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Wood Preservatives

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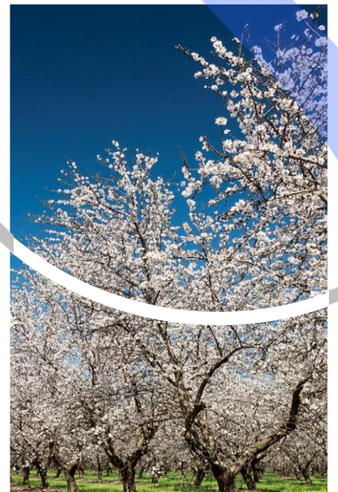

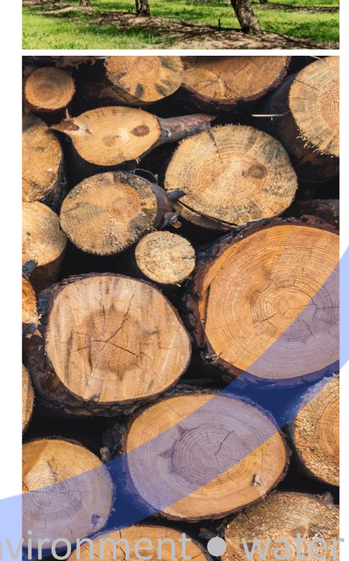

Wood Preservatives[1]

Wood preservation is the pressure or thermal impregnation of chemicals into wood to provide effective long-term resistance to attack by fungi, bacteria, insects, and marine borers. By extending the service life of timber products, wood preservation reduces the need for harvest of already stressed forestry resources, reduces operating costs in industries such as utilities and railroads, and ensures safe working conditions where timbers are used as support structures. However, the chemicals used for preservation often have negative impacts on human health and the environment.

There are two general classes of wood preservatives: oils, such as creosote and petroleum solutions of pentachlorophenol (PCP); and waterborne salts that are applied as water solutions, such as chromated copper arsenate (CCA).

Creosote[2]

Creosote is a wood preservative used for commercial purposes only (i.e., telephone poles and railroad ties). This compound is manufactured by the distillation of coal tar and is composed of numerous chemicals with varying physical characteristics. Polycyclic aromatic hydrocarbons (PAHs) are its primary constituents. Exposure to PAHs may cause harmful health effects.

Chromated Copper Arsenate[2]

Chromated copper arsenate (CCA) is a chemical wood preservative containing chromium, copper, and arsenic. This mixture commonly contains chromium(VI) (hexavalent chromium) as chromic acid, arsenic(V) (pentavalent arsenic) as arsenic pentoxide, and copper(II) (divalent copper) as cupric oxide, often in an aqueous solution or concentrate. The copper serves as the primary fungicide, the arsenic serves as a fungicide and insecticide, and chromium fixes the copper and arsenic in the wood. CCA has been used in pressure-treated wood since the 1940s to protect wood from rotting due to decay-causing insects and microbial agents. Since the 1970s, the majority of the wood used in outdoor residential settings has been CCA-treated wood. Since December 31, 2003, the United States Environmental Protection Agency (EPA) has classified CCA as a restricted-use product, and pressure-treated wood containing CCA is no longer being produced for use in most residential settings, including decks and playsets.

Pentachlorophenol[3]

Pentachlorophenol (PCP) has been used for many years as a preservative in the wood treatment industry. It is a manufactured substance not occurring naturally in the environment. PCP was formerly one of the most heavily used pesticides in the United States. Today its purchase and use is restricted to certified applicators, and it is used industrially as a wood preservative for power line poles, fence posts, etc. Commercial grade PCP used for treating wood is a mixture of many related compounds.

