

**UNITED STATES PATENT AND TRADEMARK OFFICE**

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**BEFORE THE PATENT TRIAL AND APPEAL BOARD**

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**ARKEMA FRANCE,**  
*Petitioner*

**v.**

**HONEYWELL INTERNATIONAL INC.**  
*Patent Owner*

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**Case IPR2015-00916**  
**U.S. Patent No. 8,710,282**

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**Exhibit 2001**

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*Hawley's*

# CONDENSED CHEMICAL DICTIONARY

Richard J. Lewis, Sr.

Thirteenth Edition

*Hawley's*  
*Condensed Chemical*  
*Dictionary*

**THIRTEENTH EDITION**

*Revised by*  
Richard J. Lewis, Sr.



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**injection molding.** A plastic-molding operation, introduced approximately 1935, performed in a single machine capable of producing both small articles of complex geometry (combs), and large units that could not be made economically in any other way (auto body parts, tubs, etc.). Though used primarily for thermoplastics, the injection method can be modified to handle thermosets. A simplified description is as follows: (1) A molding powder is fed into the heating chamber of the machine, which holds several times as much material as is necessary to fill the mold. The powder is heated to a viscous liquid. (2) An amount of molding powder that is just sufficient to fill the mold cavity is then forced into the rear of the heating chamber by a plunger, thus injecting an equal amount of liquid plastic from the front of the heating chamber into the mold. (3) The material remains in the mold under high pressure until it cools, and is then ejected. The rheological properties of the fluid plastic are of critical importance, as it must flow readily through the sprue and mold gate and fill the mold uniformly. The amount of material injected into a mold can range from less than 1 ounce to 25 pounds or more. Modern injection-molding machines have many specialized mechanical features and are of impressive dimensions.

Of comparatively recent development is the technique of reaction injection molding, in which a two-part semiliquid resin blend is flowed through a nozzle into the mold cavity, where it polymerizes as a result of chemical reaction. One of the components contains the activating agent or curative; the two parts must be mixed with the greatest care for satisfactory results. Isocyanate resins (urethanes) and epoxy resins are well adapted to this fast, low-energy process.

**ink.** See printing ink; writing ink.

**"Inoc" [Nalco].** TM for bioaugmentation products.

**Use:** Treatment of wastewater for removal of organics.

**inorganic chemistry.** A major branch of chemistry that is generally considered to embrace all substances except hydrocarbons and their derivatives, or all substances that are not compounds of carbon, with the exception of carbon oxides and carbon disulfide. It covers a broad range of subjects, among which are atomic structure, crystallography, chemical bonding, coordination compounds, acid-base reactions, ceramics, and the various subdivisions of electrochemistry (electrolysis, battery science, corrosion, semiconduction, etc.). It is important to state that inorganic and organic chemistry often overlap. For example, chemical bonding applies to both disciplines; electrochemistry and acid-base reactions have their organic counterparts; catalysts and coordination compounds may be either organic or inorganic.

Regarding the importance of inorganic chemistry, R. T. Sanderson has written: "All chemistry is the science of atoms, involving an understanding of why they possess certain characteristic qualities and why these qualities dictate the behavior of atoms when they come together. All properties of material substances are the inevitable result of the kind of atoms and the manner in which they are attached and assembled. All chemical change involves a rearrangement of atoms. Inorganic chemistry [is] the only discipline within chemistry that . . . examines specifically the differences among all the different kinds of atoms."

**inosine.** (hypoxanthine riboside).

CAS: 58-63-9.  $C_{10}H_{12}N_4O_5$ . An important intermediate in animal purine metabolism. Also available as its barium salt.

**Properties:** (Dihydrate) Crystallizes in needles from water. Mp 90C (anhydrous), 218C (decomposes). Levorotatory in solution. Slightly soluble in water; soluble in alcohol.

**Derivation:** By deamination of adenosine.

**Use:** Biochemical research.

**inosinic acid.** (IMP; hypoxanthine riboside-5-phosphoric acid).

CAS: 131-99-7.  $C_{10}H_{13}N_4O_8P$ . An important intermediate in the synthesis and metabolism of animal purines.

