Salts of 2,4-toluenediamine: Human health tier II assessment

10 March 2017

Chemicals in this assessment

Chemical Name in the Inventory	CAS Number
1,3-Benzenediamine, 4-methyl-, dihydrochloride	636-23-7
1,3-Benzenediamine, 4-methyl-, hydrochloride	74283-35-5
1,3-Benzenediamine, 4-methyl-, sulfate	74283-36-6

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

This group of chemicals are hydrochloride and sulfate salts of 1,3-benzenediamine, 4-methyl- (or 2,4-toluenediamine, 2,4-TDA) (CAS No. 95-80-7). Although no industrial use information is available for the chemicals, it is expected that they have similar uses to the parent chemical, 2,4-TDA, as intermediates in the manufacture of dyes and plastics. The parent chemical is only slightly soluble in water; however, 2,4-TDA can react with mineral acids such as hydrochloric acid and sulfuric acid to form water-soluble amine salts that increase its utility in processes involving aqueous conditions.

Depending on pH, these chemicals are expected to dissociate in biological systems into the parent chemical, 2,4-TDA, and their respective counterions. The toxicity profiles of these chemicals are expected to be driven by the hazards of the parent chemical.

Import, Manufacture and Use

Australian

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

International

No specific international use, importation, or manufacturing information has been identified for the chemicals.

The following international use information has been identified for the parent chemical, 2,4-TDA, through European Union (EU) Registration, Evaluation and Authorisation of Chemicals (REACH) dossiers; the Organisation for Economic Cooperation and

Development (OECD) Screening Information Data Set Initial Assessment Profile (SIAP); Galleria Chemica; and the United States (US) National Library of Medicine Hazardous Substances Data Bank (HSDB).

The parent chemical, 2,4-TDA, has reported commercial use in food packaging or food contact use on the US FDA list of Indirect Additives Used in Food Contact Substances in the following category: '177.2600: Rubber articles intended for repeated use'.

The chemical has reported site-limited use:

- as an intermediate in the manufacturing of toluene diisocyanate (TDI);
- in the preparation of impact resins, polyamides, antioxidants, hydraulic fluids, urethane foams, fungicide stabilisers and photographic developers;
- in the production of dyes used to colour textile, paper, leather and cellulosic fibres; and
- in spirit varnishes, wood stains, indicators in the manufacturing of pigments and in biological stains.

Restrictions

Australian

These chemicals are considered to be covered by the entry for the parent compound, 2,4-TDA in the *Poisons Standard—the Standard for the Uniform Scheduling of Medicines and Poisons* (SUSMP) in Schedule 10 (SUSMP, 2017) as follows:

Schedule 10:

'2,4-TOLUENEDIAMINE in preparations for skin colouration (including tattooing) and dyeing of eyelashes or eyebrows **except** when included in Schedule 6'.

Schedule 10 chemicals are 'substances, other than those included in Schedule 9, of such danger to health as to warrant prohibition of sale, supply and use'.

International

The parent compound (2,4-TDA) and its salts are listed on the following as '4-methyl-m-phenylenediamine and its salts' (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—Table 1.5;
- Health Canada List of prohibited and restricted cosmetic ingredients (The Cosmetic Ingredient 'Hotlist'); and
- Thailand Cosmetic Act—Prohibited Substances.

The parent chemical is also prohibited in the formulation of hair dye products in the US since 1971 (Galleria Chemica).

The Resolution ResAP(2008)1 on requirements and criteria for the safety of tattoos and permanent make-up (Council of Europe, 2008) lists the parent chemical under the aromatic amines which should not be present in tattoos and permanent make-up products nor released from azo colourants.

