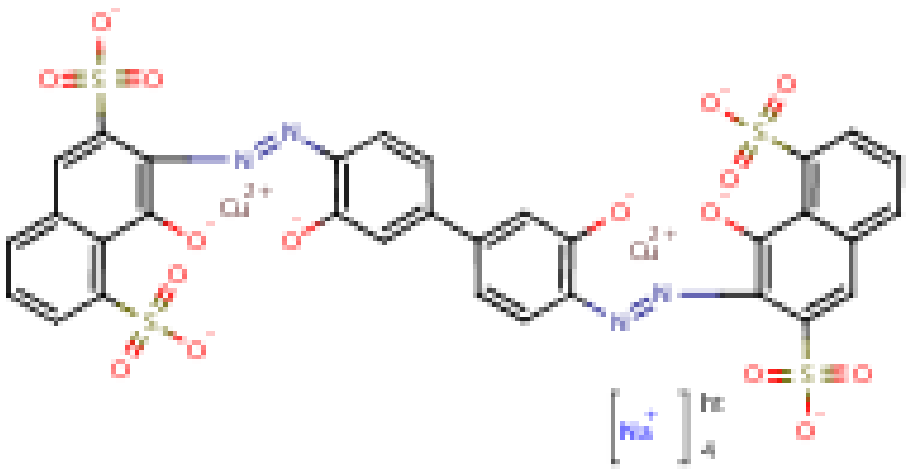
Chemical Name in the Inventory and Synonyms	**Cuprate(3-), [.mu.-[4-[[3,3'-dihydroxy-4'-[(2-hydroxy-6-sulfo-1-naphthalenyl)azo][1,1'-biphenyl]-4-yl]azo]-3-hydroxy-2,7-naphthalenedisulfonato(7-)]]di-, trihydrogen, compound with 2,2'-iminobis[ethanol] (1:3)**
CAS Number	72906-64-0
Structural Formula	



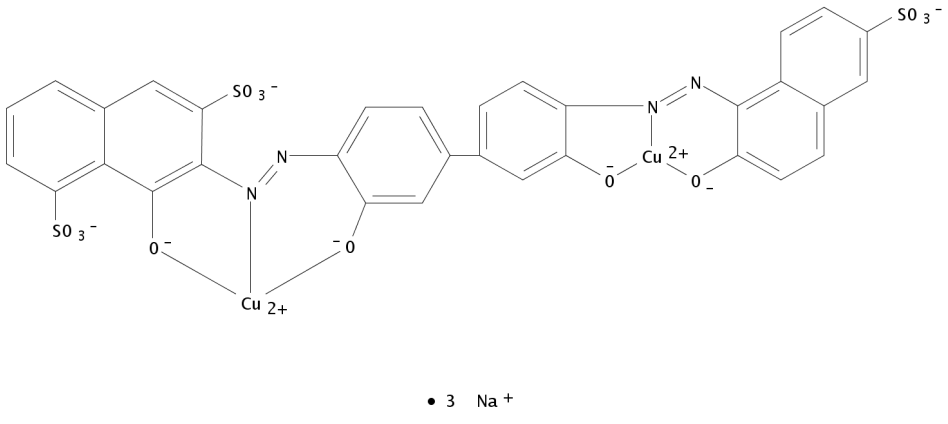
Molecular Formula	C32H15Cu2N4O13S3.3C4H11NO2.3H
Molecular Weight	1205.21

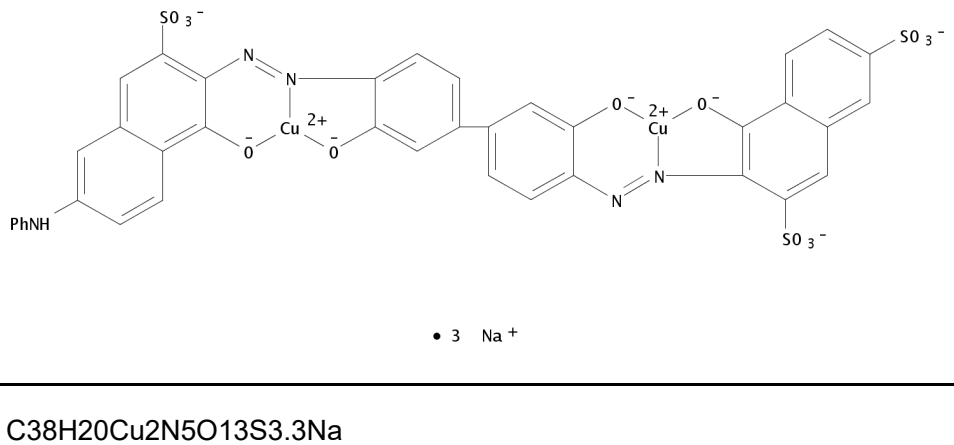
Chemical Name in the Inventory and Synonyms	**Cuprate(3-), [.mu.-[7-[[3,3'-dihydroxy-4'-[(2-hydroxy-6-sulfo-1-naphthalenyl)azo][1,1'-biphenyl]-4-yl]azo]-8-hydroxy-1,6-naphthalenedisulfonato(7-)]]-, trisodium**
CAS Number	72928-71-3
Structural Formula	

