Comparative Gaff and Pilodyn Testing of DCOI-A and Pentachlorophenol Treated Pole Sections

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ABSTRACT

In many regions of the United States and Canada utility companies are making increasing use of boom/bucket trucks for above ground line/equipment maintenance, but physical climbing of poles by lineman is still necessary and indeed preferred in some circumstances. It is well established that poles treated with oil-borne preservative systems such as pentachlorophenol (penta) are considered by linemen to be safer and easier to climb than water-borne preservative systems such as CCA. DCOI-A in an HSA solvent system was recently standardized by AWPA as an alternative to penta for utility poles and there is a need for data that demonstrate if this new system will have any impact on pole climbability.

The climbability of the DCOI-A treatment in southern pine was compared to penta using gaff and pilodyn pin penetration measurements. Pole sections were quartered, with different sections of the same poles treated with either DCOI-A or penta in an HSA solvent system. CCA was included as a "harder-to-climb" reference system. Results from "slide-hammer gaff" penetration and pilodyn pin penetration tests showed there was no difference in the depth of penetration into DCOI-A and penta treated pole sections. Results from both test methods revealed that gaff and pilodyn pin penetration into the oil-borne treated samples were about 20-25% deeper than in the matched CCA treated pole sections.

Keywords: DCOI-A, pentachlorophenol, gaff penetration, pilodyn, pole climbability

INTRODUCTION

DCOI-A is a recently developed and AWPA standardized preservative treatment for utility poles. It is an oil-based preservative system that uses similar carrier systems to that of pentachlorophenol (penta). Linemen are sometimes required to climb utility poles, and utilities are concerned that new preservative systems do not provide any unexpected problems for their linemen due to different climbing characteristics. CCA treated poles are considered to be harder to climb than oil-type treated poles such as penta in an HSA solvent system, and additives are often added to CCA treatments to improve climbability characteristics (Trumble and Messina, 1985). To assess the climbability of poles treated with DCOI-A, a laboratory study was conducted to compare the ease of penetration in matched DCOI-A, penta, and CCA treated post sections, using both a pilodyn and a "slide-hammer" gaff penetration device (IRG-WP 00-20187).

MATERIALS AND METHODS

Four southern pine pole off-cuts (18-22 cm diameter) were cut to provide two to three each end-matched sections 46 cm long. These sections were then quartered longitudinally, with three of the quarter-rounds from each end-matched section designated for one of the three different preservative treatments. Sections were staggered between the end-matched sections so that replicate treatments were from different faces on the original poles. This provided ten replicate quarter-round sections from each treatment for testing, which were end-sealed prior to treatment.

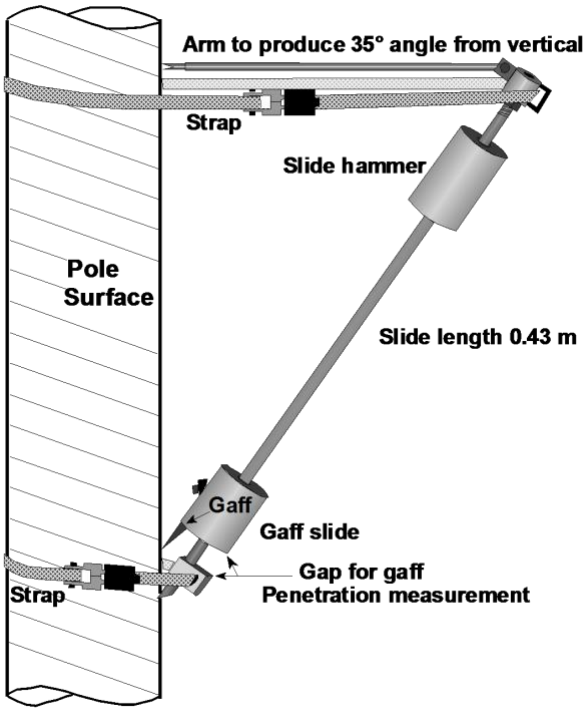
The three treatments were:

1) CCA-C at 1.7% actives using a full cell treatment cycle
2) Pentachlorophenol at 7.4% in an HSA solvent system using a heavily modified treatment cycle
3) DCOI-A at 2.45% in an HSA solvent system using a heavily modified treatment cycle

After treatment the samples were allowed to air-dry for 5 weeks and then conditioned to constant weight in a temperature/humidity-controlled chamber (12% EMC conditions) before testing with the "slide-hammer" gaff and pilodyn.