Existing Worker Health and Safety Controls

Hazard Classification

The chemicals are not listed on the Hazardous Chemical Information System (HCIS) (Safe Work Australia). However, the parent compound is classified with the following risk phrases for human health in the HCIS (Safe Work Australia):

- Carcinogenicity – category 1B; H350 (May cause cancer);
- Genotoxicity – category 2; H341 (Suspected of causing genetic defects);
- Reproductive Toxicity – category 2; H361 (Suspected of damaging fertility or the unborn child);
- Acute toxicity – category 3; H301 (Toxic if swallowed);
- Acute toxicity – category 4; H312 (Harmful in contact with skin);
- Specific target organ toxicity (repeated exposure) – category 2; H373 (May cause damage to organs through prolonged or repeated exposure); and
- Skin sensitisation – category 1; H317 (May cause an allergic skin reaction).

Exposure Standards

Australian

No specific exposure standards are available.

International

No international exposure standards are available.

Health Hazard Information

Limited data are available for the chemicals. The chemicals are salts of 2,4-toluenediamine (2,4-TDA). The health hazard information for the parent chemical 2,4-TDA is considered to be relevant to these chemicals, and is therefore used in this assessment (NICNAS). The hydrochloride and sulfate salts may produce slightly different properties to 2,4-TDA with respect to local effects, as they are expected to be closer to neutral pH than 2,4-TDA. As a result, data for 2,4-TDA are not considered relevant for these endpoints for the 2,4-TDA salts. In addition, while there can be variations between the chemicals in this group for acute toxicity and local effects, precautions to avoid exposure to the carcinogenic 2,4-TDA base should limit the risk associated with these endpoints.

Toxicokinetics

Limited toxicokinetic data are available for the chemicals. The metabolism of the parent chemical, 2,4-TDA, has been investigated in animal studies.

The parent chemical, 2,4-TDA, is almost completely absorbed when administered orally to rats. It is well absorbed through the skin at 53 % in monkeys and 24 % in humans (EU RAR, 2008; REACH). In rats, the major target tissues are liver and kidneys, following oral (300 mg/kg bw) or intraperitoneal (i.p.) (77 mg/kg bw) administration (EU RAR, 2008).

Only 0.1–3.0 % of the administered dose of 2,4-TDA in rats and guinea pigs was excreted in the unchanged form. The major part of the absorbed dose is metabolised by oxidation or acetylation of the side groups. Major metabolites include: 4-acetylamino-2-aminotoluene; 2,4-diacetylaminotoluene; and 4-acetylamino-2-aminobenzoic acid in the rat; and 4-acetylamino-2-aminobenzoic acid; 4-acetylamino-2-aminobenzoic acid and 2,4-diacetylaminobenzoic acid in the mouse. Other metabolites such as alphahydroxy-2,4-diacetylaminotoluene and alpha-hydroxy-2,4-diaminotoluene have also been identified (EU RAR, 2008).

The primary route of excretion of 2,4-TDA is the urine (64–72 % in rats), with faecal elimination accounting for the majority of the remainder (22–31 % in rats) (REACH). The urinary elimination half-life was 4.6 hours for a 3 mg/kg bw dose and eight hours for a 60 mg/kg bw dose in rats. According to several studies in mice and rats, the renal elimination takes up to 48 hours to complete in both species, but is more rapid and effective in mice (92 % of the intraperitoneally injected dose eliminated in 48 hours) (EU RAR, 2008).

Acute Toxicity

Oral

Based on data available for the parent chemical, 2,4-TDA, the chemicals are considered to have high acute oral toxicity warranting hazard classification (see **Recommendation** section).

The parent chemical, 2,4-TDA, has high acute toxicity based on results from animal tests following oral exposure. The median lethal dose (LD50) in Wistar rats is 73 mg/kg bw in females and 136 mg/kg bw in males. Reported signs of toxicity include poor general appearance, enhanced diuresis (large volume of urine excretion), sedation, diarrhoea and loss of body weight (EU RAR, 2008).

Dermal

Based on data available for the parent chemical, 2,4-TDA, the chemicals are considered to have moderate acute dermal toxicity, warranting hazard classification (see **Recommendation** section).