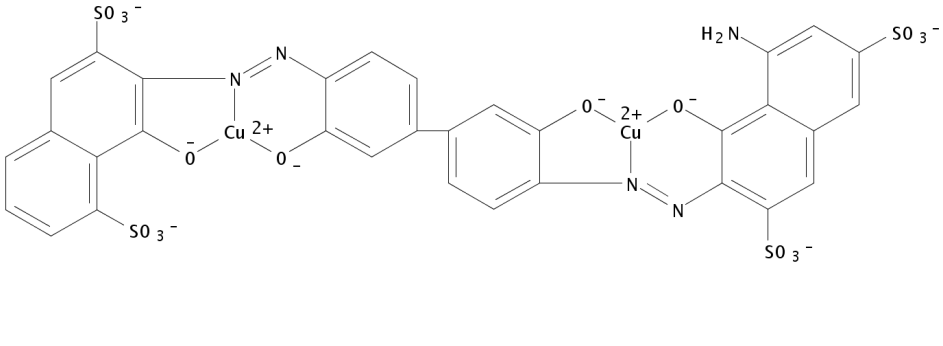
Molecular Formula	C32H15Cu2N4O13S3.3Na
Molecular Weight	955.74

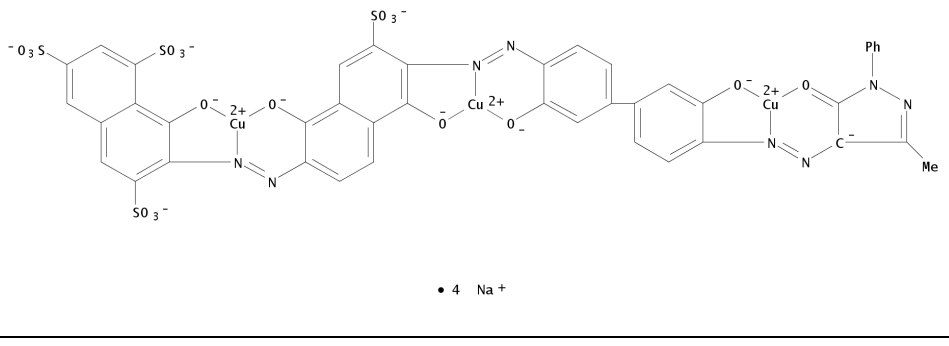
Chemical Name in the Inventory and Synonyms	**Cuprate(4-), [.mu.-[[7,7'-[(3,3'-dihydroxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[1,6-naphthalenedisulfonato]](8-)]]di-,tetrasodium** C.I. Direct Blue 95
CAS Number	72939-55-0
Structural Formula	
Molecular Formula	C32H14Cu2N4O16S4.4Na
Molecular Weight	1057.79

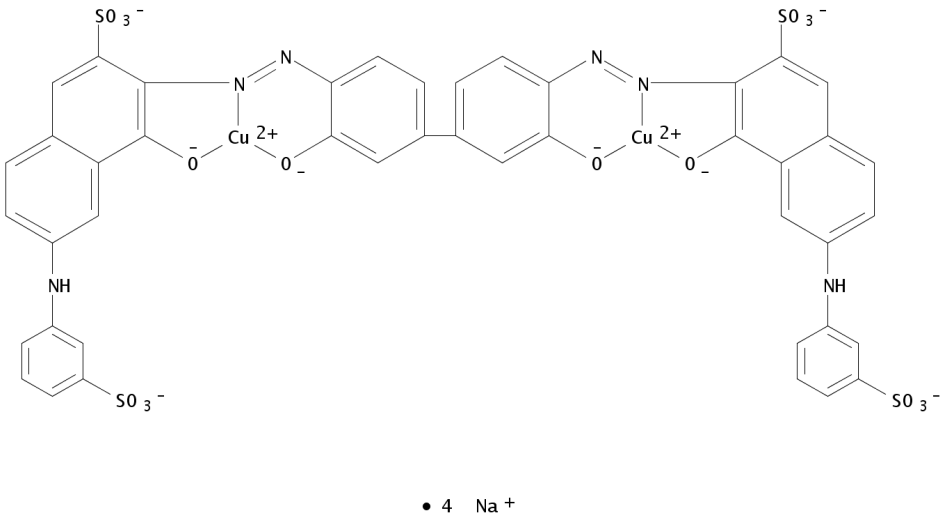
Chemical Name in the Inventory and Synonyms	**Cuprate(3-), [.mu.-[7-[[3,3'-dihydroxy-4'-[(2-hydroxy-6-sulfo-1-naphthalenyl)azo][1,1'-biphenyl]-4-yl]azo]-8-hydroxy-1,6-naphthalenedisulfonato(7-)]]di-, trisodium**

CAS Number	73507-21-8
Structural Formula	
Molecular Formula	C32H15Cu2N4O13S3.3Na
Molecular Weight	955.74