**Properties:** Syrup; agreeable sour taste. Freely soluble in water and formic acid; very sparingly soluble in alcohol and ether.

**Derivation:** From meat extract or by enzymatic deamination of muscle adenylic acid.

**Use:** Biochemical research, flavor enhancer.

See sodium inosinate.

**inositol.** (hexahydroxycyclohexane).

CAS: 87-89-8.  $C_6H_6(OH)_6 \cdot 2H_2O$ . A constituent of body tissue. There are nine isomeric forms of inositol (myo-inositol or meso-inositol or specifically the *cis*-1,2,3,5-*trans*-4,6-hexahydroxycyclohexane has vitamin activity).

**Properties:** (l-inositol) White crystals; odorless; sweet taste. Mp 224-227C, d 1.524 (dihydrate), 1.752 when anhydrous, dihydrate melts at 215-216C. Soluble in water; insoluble in absolute alcohol and ether. Stable to heat, strong acid, and alkali. Amounts are expressed in milligrams of inositol.

**Source:** Food source: vegetables, citrus fruits, cereal grains, liver, kidney, heart, and other meats. Commercial source: corn steep liquor by precipitation and hydrolysis of crude phytate.

**Grade:** NF, FCC.

**Use:** Medicine, nutrition, intermediate.

**inositol hexaphosphoric acid.** See phytic acid.

**inositol hexaphosphoric acid ester, sodium salt.** See sodium phytate.

**Impurities:** Oleyl and linoleyl alcohols with some saturated alcohols.

**Use:** Paints, flotation, lubricants; surface-active agents, resins, synthetic fibers.

**linoleyl alcohol.**

$\text{CH}_3(\text{CH}_2)_4\text{CH}:\text{CHCH}_2\text{CH}:\text{CH}(\text{CH}_2)_7\text{CH}_2\text{OH}$ . The fatty alcohol derived from linoleic acid.

**Properties:** Colorless solid. Iodine value 137, d 0.855, cloud point 59F (15C). Combustible.

**Derivation:** Reduction of linoleic acid.

**Available forms:** Available commercially as 50–60% pure alcohol.

**Impurities:** Mostly oleyl alcohol with some linolenyl and saturated alcohols.

**Use:** Paints, flotation, paper, surface-active agents, resins, leather.

**linoleyltrimethylammonium bromide.** An amorphous solid from yellow to very light-brown in color. Soluble in water, alcohol.

**Use:** Germicide, deodorant, algicide, slime control.

**linolic acid.** See linoleic acid.

**linseed cake.** The press cake formed when the seeds are crushed and the oil is extracted. See linseed-oil meal.

**linseed oil.** (flaxseed oil).

CAS: 8001-26-1.

**Properties:** Golden-yellow, amber, or brown drying oil; peculiar odor; bland taste. D 0.921–0.936, iodine value 177, saponification value 189–195, acid number (max) 4 (ASTM D 234-48), flash p 432F (222C), autoign temp approximately 650C (343C), polymerizes on exposure to air. Soluble in ether, chloroform, carbon disulfide, and turpentine; slightly soluble in alcohol; spontaneous heating. Combustible.

**Chief constituents:** Glycerides of linolenic, oleic, linoleic, and saturated fatty acids. The drying property is due to the linoleic and linolenic groups.

**Derivation:** From seeds of the flax plant *Linum usitatissimum* by expression or solvent extraction. Various refining and bleaching methods are used.

**Grade:** Raw, boiled, doubled-boiled, blown, varnish maker's, refined.

See linseed oil, boiled.

**Use:** Paints, varnishes, oilcloth, putty, printing inks, core oils, linings, and packings, alkyd resins, soap, pharmaceuticals.

**Note:** Use of linseed oil in paints has decreased sharply since the introduction of emulsion paints.

**linseed oil, blown.** Linseed oil whose viscosity is increased by air bubbled through it at 93C. The reaction is mainly oxidation followed by polymerization. The resulting product dries to a harder film than heat-bodied oils and is used in interior paints and enamels.