The parent chemical, 2,4-TDA, has moderate acute toxicity based on results from animal tests following dermal exposure. The median lethal dose (LD50) in rats is 1200 mg/kg bw (EU RAR, 2008). Reported signs of toxicity include slight hyperaemia (excessive blood) in the lungs, discolouration of lungs and liver and increased concentrations of methaemoglobin.

Inhalation

No data are available on the chemicals or the parent chemical, 2,4-TDA. Based on the data available for toluenediamine (TDA, CAS No. 25376-45-8), the chemicals are not considered to cause acute inhalation toxicity.

In a non-guideline study, rats and mice were exposed to 5.57 mg/L of TDA vapour–dust mixture (with a high amount of particles) for four hours. During the observation period of 14 days, no mortalities were recorded. Reported signs of toxicity included laboured breathing (EU RAR, 2006; OECD, 2006).

Corrosion / Irritation

Skin Irritation

No data are available.

Eye Irritation

No data are available.

Sensitisation

Skin Sensitisation

Based on data available for the parent chemical, 2,4-TDA, the chemicals are considered to have potential for skin sensitisation, warranting hazard classification (see **Recommendation** section).

According to a Magnusson Kligman study (OECD TG 406) conducted in guinea pigs with 2,4-TDA used at 0.5 % for intradermal induction and 50 % for topical induction, 10/10 animals had a positive reaction to a 25 % concentration and 5/10 to a 5 % concentration of 2,4-TDA at the challenge phase (EU RAR, 2008).

A local lymph node assay (LLNA) following OECD TG 429 indicated an EC3 (estimated concentration needed to produce a stimulation index of three) of 19 % for 2,4-TDA, indicating that the chemical is a weak skin sensitiser (Vanoirbeek et al., 2009).

Repeated Dose Toxicity

Oral

Based on data available for the parent chemical, 2,4-TDA, the chemicals are considered to cause harmful effects to the liver and kidneys following repeated oral exposure, warranting hazard classification (see **Recommendation** section).

The following effects are reported in repeated dose animal studies conducted with the parent chemical, 2,4-TDA:

- Short-term studies (less than 90 days): The liver is identified as the main target organ for both rats and mice. Toxic effects include decreased body weights, liver damage, increased liver weights (OECD, 2006), decreased blood urea nitrogen levels and centrilobular necrosis in the liver (EU RAR, 2008).
- Long-term studies (between 36 weeks and two years): The observed toxic effects include (but are not limited to) increased mortality rates, decreased body weights, increased liver weights and atrophy of the spleen. Serious damage is recorded for the liver in particular: cholangiofibrosis (fibrosis of the bile ducts), cirrhosis, areas of fatty degeneration, focal necrosis of hepatocytes, cystic bile ducts, cholangitis (infected bilary tract) (EU RAR, 2008). In a two-year study in rats (NCI, 1979),

oral doses of 5.9 and 13 mg/kg bw/day induced general hepatotoxicity (lipidosis, necrosis of hepatocytes and severe cell degeneration), kidney lesions, decreased body weight and survival rate. A lowest observed adverse effect level (LOAEL) of 5.9 mg/kg bw/day was reported in rats based on toxic effects in the liver and kidneys at the lowest dose tested (EU RAR, 2008).

Dermal

No data are available for the chemicals or the parent chemical.

Inhalation

No data are available for the chemicals or the parent chemical.

Genotoxicity

Based on data available for the parent chemical, 2,4-TDA, the chemicals have the potential to be cause genotoxic effects, warranting hazard classification (see **Recommendation** section).