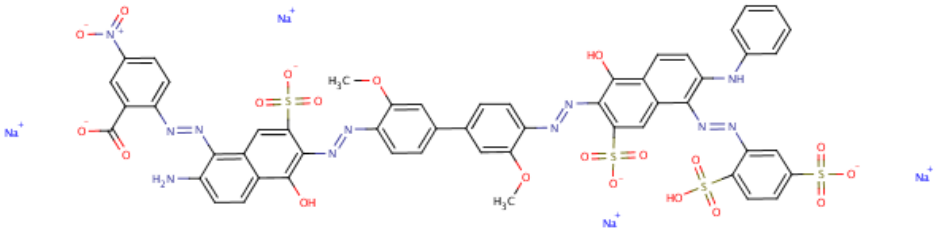
Chemical Name in the Inventory and Synonyms	**Cuprate(3-), [.mu.-[3-[[3,3'-dihydroxy-4'-[[1-hydroxy-6-(phenylamino)-3-sulfo-2-naphthalenyl]azo][1,1'-biphenyl]-4-yl]azo]-4-hydroxy-2,7-naphthalenedisulfonato(7-)]]di-, trisodium**
CAS Number	73507-22-9
Structural Formula	
Molecular Formula	C38H20Cu2N5O13S3.3Na
Molecular Weight	1046.85

Chemical Name in the Inventory and Synonyms	**Cuprate(4-), [.mu.-[7-[[4'-[(8-amino-1-hydroxy-3,6-disulfo-2-naphthalenyl)azo]-3,3'-dihydroxy[1,1'-biphenyl]-4-yl]azo]-8-hydroxy-1,6-naphthalenedisulfonato(8-)]]di-, tetrasodium**
CAS Number	73507-23-0
Structural Formula	
Molecular Formula	C32H15Cu2N5O16S4.4Na
Molecular Weight	1072.80

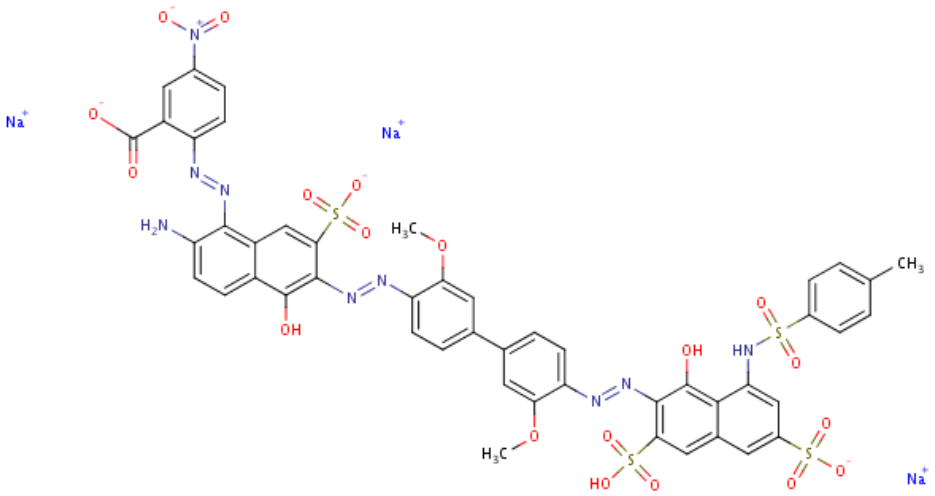
Chemical Name in the Inventory and Synonyms	**Cuprate(4-), [.mu.-3-[7-[[6-[[4'-[(4,5-dihydro-3-methyl-5-oxo-1-phenyl-1H-pyrazol-4-yl)azo]-3,3'-dihydroxy[1,1'-biphenyl]-4-yl]azo]-1,5-dihydroxy-7-sulfo-2-napthalenyl]azo]-8-hydroxy-1,3,6-naphthalenetrisulfonato(10-)]]tri-, tetrasodium**
CAS Number	73507-24-1
Structural Formula	
Molecular Formula	C42H20Cu3N8O18S4.4Na
Molecular Weight	1335.51

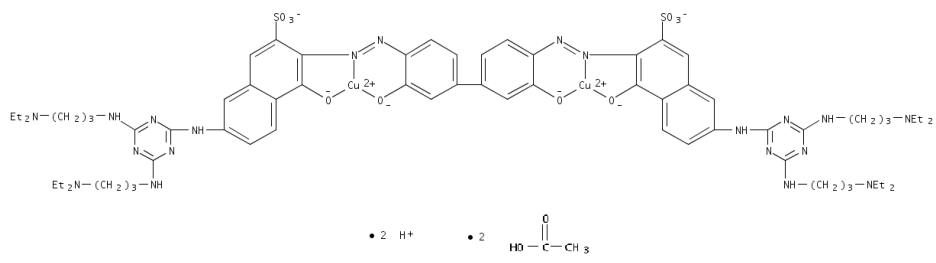
Chemical Name in the Inventory and Synonyms	**Cuprate(4-), [.mu.-[[3,3'-[(3,3'-dihydroxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[4-hydroxy-6-[(3-sulfophenyl)amino]-2-naphthalenesulfonato]](8-)]]di-, tetrasodium**
CAS Number	74432-30-7
Structural Formula	
Molecular Formula	C44H24Cu2N6O16S4.4Na
Molecular Weight	1240.00