Each quarter-round section was tested in four separate areas for depth of pin penetration using a 6-joule pilodyn (2.5 mm pin), as well as the depth of gaff penetration using a "slide-hammer" gaff for both a first and second hit. Areas of sampling were distributed over the quarter-round sections to be clear of knots, checks, or other irregularities. The specifics of the "slide-hammer" gaff testing apparatus has been described in detail previously (Zahora, 2000) and consists of a lineman's gaff at a 35° angle from vertical that is hit with a sliding weight and driven into the post surface (Figure 1). Statistical comparisons comparing the averages of the four replicate samplings from each matched quarter-round post section were conducted using an ANOVA randomized block design.

Figure 1. Diagram of the "slide hammer" gaff penetration device used to measure the depth of penetration of a lineman's gaff after being hit with a reproducible force by a sliding weight and photo of apparatus used testing the quarter-round pole sections.



RESULTS AND DISCUSSION

The quarter-round post sections treated with 1.7% CCA had an average solution uptake of 524 kg/m3 representing an average retention of 8.9 kg/m3 actives. The matched sections treated with 7.4% pentachlorophenol in the HSA solvent system had an average solution uptake of 137 kg/m3, representing an average retention of 10.1 kg/m3, while the sections treated with DCOI-A in the HSA solvent had an average solution uptake of 139 kg/m3 and 3.42 kg/m3 of actives. These retentions are higher than typical for southern pine poles, although were useful to determine if the actives would in any way influence climbability characteristics.

The averages of the four replicate slide-hammer gaff and pilodyn pin penetration measurements for each post section are shown in Table 1, along with their overall average for each preservative treatment. Statistical analysis (ANOVA randomized block design, Table 2) determined that there was no statistical difference in the depth of penetration by either test method between the posts treated with DCOI-A and penta, with both of them statistically greater by about 20-25% than that observed in the CCA treated posts. Treatment of southern pine poles with DCOI-A should result in poles with climbability characteristics equivalent to that for penta treated poles using similar carrier systems.

Table 1. Penetration results for the slide-hammer gaff and pilodyn pin penetration measurements as the average of four replicate measurements for each quarter-round post section sample.

Post ID					Slide-Hammer Gaff Penetration (mm)						Pilodyn		
		¼ Round Section			First Hit			Second Hit			Pin Penetration (mm)		
Post	Seg	CCA	Penta	DCOI	CCA	Penta	DCOI	CCA	Penta	DCOI	CCA	Penta	DCOI
1	A	A	C	B	9.3	10.7	11.2	12.3	14.7	15.4	15.4	16.6	17.6
1	B	C	A	D	9.7	10.4	10.6	12.9	14.5	14.3	13.6	18.0	16.1
2	A	A	C	B	10.0	9.8	11.2	13.1	14.2	16.1	13.4	14.1	17.1
2	B	C	A	D	9.2	11.6	11.5	12.0	16.2	16.2	12.3	16.0	16.1
2	C	B	D	C	8.8	11.2	12.0	11.9	15.7	16.5	13.3	16.8	16.5
3	A	A	C	B	9.0	10.0	10.5	12.1	13.9	14.0	12.9	17.1	15.6
3	C	C	A	D	9.2	10.5	10.9	11.9	14.4	14.8	11.9	17.3	15.4
4	A	A	C	B	9.3	11.7	12.5	12.6	16.3	17.2	16.4	17.9	21.3
4	B	C	A	D	9.9	11.5	11.9	13.0	16.0	16.2	16.5	18.9	19.8
4	C	B	D	C	9.2	11.5	10.9	12.4	15.8	15.0	17.3	20.6	19.8
				Average =	**9.4**	**10.9**	**11.3**	**12.4**	**15.2**	**15.6**	**14.3**	**17.3**	**17.5**
				Compared to CCA =		**117%**	**121%**		**122%**	**125%**		**121%**	**123%**

Table 2. Statistical analysis (ANOVA, randomized block design) of the slide-hammer gaff and pilodyn pin penetration measurements for the three treatments of matched quarter-round pole sections.

	ANOVA RBD	Treatment Mean Penetration			Critical Range α=0.05 Difference of means	
	F	CCA	Penta	DCOI-A	1	2
Slide-Hammer Gaff						
1st Hit	39.5	9.35	10.90	11.33	0.49	0.52
2nd Hit	64.2	12.43	15.16	15.59	0.64	0.67
Pilodyn	30.7	14.28	17.33	17.53	0.98	1.03

REFERENCES

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