The following results are reported for the in vitro studies conducted using the parent chemical, 2,4-TDA (EU RAR, 2008; REACH):

- Bacterial gene mutation test (according to or similar to OECD TG 471): positive in the presence of metabolic activation in most studies with doses from 20 µg/plate up to 10000 µg/plate.
- Mammalian gene mutation assay (similar to OECD TG 476): negative with and without metabolic activation with doses up to 6000 µg/mL and 10000 µg/mL, respectively.
- Chromosome aberration test (similar to OECD TG 473): positive with and without metabolic activation with doses from 98.5 µg/mL up to 1227 µg/mL, with toxic effects starting at 490.8 µg/mL.
- Sister chromatid exchange assay (similar to OECD TG 479): positive with and without metabolic activation with doses from 468 µg/mL to 4680 µg/mL.
- Unscheduled DNA synthesis (UDS) test (similar to OECD TG 482) in mammalian hepatocytes: positive without metabolic activation with doses from 1.2 µg/mL.
- DNA strand breaks test (non guideline) in mammalian cells: positive with and without metabolic activation with doses from 12.3 µg/mL to 367 µg/mL.
- DNA adduct test (non guideline) in mammalian cells: positive with and without metabolic activation from 3.6 µg/mL to 36.6 µg/mL.

The results of the most relevant in vivo tests with 2,4-TDA are summarised below (EU RAR, 2008; REACH):

- Micronucleus test in rats (similar to OECD TG 474): negative with oral or i.p. doses up to 240 mg/kg bw.
- Transgenic mouse assays (similar to OECD TG 488): oral doses of 80 mg/kg bw/day for 10 days, or 123 mg/kg bw/day for 30–90 days induced mutations in the liver.
- Sister chromatid exchange assay in mice (non-guideline): positive after i.p. injection of 2,4-TDA at 9 and 18 mg/kg bw.
- UDS test in rats (similar to OECD TG 486): DNA damage (positive) in rat liver cells with single doses of 150 and 300 mg/kg bw.

- Dominant lethal test in mice (similar to OECD TG 478): negative after both oral and i.p. administration of 2,4-TDA at 40 mg/kg bw.
- Sex-linked recessive lethal test in *Drosophila melanogaster* (similar to OECD TG 477): positive following oral administration or injection of 2,4-TDA at 611 and up to 2443 µg/mL.

Most in vitro studies gave positive results. Apart from the dominant lethal test in mice, the in vivo studies listed above demonstrate the ability of the parent chemical, 2,4-TDA, to induce mutations in mice and rats. Although the sex-linked recessive lethal test in *D. melanogaster* was positive for germ cell mutations—a major consideration for upgrading the hazard classification, mammalian/rodent in vivo studies, particularly the dominant lethal test in mice, do not provide sufficient information to determine whether 2,4-TDA reached the germ cells to cause the mutations.

Carcinogenicity

Based on data available for the parent chemical, 2,4-TDA, the chemicals have the potential to be carcinogenic, warranting hazard classification (see **Recommendation** section).

The International Agency for Research on Cancer (IARC) has classified the parent chemical 2,4-TDA as a Group 2B carcinogen (possibly carcinogenic to humans based on sufficient evidence of carcinogenicity in animal studies) (IARC, 1978).

The key study for assessment of carcinogenicity is a two-year feeding study of 2,4-TDA in groups of rats and mice (OECD TG 453 with some deviations). The parent chemical 2,4-TDA was found to be carcinogenic for Fischer 344 rats, inducing hepatocellular carcinomas, neoplastic nodules in both sexes and adenomas of the mammary glands in females. Mice were less sensitive to 2,4-TDA, but oral administration induced hepatocellular carcinomas in female mice (NCI, 1979). The LOAEL was reported as 5.9 mg/kg bw/day, based on increased tumour incidence in the liver (male and female rats, female mice) and in the mammary gland (female rats) at this lowest tested dose (EU RAR, 2008).

Other studies conducted on rodents show that oral administration of 2,4-TDA is associated with tumour development in the liver, lungs and mammary glands. The overall results clearly indicate that 2,4-TDA is carcinogenic when administered orally. There are no relevant data available for the other routes of exposure (inhalation and dermal).

Given the positive results for mutagenicity in various systems, the mechanism of tumour induction may be related to the genotoxic potential of 2,4-TDA (see **Genotoxicity** section) (EU RAR, 2008; REACH).