Chemical Name in the Inventory and Synonyms	**Benzoic acid, 2-[[2-amino-6-[[4'-[[5-[(2,5-disulfophenyl)azo]-1-hydroxy-6-(phenylamino)-3-sulfo-2-naphthalenyl]azo]-3,3'-dimethoxy[1,1'-biphenyl]-4-yl]azo]-5-hydroxy-7-sulfo-1-naphthalenyl]azo]-5-nitro-, tetrasodium salt**
CAS Number	75522-93-9
Structural Formula	

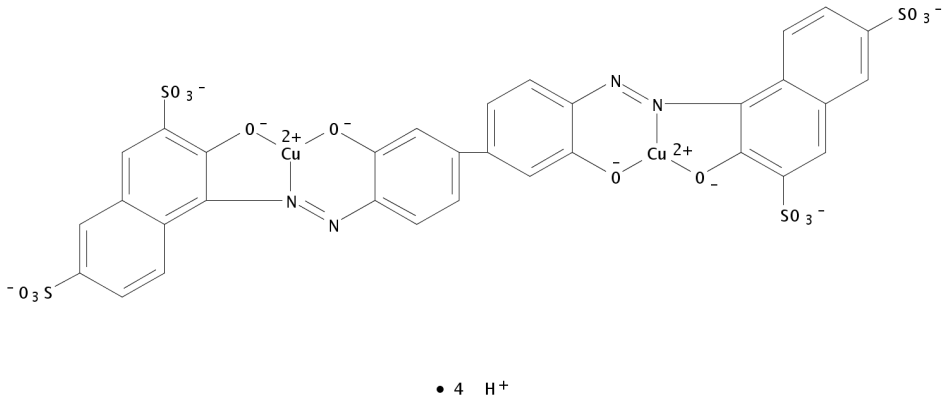
	
Molecular Formula	C53H39N11O20S4.4Na
Molecular Weight	1366.14

Chemical Name in the Inventory and Synonyms	**Benzoic acid, 2-[[2-amino-5-hydroxy-6-[[4'-[[1-hydroxy-8-[[(4-methylphenyl)sulfonyl]amino]-3,6-disulfo-2-naphthalenyl]azo]-3,3'-dimethoxy(1,1'-biphenyl)-4-yl]azo]-7-sulfo-1-naphthalenyl]azo]-5-nitro-, trisodium salt**
CAS Number	75522-94-0
Structural Formula	

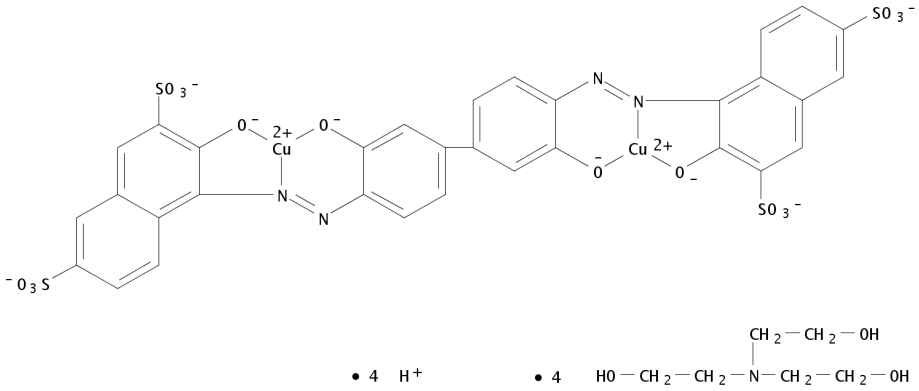
	
Molecular Formula	C48H37N9O19S4.3Na
Molecular Weight	1238.07

Chemical Name in the Inventory and Synonyms	**Cuprate(2-), [.mu.-[[3,3'-[[3,3'-dihydroxy[1,1'-biphenyl]-4,4'-diyl]bis(azo)]bis[7-[[4,6-bis[[3-(diethylamino)propyl]amino]-1,3,5-triazin-2-yl]amino]-4-hydroxy-2-naphthalenesulfonato]](6-)]]di-, dihydrogen, diacetate (salt)**
CAS Number	79135-30-1
Structural Formula	
Molecular Formula	C66H84Cu2N20O10S2.2C2H4O2.2H