**linseed oil, boiled.** The term is a misnomer since the oil does not boil. Small amounts of driers (e.g., oxides of manganese, lead, or cobalt or their naphthenates, resins, or linoleates) are added to hot linseed oil to accelerate drying. The "boiled oil" becomes thicker and darker.

**linseed oil, heat-bodied.** Linseed oil that has been polymerized by heating at 287–315C. This increases viscosity and acid content and reduces iodine value. Bodied oil dries much faster than unprocessed oil.

**linseed-oil meal.** (linseed cake). The crushed and extracted residue from flaxseed (linseed), generally prepared by crushing the seeds, cooking with steam, and hydraulic expression of the oil. The resulting cake is sold by its protein content.

**linters, cotton.** See cotton linters.

**LINUP.** See laser-induced nuclear polarization.

**linuron.** (generic name for 3-(3,4-dichlorophenyl)-1-methoxy-1-methylurea).

CAS: 330-55-2.  $\text{C}_8\text{H}_7\text{Cl}_2\text{NHC}(\text{O})\text{N}(\text{OCH}_3)\text{CH}_3$ .

**Properties:** Solid. Mp 93–94C. Slightly soluble in water; partially soluble in acetone and alcohol.

**Use:** Herbicide.

**"Lipal" [Drew].** TM for a series of polyoxyethylene esters and ethers of fatty acids.

**Use:** Detergents, emulsifiers, solubilizers, wetting agents, and coupling agents.

**lipase.**

CAS: 9001-62-1. Any of a class of enzymes that hydrolyze fats to glycerol and fatty acids. Lipase is abundant in the pancreas but also occurs in gastric mucosa, in the small intestine, and in fatty tissue. It is found in milk, wheat germ, and various fungi. Commercial pancreatin and most trypsin preparations contain lipase.

**Derivation:** From pork pancreas or calf glands.

**Use:** Manufacture of cheese and similar foods, for removal of fat spots in dry cleaning or grease accumulations, in analytical chemistry of fats because it selectively hydrolyzes only fatty acids on the ends of triglycerides.

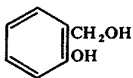
**lipid.** (lipide). An inclusive term for fats and fat-derived materials. It includes all substances that are (1) relatively insoluble in water but soluble in organic solvents (benzene, chloroform, acetone, ether, etc.); (2) related either actually or potentially to fatty acid esters, fatty alcohols, sterols, waxes, etc.; and (3) utilizable by the animal organism. One of the chief structural components of living cells. See phospholipid; fat; fatty acid.

**Lipmann, Fritz.** (1899–1986). A German-born biochemist who won the Nobel Prize in 1953 for the discovery of coenzyme A (CoA). He earned

in 1926. It has yielded a better understanding of the electron and its critical part in chemical bonding than is possible with Newtonian mechanics. In simple language, the orbital theory considers the electron not as a particle but as a three-dimensional wave that can exist at several energy levels; its exact location and position in the "shell" (which in most elements is a group of orbitals) cannot be precisely determined but only predicted by the laws of mathematical probability. The orbital levels and the movement of electrons within them are expressed by wave functions and quantum numbers. The probability that an electron will be found in a given volume (i.e., the square of the one-electron wave function) is called the orbital of that electron, and the shape of the orbital is defined by surfaces of constant probability (i.e., spheres and elliptically shaped doughnuts). The electron orbital, described in terms of probability, is like a cloud, with indefinite boundaries. The energy state of each electron is given by four quantum numbers that describe its principal level, its angular momentum, its magnetic moment, and its spin. This concept has exerted a profound effect on modern ideas about chemical bonding, transition metal complexes, semiconductors, and solid-state physics.

**orcin.** (dihydroxytoluene; methylresorcinol; orcinol).

CAS: 504-15-4.  $\text{CH}_3\text{C}_6\text{H}_3(\text{OH})_2$ .



**Properties:** White, crystalline prisms becoming red in air; intensely sweet, unpleasant taste. D 1.2895, mp (anhydrous) 107°C, (hydrated) 56°C; bp 287–290°C. Soluble in water, alcohol, and ether.