Reproductive and Developmental Toxicity

Based on data available for the parent chemical, 2,4-TDA, the chemicals have the potential to cause reproductive toxicity, warranting hazard classification (see **Recommendation** section).

The toxicity of 2,4-TDA for reproductive functions was investigated through a series of tests conducted on Sprague Dawley male rats by oral administration of 2,4-TDA (non-guideline studies). A preliminary study showed that feeding male rats at 0.1 % concentration of 2,4-TDA for nine weeks (daily intake average = 50 mg/kg bw/day) resulted in reproductive failure characterised by body and testicular weight losses, and arrested spermatogenesis (EU RAR, 2008).

Further studies were focused on the mechanism of toxicity in male rats. After 10 weeks of treatment with 2,4-TDA at 5 or 15 mg/kg bw/day, spermatogenesis was clearly inhibited at the highest dose, possibly due to structural damage to Sertoli cells. The LOAEL was 5 mg/kg bw/day due to the observation of reduced sperm reserves at this dose (EU RAR, 2008).

In a screening assay, pregnant mice were orally administered 2,4-TDA at 150 mg/kg bw/day for seven days. The toxic effects reported include significantly reduced maternal mean body weights, maternal toxicity (mortality 17/50) and significant reduction in live litters (EU RAR, 2008; REACH).

Risk Characterisation

Critical Health Effects

Based on information for the parent chemical, 2,4-TDA (CAS No. 95-80-7) (NICNAS), the chemicals are considered to be carcinogenic and mutagenic, and can cause reproductive toxicity following long-term repeated exposure. The critical health effects for risk characterisation also include systemic acute toxicity from oral and dermal exposure, and harmful effects following repeated oral exposure. The chemicals may also cause skin sensitisation.

Public Risk Characterisation

Given the main use of the parent chemical, 2,4-TDA, as an intermediate to manufacture other chemicals, it is unlikely that the public will be exposed to these chemicals. It is expected that these chemicals will not be present in final consumer products, although they are likely to have properties that would make them useful for applications such as hair dyes.

Many countries such as USA, Canada, New Zealand and the EU have prohibited the use of the parent chemical and its salts in cosmetics. In Australia, the parent chemical, 2,4-toluenediamine, is listed in Schedule 10 of the SUSMP, with prohibition of its use in specific cosmetics products. This entry also includes salts of the parent chemical such as those assessed in this report. Therefore, it is unlikely that the public will be exposed to these chemicals. The chemicals are not considered to pose an unreasonable risk to public health.

Occupational Risk Characterisation

Occupational exposure to the chemicals can occur via dermal contact and inhalation, particularly where manual or open processes are used. These could include transfer or blending activities, quality control analysis, and cleaning and maintaining equipment. 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 chemicals may pose an unreasonable risk to workers unless adequate control measures to minimise dermal and inhalation exposure are implemented. The 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* advises that exposure to carcinogens should be eliminated or minimised as far as reasonably practicable (Safe Work Australia, 2013).

The data available support an amendment to the hazard classification in the HCIS (Safe Work Australia) (refer to **Recommendation** section).

NICNAS Recommendation

Assessment of these chemicals are considered to be sufficient, provided that the recommended amendment to the classification is adopted, and labelling and all other requirements are met under workplace health and safety and poisons legislation as adopted by the relevant state or territory.

Regulatory Control

Work Health and Safety

The chemicals are recommended for classification and labelling aligned with the Globally Harmonised System of Classification and Labelling of Chemicals (GHS) as below. This does not consider classification of physical hazards and environmental hazards.

From 1 January 2017, under the model Work Health and Safety Regulations, chemicals are no longer to be classified under the Approved Criteria for Classifying Hazardous Substances system.