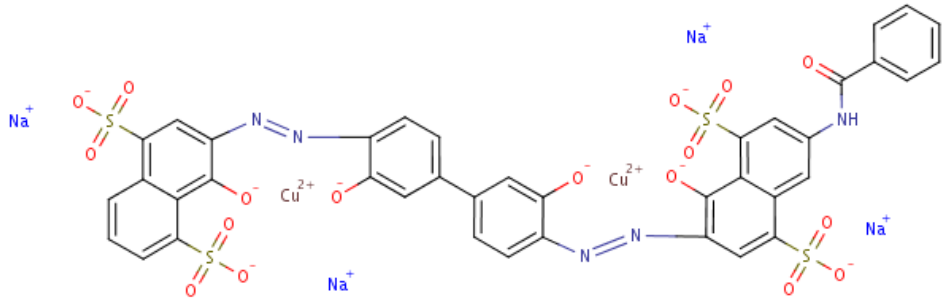
Molecular Weight	1630.84

Chemical Name in the Inventory and Synonyms	**Cuprate(4-), [.mu.-[[4,4'-[(3,3'-dihydroxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[3-hydroxy-2,7-naphthalenedisulfonato]](8-)]]di-, tetrahydrogen**
CAS Number	81737-16-8
Structural Formula	
Molecular Formula	C32H14Cu2N4O16S4.4H
Molecular Weight	969.85

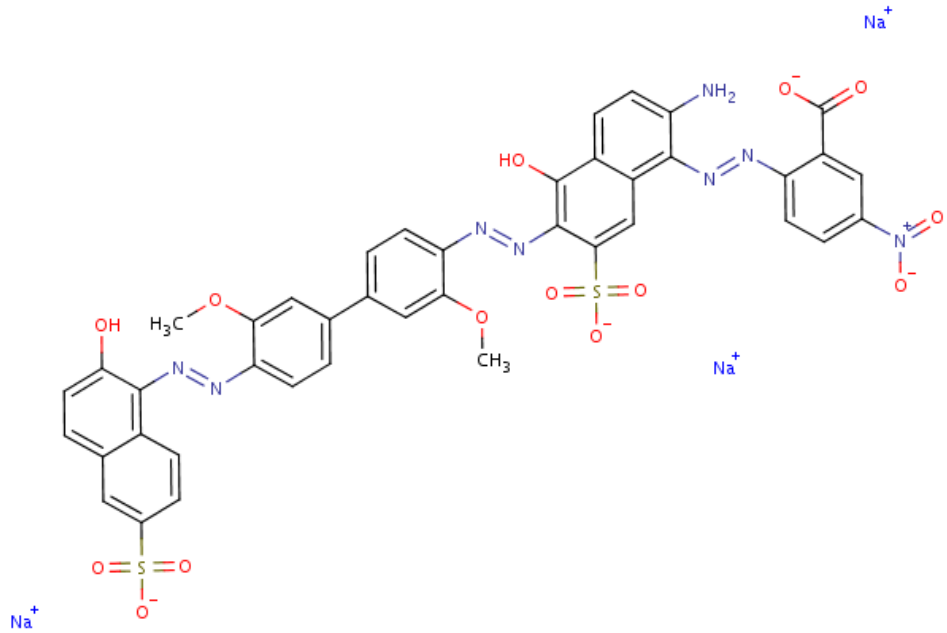
Chemical Name in the Inventory and Synonyms	**Cuprate(4-), [.mu.-[[4,4'-[(3,3'-dihydroxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[3-hydroxy-2,7-naphthalenedisulfonato]](8-)]]di-, tetrahydrogen, compd. with 2,2',2''-nitrilotris[ethanol] (1:4)**
CAS Number	81737-17-9
Structural Formula	

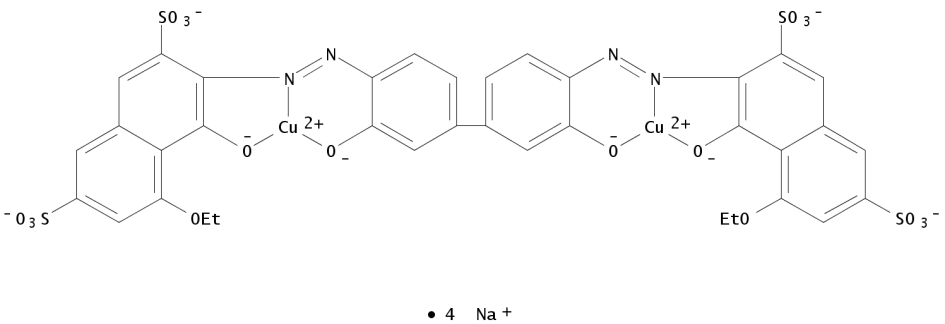
	
Molecular Formula	C32H14Cu2N4O16S4.4C6H15NO3.4H
Molecular Weight	7966.36

Chemical Name in the Inventory and Synonyms	**Cuprate(4-), [.mu.-[7-(benzoylamino)-3-[[3,3'-dihydroxy-4'-[(1-hydroxy-4,8-disulfo-2-naphthalenyl)azo][1,1'-biphenyl]-4-yl]azo]-4-hydroxy-1,5-naphthalenedisulfonato(8-)]]di-, tetrasodium**
CAS Number	83027-55-8
Structural Formula	