**Derivation:** By fermentation of various species of lichens (rocella) and extraction.

**Use:** Reagent for certain carbohydrates (beet sugar, lignin, pentoses, etc.).

**order of magnitude.** A range of values applied to numbers, distances, dimensions, etc., that begins at any value and extends to 10 times that value; e.g., 2 is of the same order of magnitude as any number between itself and 20; and 5 miles is of the same order of magnitude as any distance between 5 and 50 miles. The expression usually applies to extremely large or extremely small units, i.e., the size ranges of atoms, molecules, colloidal particles, etc., or astronomical distances.

**ore.** An aggregate of valuable minerals and gangue from which one or more metals can be extracted at a profit.

**ore flotation.** See flotation.

**organelle.** A portion of a cell having specific functions, distinctive chemical constituents, and characteristic morphology; it is a unit subsystem of a cell. Examples are mitochondria and chromosomes. Organelles are often closely associated with enzymes. The lysosome (an enzyme-bearing organelle) has been synthesized.

**organic chemistry.** A major branch of chemistry that embraces all compounds of carbon except such binary compounds as the carbon oxides, carbides, carbon disulfide, etc.; such ternary compounds as the metallic cyanides, metallic carbonyls, phosgene ( $\text{COCl}_2$ ), carbonyl sulfide ( $\text{COS}$ ), etc.; and the metallic carbonates, such as calcium carbonate and sodium carbonate. The total number of organic compounds is indeterminate, but some 6,000,000 have been identified and named. These fall into several structural groups as follows:

- I. Aliphatic (straight chain)
  1. Hydrocarbons (petroleum and coal derived)
    - (a) Paraffins or alkanes (saturated) ( $\text{C}_n\text{H}_{2n+2}$ ) methane and homologs; halogen-substituted derivatives, e.g., fluorocarbons
    - (b) Olefins (unsaturated)
      - (1) Alkenes (one double bond) ( $\text{C}_n\text{H}_{2n}$ ) ethylene and homologs
      - (2) Alkadienes (two double bonds) ( $\text{C}_n\text{H}_{2n-2}$ ) butadiene, allene
    - (c) Acetylenes or alkynes (triple bond)
  2. Alcohols (ROH): methanol and homologs
  3. Ethers (ROR): methyl ether and homologs
  4. Aldehydes (RCHO): formaldehyde, acetaldehyde
  5. Ketones (RCOR): acetone, methyl ethyl ketone
  6. Carboxylic acids ( $\text{RCOOH}$ )
  7. Carbohydrates ( $\text{C}_n\text{H}_{2n}\text{O}_n$ )
    - (a) Sugars: glucose, fructose, sucrose, gums
    - (b) Starches: wheat, corn, potato
    - (c) Cellulose: cotton, plant fibers
- II. Cyclic (closed ring)
  1. Alicyclic hydrocarbons (properties similar to aliphatics)
    - (a) Cycloparaffins (naphthenes) (saturated): cyclohexane, cyclopentane, etc.
    - (b) Cycloolefins (unsaturated): cyclopentadiene, cyclooctatetraene
    - (c) Cycloacetylenes (triple bond)
  2. Aromatic hydrocarbons (arenes): unsaturated compounds; hexagonal ring structure; single and multiple fused rings
    - (a) Benzene group (1 ring)
    - (b) Naphthalene group (2 rings)
    - (c) Anthracene group (3 rings)
    - (d) Polycyclic group (steroids, sterols)
  3. Heterocyclic: unsaturated; usually pentagonal rings containing at least one other element besides carbon
    - (a) Pyrroles
    - (b) Furans
    - (c) Thiazoles

- (d) Porphyrins
- III. Combinations of aliphatic and cyclic structures
  1. Terpene hydrocarbons
  2. Amino acids (some are aliphatic and others combinations)
  3. Proteins and nucleic acids (coiled or helical formations)
- IV. Organometallic compounds
- V. Synthetic high polymers, including silicones

Important areas of organic chemistry include polymerization, hydrogenation, isomerization, fermentation, photochemistry, and stereochemistry. There is no sharp dividing line between organic and inorganic chemistry; the two often tend to overlap. See inorganic chemistry.

