Experience on impregnation of wooden poles with water borne salts

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The paper briefly describes the experience of the Ethiopian Electric Light and Power Authority in treatment of wooden poles used for over-head power transmission. Two types of treatment methods have been tried by the Authority. They are:

1. *the COBRA treatment method*
2. *the FULL CELL treatment method*

The first treatment method has been discontinued in favour of the FULL CELL treatment for both technical and economical reasons.

Eucalyptus globulous being a widely spread tree in Ethiopia has been in use in the construction of distribution over head network up to 15 kV.

It is known that termites attack a pole at any point below the ground line and the decay of poles due to fungal attack invariably commences at the ground line where conditions of development for rot fungus are optimum. Such decay may continue to a depth of 30 - 40 cm below ground line and to a height of 10 - 15 cm. above ground line.

To minimize the decay of poles due to termite and fungal attack and thereby lengthen the service life, the Authority initiated the use of water borne preservative in 1960 when treatment of some implanted poles was made with COBRA salt - a compound of sodium fluoride, dinitrophenol and arsenious oxide.

The treatment of implanted poles is primarily intended to protect that portion which is most vulnerable to attack, i.e. the portion of the pole 30 - 40 cm below and above the ground line. The method employed in the COBRA treatment is to excavate the filling material around an implanted pole up to a depth of about 40 cm and inject a paste of COBRA salt into the pole by means of a hand pump through an injection needle. The treated portion is then tarred and the excavation refilled and tamped. Such injection may take up from 300 - 500 grams of the preservative per pole. The cost of the preservative in 1960 was over Eth. $17 per kg delivered CIF Ethiopian port.

The penetration and diffusion of the preservative is dependent upon the moisture content of the part of pole treated. To ensure this diffusion of the preservative all around, the pole is pricked every 8 - 10 cm. vertically and 4 - 5 cm peripherally. The treatment with COBRA was discontinued soon after for the following reasons:-

1. **Leechability**

Since the process depends on osmosis, the preservative must be highly soluble in water and rains may wash it away.

2. **Diminished Mechanical Strength**

Pricking of the pole at and around the ground line will diminish the mechanical strength of the pole.

3. **Cost**

Most important of all, the cost of the preservative was excessively high (Eth.$5 - 8.50 per pole).

(All poles treated with COBRA have decayed and have been removed in 1965 and 1966)

Investigations revealed the establishment of a treating plant where the FULL CELL method can be employed to be more suitable. In June 1961 the plant was acquired from Sweden and treating of poles commenced using a water borne preservative commonly known in the market as BOLDEN K-33 which is a complex salt of copper and arsenic in acid chrome solution.

The preservative contains copper and chromium in the tetra - valent condition and these react with the sap and wood substance of the pole to form insoluble copper and chromium arsenites. The danger of leeching of these compounds is little. The cost of Bolden salt K-33 is Eth.$1.65 per kg. delivered CIF Ethiopian port. The retention recommended to prevent decay and termite attack is in the range of 8 to 10 kgs. per cubic meter of wood treated. Average retention of preservative per pole is about 1.5 kg and thus the cost of preservative alone will amount to about Eth. $2.50 per pole. The Authority has, as at the end of 1968, treated 170,000 poles and the percentage of failure reported so far is minimal (less than 0.3%). It has been noted that failures experienced so far are due to soft-rot fungus and not to termites. The Authority's labour cost per pole

is Eth.$1.25; plant depreciation and other sundry costs come to about Eth.$0.50 per pole.

Poles treated with water borne preservatives must absorb not only an adequate quantity of the preservative but are also to retain it for long, ie the presentative has to be well fixed in the pole. The fixation of the preservative depends upon seasoning before and after treatment and this has posed a problem on the Authority - poles are acquired from various small forest owners that have little or no knowledge about the importance of seasoning and demand of poles is such that it does not allow one to keep sufficient quantity in stock and thereby let poles to season.

End splitting of poles during seasoning is yet another problem faced. The globulous specie has a high shrinkage ratio (tangential/shrinkage = 2.2) and splitting of poles to a distance of 100 - 200 cm measured from the ends is not uncommon. Coating of ends with tar and similar emulsions reduces the extent of splitting but does not eliminate it. As the impregnation is mainly intended to treat the sap and make it toxic to fungus and termites, the splitting of the ends exposes the heart wood to termite and fungal attack. The Authority is investigating the possibility of replacing eucalyptus globulous with some other specie that have shrinkage ratio lower than the globulous tree.

Rentention is dependent upon the moisture content of poles treated. The ideal moisture content to which the globulous tree is to be seasoned prior to treatment is yet to be determined. With the demand of eucalyptus rising rapidly it will be hard to be selective and acquire poles with pre-determined moisture content. Lack of accessibility lengthens the time of hauling of poles from various localities to the plant and limits the extent of control over seasoning prior to treatment. Although the Authority pays higher prices for poles than its competitors such as the chip board & plywood factories it is finding it hard to cope with the day to day demand let alone afford to become selective in acquiring poles. The Authority is thus considering the possibility of growing trees for its own use.