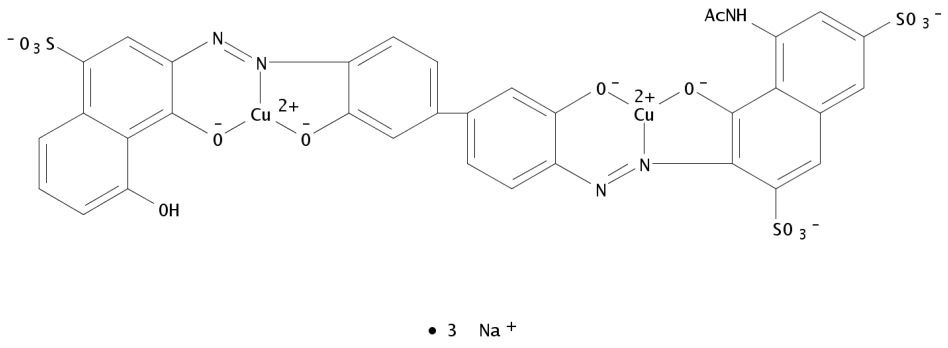
	
Molecular Formula	C39H19Cu2N5O17S4.4Na
Molecular Weight	1176.91

Chemical Name in the Inventory and Synonyms	**Benzoic acid, 2-[[2-amino-5-hydroxy-6-[[4'-[(2-hydroxy-6-sulfo-1-naphthalenyl)azo]-3,3'-dimethoxy[1,1'-biphenyl]-4-yl]azo]-7-sulfo-1-naphthalenyl]azo]-5-nitro-, sodium salt**
CAS Number	83221-79-8
Structural Formula	

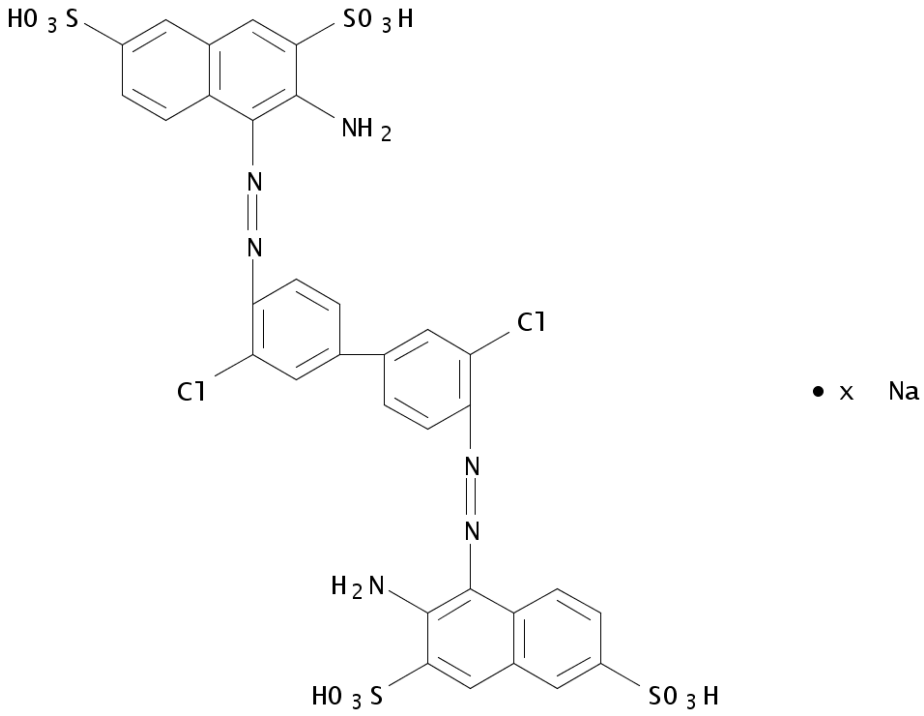
	
Molecular Formula	C41H30N8O14S2.xNa
Molecular Weight	988.81

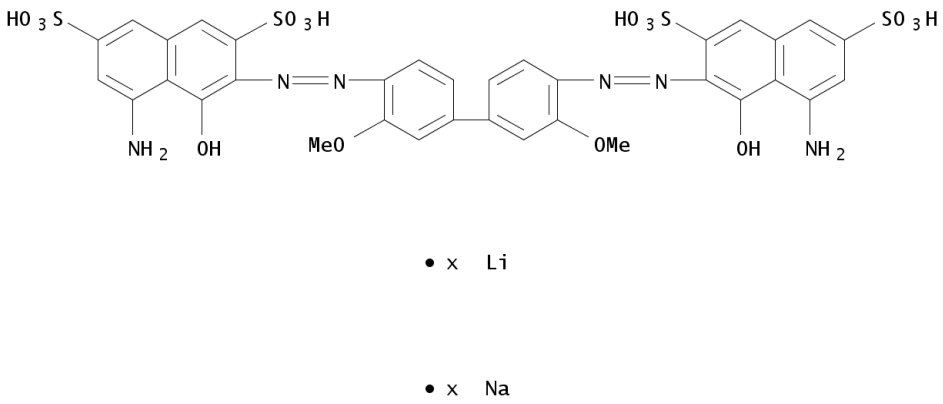
Chemical Name in the Inventory and Synonyms	**Cuprate(4-), [.mu.-[[3,3'-[(3,3'-dihydroxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[5-ethoxy-4-hydroxy-2,7-naphthalenedisulfonato]] (8-)]]di-, tetrasodium**
CAS Number	83232-53-5
Structural Formula	
Molecular Formula	C36H22Cu2N4O18S4.4Na