Hazard	Approved Criteria (HSIS)[a]	GHS Classification (HCIS)[b]
Acute Toxicity	Not Applicable	Toxic if swallowed - Cat. 3 (H301) Harmful in contact with skin - Cat. 4 (H312)
Sensitisation	Not Applicable	May cause an allergic skin reaction - Cat. 1 (H317)
Repeat Dose Toxicity	Not Applicable	May cause damage to organs through prolonged or repeated exposure - Cat. 2 (H373)
Genotoxicity	Not Applicable	Suspected of causing genetic defects - Cat. 2 (H341)
Carcinogenicity	Not Applicable	May cause cancer - Cat. 1B (H350)
Reproductive and Developmental Toxicity	Not Applicable	Suspected of damaging fertility or the unborn child - Cat. 2 (H361)

[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 industry

Control measures

Control measures to minimise the risk from oral, dermal, ocular 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 chemicals are used. Examples of control measures that could minimise the risk include, but are not limited to:

- using closed systems or isolating operations;
- using local exhaust ventilation to prevent the chemicals from entering the breathing zone of any worker;
- health monitoring for any worker who is at risk of exposure to the chemicals, 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 chemicals.

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 help meet 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 chemicals 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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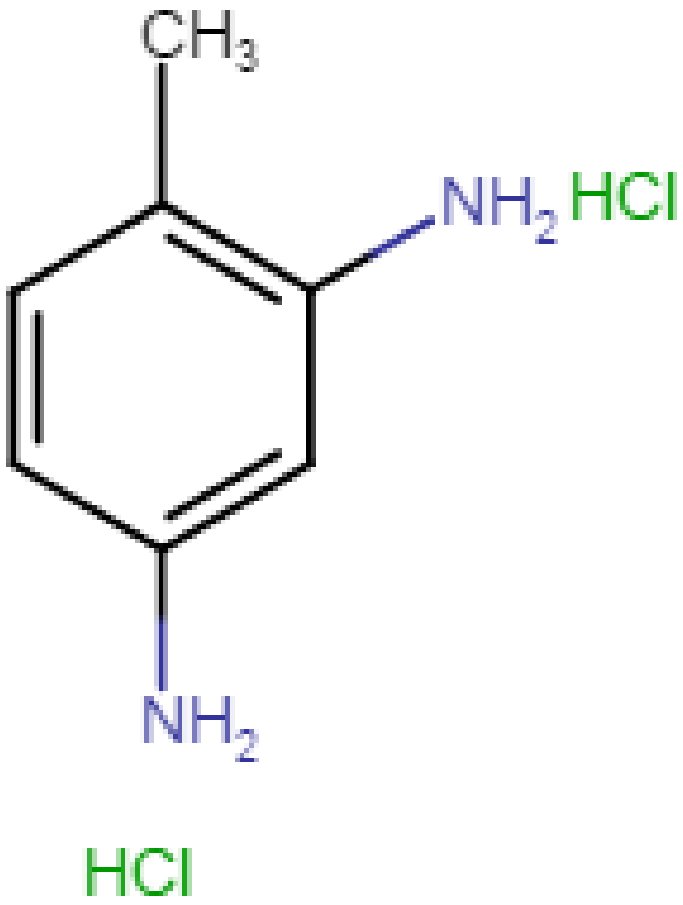
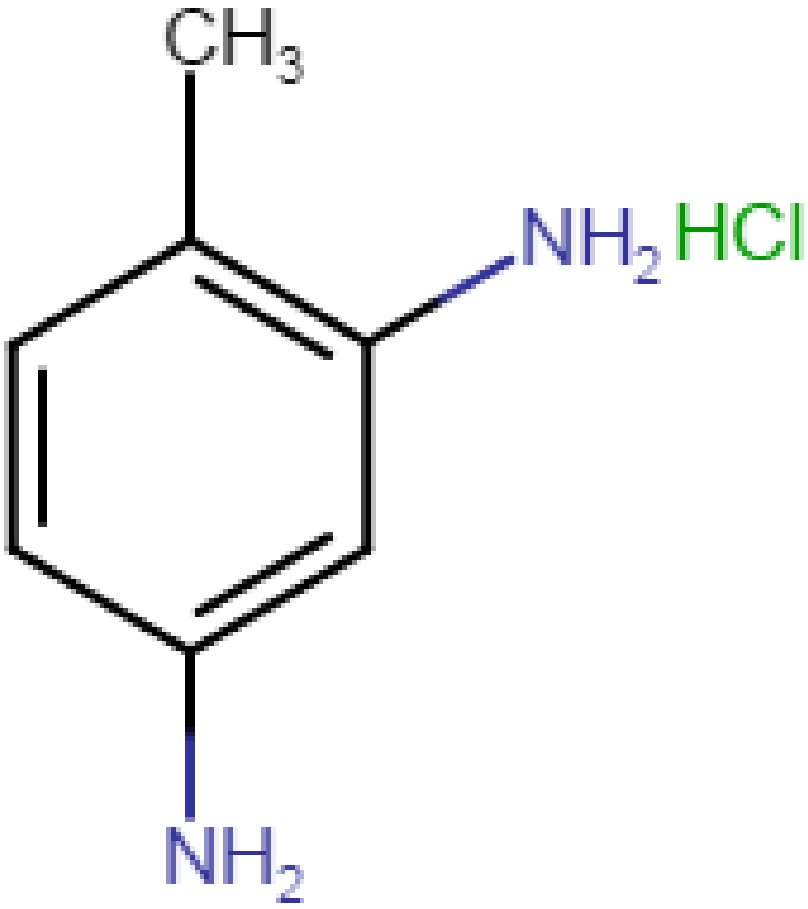
Last Update 10 March 2017