**"Organiclear" [Standard].** (methylene bis-thiocyanate).  
 CAS: 6317-18-6. TM for wood preservative.  
 Use: To stop wood rot, termite attack, mildew, and decay.

**organoborane.** A compound composed of an unsaturated organic group and a borane obtained by the hydroboration reaction. Such compounds are useful catalytic reagents in organic syntheses of some complexity, e.g., *cis*- or *trans*-olefins, optically pure alcohols, alkanes, and ketones. Prostaglandins and insect pheromones have been synthesized by this means. A particularly versatile example is triphenylboron,  $B(C_6H_5)_3$ . See hydroboration; carborane; borane.

**organoclay.** (organopolysilicate). A clay such as kaolin or montmorillonite, to which organic structures have been chemically bonded; since the surfaces of the clay particles, which have a latticelike arrangement, are negatively charged, they are capable of binding organic radicals. When this type of structure is in turn reacted with a monomer such as styrene, a complex known as a polyorganosilicate graft polymer results.

**organoleptic.** A term widely used to describe consumer testing procedures for food products, perfumes, wines, and the like in which samples of various products, flavors, etc. are submitted to groups or panels. Such tests are a valuable aid in determining the acceptance of the products and thus may be viewed as a marketing technique. They also serve psychological purposes and are an important means of evaluating the subjective aspects of taste, odor, color, and related factors. The physical and chemical characteristics of foods are stimuli for the eye, ear, skin, nose, and mouth, whose receptors initiate impulses that travel to the brain, where perception occurs.

**organometallic compound.** An organic compound composed of a metal attached directly to carbon (RM); such compounds have been prepared of

practically all the metals, as well as with such non-metals as silicon and phosphorus. Metallic salts (soaps) of organic acids are excluded. Examples are diethylzinc (the first known organometallic), Grignard compounds such as methyl magnesium iodide ( $CH_3MgI$ ), and metallic alkyls such as butyllithium ( $C_4H_9Li$ ), tetraethyllead, triethyl aluminum, tetrabutyl titanate, sodium methylate, copper phthalocyanine, and metallocenes. Some are highly toxic or flammable; others are coordination compounds.

Reactive and moderately reactive organometallic compounds will react with all functional groups; two major types of reaction in which they are involved are oxidation and cleavage by acids. Probably the most important organometallic reactions are those involving addition to an unsaturated linkage. Many of them are powerful catalysts and form useful coordination complexes.

See catalysis; metallocene; coordination compound.

**organophosphorus compound.** Any organic compound containing phosphorus as a constituent. These fall into several groups, chief of which are the following: (1) phospholipids, or phosphatides, which are widely distributed in nature in the form of lecithin, certain proteins, and nucleic acids; (2) esters of phosphinic and phosphonic acids, used as plasticizers, insecticides, resin modifiers, and flame-retardants; (3) pyrophosphates, e.g., tetraethyl pyrophosphate, which are the basis for a broad group of cholinesterase inhibitors used as insecticides; (4) phosphoric esters of glycerol, glycol, sorbitol, etc., which are components of fertilizers. While many of these compounds play an important part in animal metabolism, those in group (3) are toxic and should be handled with extreme care.

**organopolysilicate.** See organoclay.

**organosilane.** See organosilicon.

**organosilicon.** An organic compound in which silicon is bonded to carbon (organosilane). Such compounds were first made by Friedel and Crafts in 1863. Silicon was found to have a remarkable chemical similarity to carbon, which it can replace in organic compounds. The silicon-carbon bond is about as strong as the carbon-carbon bond, and compounds containing them are similar in properties to all-carbon compounds. Organosilicon oxides (organosiloxanes or silicones) were discovered by F. S. Kipping in England in 1900; he found that Grignard reagents would react with silicon tetrachloride to form silicon-carbon-bonded polymers of both ring and chain types. These were named silicones because of the similarity of their empirical formula ( $R_2SiO$ ) to that of ketones ( $R_2CO$ ).

An organosilicon compound (tetramesityldisilene) containing a silicon to silicon double bond has been synthesized. It is a crystalline solid, mp 176C, and