

COPPER NAPHTHENATE AS A WOOD PRESERVATIVE

by

Richard W. Hein
MOONEY CHEMICALS, INC.
Cleveland, Ohio
USA

INTRODUCTION

Copper naphthenate is one of a class of compounds called metal soaps, which exhibits broad fungicidal activity, along with zinc naphthenate. Naphthenic acids are naturally-occurring organic acids extracted from petroleum. Copper naphthenate has been used as a general purpose, heavy-duty fungicide for a variety of wood and fiber products around the world since the turn of the century. Recent examples of copper naphthenate pressure-treated wood products in the U.S. are presented. The status of copper naphthenate in the AWWA standards is discussed.

DISCUSSION

Copper naphthenate has been made by Mooney Chemicals since 1946 by reacting copper with hot naphthenic acids. In the mid-forties, according to AWWA statistics, copper naphthenate was mixed with creosote (50-50) to treat over 1.5 million utility poles during a creosote shortage. Examples of these poles have been found in service in Alabama. Analyses showed that the copper naphthenate is still there.

Copper naphthenate is usually sold as a 6 % or 8 % copper concentrate. It is soluble in most organic solvents, but insoluble in water. Here are some properties of interest:

- Amorphous glass in the absence of solvent
- Non-volatile
- Non-conductive (8×10^{11} ohms/cc)
- Non-corrosive to steel, aluminum and many other metals.

Note: Under certain acidic conditions, the copper will displace the zinc on galvanized metal.

- The water solubility is about 2 ppm as copper
- Reacts with many acids to produce copper salts and free naphthenic acid.

Copper naphthenate is considered to be a low hazard material. It has a high LD_{50} of 6500 mg/kg. It is not considered to be carcinogenic. It is not listed as a hazardous waste or a restricted-use pesticide. It is available over-the-counter (usually as a 2 % copper solution in mineral spirits) in many countries. Copper naphthenate is recommended for such sensitive uses as beehives, seed flats, fish nets, and horses hoofs.

Recently, in the U.S., copper naphthenate has been used for the pressure treatment of utility poles, fence posts, lumber and timbers. Niedermeyer-Martin in Ridgefield, Washington has been treating Douglas fir poles for a variety of utilities. A point of interest is that good heartwood treatment was achieved in deep-incised and thru-bored poles. Permapost in Hillsboro, Oregon has been treating Douglas fir lumber, cross-arms, and timbers and Lodgepole posts. In Missouri there are currently six treaters treating southern pine and various hardwood posts and timbers. Most of these treaters use an AWWA P9A oil (either a Medium Aromatic Treating Oil or No. 2 Fuel Oil), except that Permapost uses both P9A and P9C solvents. In Louisiana, one small treater has been treating posts, timbers, and lumber with water-borne copper naphthenate. In California, McCormick and Baxter is treating utility poles using butane (P9B) as the solvent.

The AWWA is in the process of adding copper naphthenate to the Commodity standards. Copper naphthenate has been in the Preservative, Analytical, and General AWWA standards for decades. The general approach to adding copper naphthenate to the Commodity standards is to specify the assay zones, penetration requirements, and treating conditions as being identical to those specified for penta. The main differences between the Commodity standards for copper naphthenate and for penta are the solvency requirement for penta and the retentions. The Preservative Committee P-3 recommends the following retentions:

	Minimum Retentions of CuNap as Cu	
	pcf	kg/m ³
Lumber and Timbers:		
Above Ground	0.040	0.644
Soil Contact	0.060	0.966
Poles	0.075 0.060*	1.208 0.966*
Posts	0.050	0.805
Piles (Fresh Water, Land, and Foundation)	0.075	1.208
Ties	0.050	0.805

* SYP only

The current status of copper naphthenate in the Commodity standards is as follows:

AWPA Standard	Product	Species	Min. Retention pcf Copper
C2	Lumber, Timbers:	Above Ground SYP	0.040
		Soil Contact SYP	0.060
C4	Poles	SYP	.060, .080, .130
		Doug. fir	.075, .095, .150
		WRC	0.120
C5	Posts	SYP	0.055
		Doug. fir	0.055
		Lodgepole pine	0.055
C7	Pole Butts (Thermal)	WRC	0.150
C8	Poles (Thermal)	WRC (mid-point)	0.050
		(groundline)	0.150
C25	Cross Arms	SYP	0.040, 0.060
		Doug. fir	0.040, 0.050

The C2 and C5 items have full AWPA approval, but the other items still have to pass several levels of approval. If all goes well full approval should be finalized next summer.

CONCLUSIONS

Copper naphthenate is a well-established, proven, broad-spectrum, ground-contact wood preservative. The expanded usage of copper naphthenate is attracting interest worldwide because of its safety and low toxicity. In the last two years in the U.S., ten pressure treaters have started using copper naphthenate in a variety of solvents. The AWPA has added copper naphthenate to several standards and is in the process of adding more.

REFERENCES

- Asmus, R.W., W.C. Kelso, Jr., and R.W. Hein, "Copper Naphthenate, a Proven Wood Preservative", Proceedings of the Eighth Wood Pole Institute, pp. 137-149, July, 1985. ed. by C.E. Shuller.
- Curwen, M.D., "Naphthenates in Wood and Fabric Preservation", Oil and Color Journal, January, 1946, pp. 82-86.
- Grove, S.L., "Copper Naphthenate: an Alternative Wood Preservative", presented at the 41st Annual Meeting of the Forest Products Research Society, June, 1987.
- Higaki, M., T. Suzuki, and T. Iijima, "Wood Preserving Performance of Emulsified Metal Naphthenates", Journal of Antibacterial and Antifungal Agents (Japan), Vol. 15, No.8, pp. 381-430 (1987).
- Minich, A. and M. Goll, "Technical Aspects of Copper Naphthenate as a Wood Preservative", AWPA Proceedings, 1948, pp. 72-81.