Chemical Identities

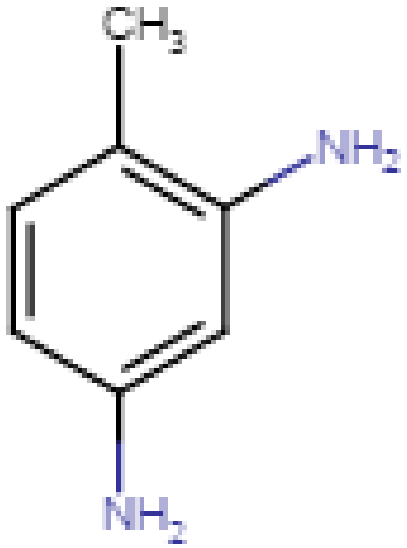
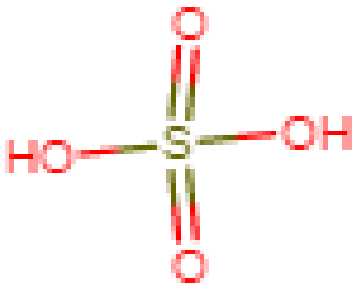
Chemical Name in the Inventory and Synonyms	**1,3-Benzenediamine, 4-methyl-, dihydrochloride** toluene-2,4-diamine, dihydrochloride 2,4-diaminotoluene dihydrochloride 4-methyl-m-phenylenediamine dihydrochloride 2,4-toluenediamine dihydrochloride
CAS Number	636-23-7
Structural Formula	

	
Molecular Formula	C7H10N2.2ClH
Molecular Weight	

Chemical Name in the Inventory and Synonyms	**1,3-Benzenediamine, 4-methyl-, hydrochloride** 4-methyl-m-phenylenediamine hydrochloride 2,4-toluenediamine hydrochloride
CAS Number	74283-35-5
Structural Formula	

	
Molecular Formula	C7H10N2.xClH
Molecular Weight	

Chemical Name in the Inventory and Synonyms	**1,3-Benzenediamine, 4-methyl-, sulfate** 4-methylbenzene-1,3-diamine, sulfuric acid 4-methyl-m-phenylenediamine sulfate 2,4-toluenediamine sulfate
CAS Number	74283-36-6
Structural Formula	

	 
Molecular Formula	C7H10N2.xH2O4S
Molecular Weight	

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