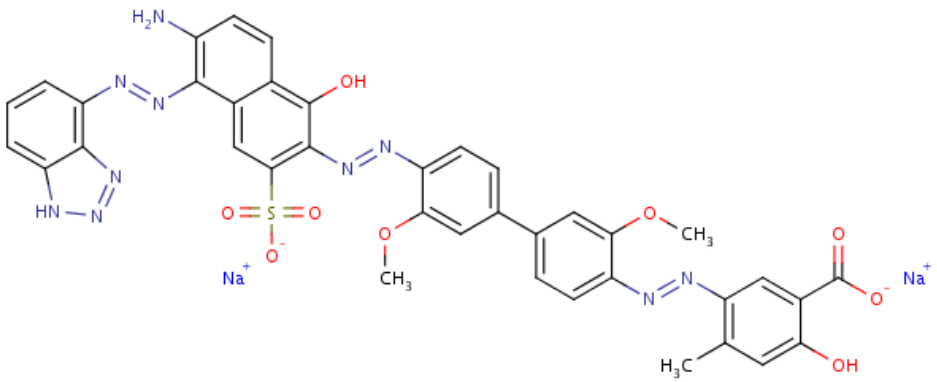
Molecular Weight	1145.89

Chemical Name in the Inventory and Synonyms	**Cuprate(3-), [.mu.-[5-(acetylamino)-3-[[4'-[(1,8-dihydroxy-4-sulfo-2-naphthalenyl)azo]-3,3'-dihydroxy[1,1'-biphenyl]-4-yl]azo]-4-hydroxy-2,7-naphthalenedisulfonato(7-)]]di-, trisodium**
CAS Number	83232-54-6
Structural Formula	
Molecular Formula	C34H18Cu2N5O15S3.3Na
Molecular Weight	1028.79

Chemical Name in the Inventory and Synonyms	**2,7-Naphthalenedisulfonic acid, 4,4'-[(3,3'-dichloro[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[3-amino-, sodium salt**
CAS Number	83249-25-6
Structural Formula	

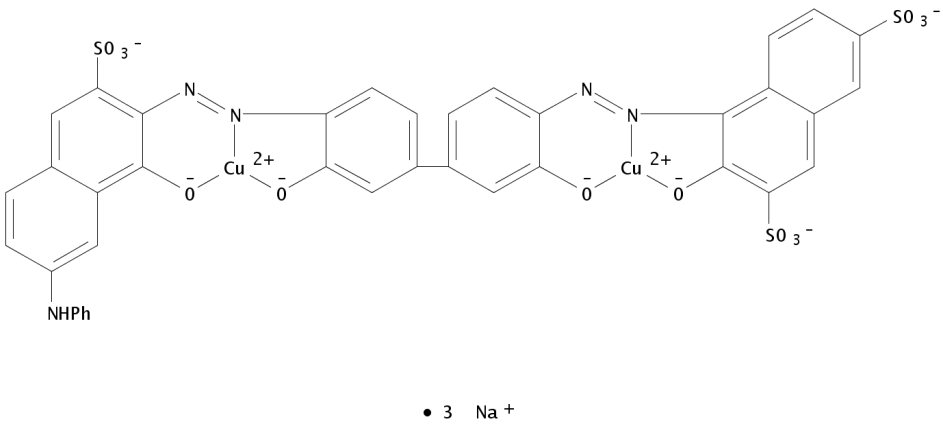
	
Molecular Formula	C32H22Cl2N6O12S4.xNa
Molecular Weight	

Chemical Name in the Inventory and Synonyms	**2,7-Naphthalenedisulfonic acid, 3,3'-[(3,3'-dimethoxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[5-amino-4-hydroxy-, lithiumsodium salt**
CAS Number	83400-08-2
Structural Formula	
Molecular Formula	C34H28N6O16S4.xLi.xNa
Molecular Weight	

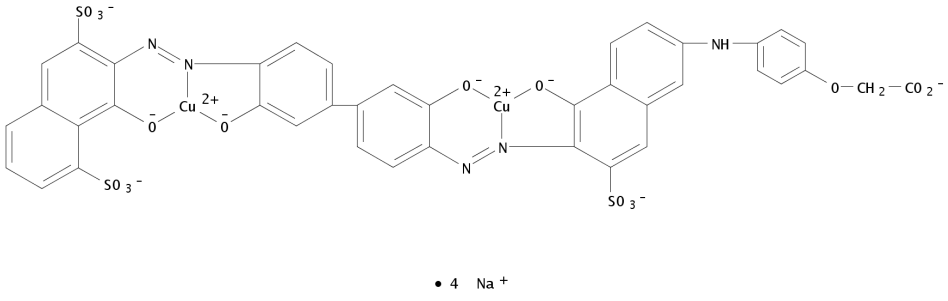
Chemical Name in the Inventory and Synonyms	**Benzoic acid, 5-[[4'-[[6-amino-5-(1H-benzotriazol-4-ylazo)-1-hydroxy-3-sulfo-2-naphthalenyl]azo]-3,3'-dimethoxy[1,1'-biphenyl]-4-yl]azo]-2-hydroxy-4-methyl-, disodium salt**
CAS Number	85153-20-4
Structural Formula	
Molecular Formula	C38H30N10O9S.2Na
Molecular Weight	846.75