Sources:
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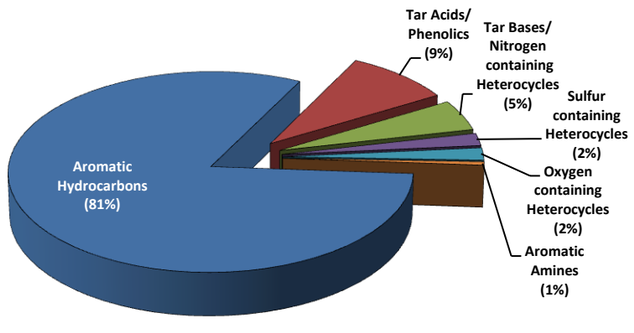
2. http://www.clu-in.org/issues/default.focus/sec/Wood_Treater_Sites/cat/Overview/
3. http://www.princeton.edu/~ota/disk1/1995/9509/950904.PDF
4. http://www.gsi-net.com/en/publications/gsi-chemical-database/list.html
5. Melber, C., et al., (2004). COAL TAR CREOSOTE. World Heath Organization. (http://www.who.int/ipcs/publications/cicad/en/CICAD62.pdf)
6. Crosby, D.G.,(1981). Environmental Chemistry of Pentachlorophenol. Pure and Applied Chemistry, Vol. 53, pp 1051-1080

Properties of Wood Preservatives[4]

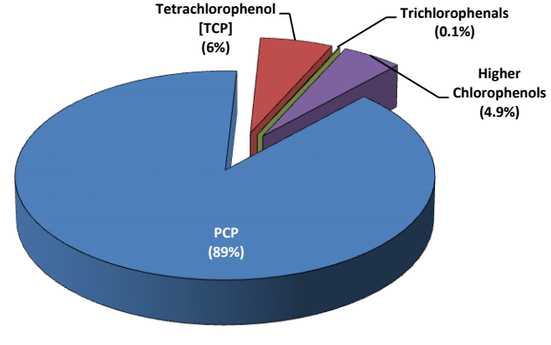
Compound	Volatility (mm Hg)	Sorption (Log K_{oc}) (unitless)	Log K_{ow} (unitless)	Solubility (mg/L)	Henry's Constant (atm-m^3/mole)	Regulatory Levels	
						CA MCL (µg/L)	US MCL (µg/L)
PCP	$1.7x10^{-5}$	2.61	4.74	14	$1.2x10^{-5}$	1	1
p*-Cresol	0.13	1.91	2.06	23,000	$4.0x10^{-5}$	-	-
Phenol*	0.46	1.24	1.51	87,000	$2.5x10^{-5}$	-	-
Naphthalene*	0.089	3.19	3.17	31.4	0.02	-	-
Chrysene*	$7.8x10^{-9}$	5.49	5.52	0.002	$5.0x10^{-5}$	-	-
Hexavalent Chromium#	-	1.15	-	-	-	10	-
Arsenic#	-	1.40	0.68	-	-	10	10
Copper#	-	1.60	-0.57	-	-	1,300	1,300

Notes: K_{ow} = octanol-water partition coefficient; K_{oc} = organic carbon partition coefficient; MCL = maximum contaminant level; * = components of creosote; # = components of Chromated Copper Arsenate

Composition of Creosote[5]



Composition of PCP[6]



Additional Chemicals Found In Pentachlorophenol[6]

Compound		Range in Concentration (ppm)	Typical Concentration (ppm)
1,2,3,4-Tetrachlorodibenzo-*p*-dioxin	**1,2,3,4-TCDD**	< 0.02 - 1.25	< 0.02
Polychlorinated Dibenzodioxine	**PCDD**	< 0.03 - 0.08	< 0.03
Heptachlorodibenzo-*p*-dioxin	**HCDD**	< 0.03 – 38	4.2
1,2,3,4,6,7,8-Heptachlorodibenzo-*p*-dioxin	**HpCDD**	0 – 870	54
Octachlorodibenzo-*p*-dioxin	**OCDD**	0 – 3,300	210
2,3,7,8-Tetrachlorodibenzofuran	**TCDF**	< 0.02 - 0.9	< 0.02
Polychlorinated Dibenzofuran	**PCDF**	< 0.03 – 0.65	0.10
Heptachlorodibenzofuran	**HCDF**	< 0.03 – 39	23
1,2,3,4,6,7,8-Heptachlorodibenzofuran	**HpCDF**	< 0.03 – 320	160
Octachlorodibenzofuran	**OCDF**	< 0.03 – 300	140

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