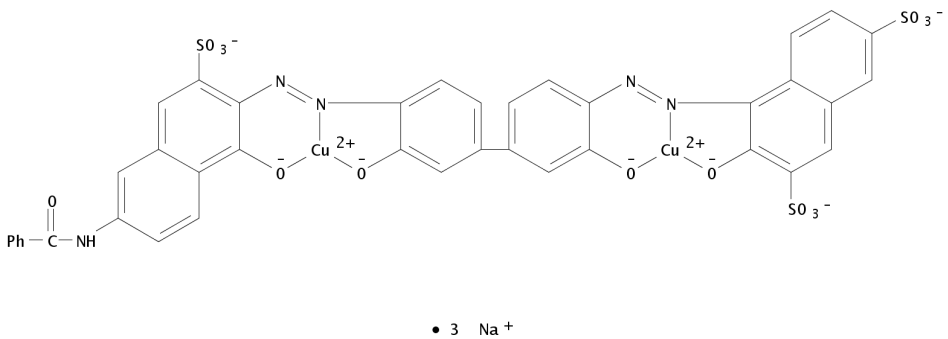
Chemical Name in the Inventory and Synonyms	**Cuprate(4-), [.mu.-[[3,3'-[(3,3'-dihydroxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[5-amino-4-hydroxy-2,7-naphthalenedisulfonato]](8-)]]di-, sodium**
CAS Number	85186-17-0
Structural Formula	

	No Structural Diagram Available
Molecular Formula	Unspecified
Molecular Weight	

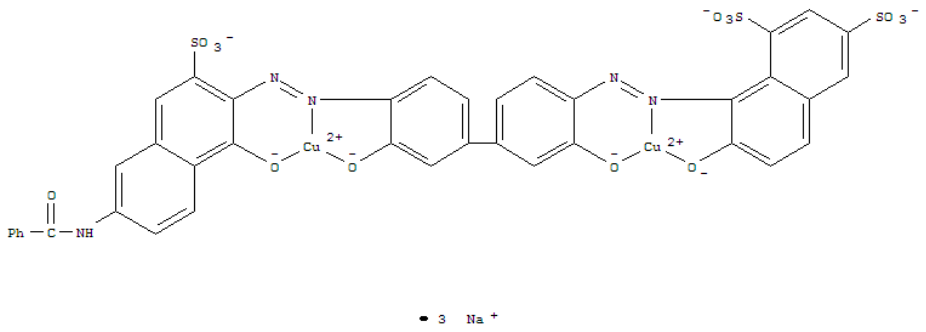
Chemical Name in the Inventory and Synonyms	**Cuprate(3-), [.mu.-[4-[[3,3'-dihydroxy-4'-[[1-hydroxy-7-(phenylamino)-3-sulfo-2-naphthalenyl]azo][1,1'-biphenyl]-4-yl]azo]-3-hydroxy-2,7-naphthalenedisulfonato(7-)]]di-, trisodium**
CAS Number	86437-49-2
Structural Formula	
Molecular Formula	C38H20Cu2N5O13S3.3Na
Molecular Weight	1046.85

Chemical Name in the Inventory and Synonyms	**Cuprate(4-), [.mu.-[[4-[[6-[[3,3'-dihydroxy-4'-[(1-hydroxy-3,8-disulfo-2-naphthalenyl)azo][1,1'-biphenyl]-4-yl]azo]-5-hydroxy-7-sulfo-2-naphthalenyl]amino]phenoxy]acetato(8-)]]di-, tetrasodium**

CAS Number	89899-26-3
Structural Formula	
Molecular Formula	C40H21Cu2N5O16S3.4Na
Molecular Weight	1142.86

Chemical Name in the Inventory and Synonyms	**Cuprate(3-), [.mu.-[4-[[4'-[[6-(benzoylamino)-1-hydroxy-3-sulfo-2-naphthalenyl]azo]-3,3'-dihydroxy[1,1'-biphenyl]-4-yl]azo]-3-hydroxy-2,7-naphthalenedisulfonato(7-)]]di-, trisodium**
CAS Number	89899-27-4
Structural Formula	
Molecular Formula	C39H20Cu2N5O14S3.3Na
Molecular Weight	1074.86

Chemical Name in the Inventory and Synonyms	**Cuprate(3-), [.mu.-[8-[[4'-[[6-(benzoylamino)-1-hydroxy-3-sulfo-2-naphthalenyl]azo]-3,3'-dihydroxy[1,1'-biphenyl]-4-yl]azo]-7-hydroxy-1,3-naphthalenedisulfonato(7-)]]di-, trisodium**

CAS Number	89899-28-5
Structural Formula	
Molecular Formula	C39H20Cu2N5O14S3.3Na
Molecular Weight	

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