Plastics that termites can't chew

Relentlessly gnawing, termites will try to eat through anything they come across. Lead batteries, car tyres, billiard balls, even soft stone, are some of the more unusual recorded targets, but underground telephone and power cables remain among the most important and troublesome menu items.

Telecom Australia is sponsoring research at the CSIRO Division of Entomology to find an economical, termite-resistant (and ant-resistant) cable sheath.

The extremely tough plastic nylon-12 has been widely used throughout Australia for the past 15 years as a jacket to protect cables against termites and ants. Although it performs well, combining hardness that defies a termite's chewing with enough flexibility to allow the cable to be wound on drums, nylon-12 is expensive — in the region of $7000 per tonne.

Common plasticized polyvinyl chloride materials cost about one-quarter as much, and can be easily extruded, but, being relatively soft, don't have anywhere near the same resistance to termite attack. Unplasticized PVC is harder and more termite-resistant, but is too rigid for use on cables.

Impregnating cable sheaths, and soil, with insecticide or repellent has been tried, but with little success. The difficulty with loading the cable sheath with chemicals is that the termites only have to eat through a millimetre or so of plastic to cause trouble, yet this amount doesn't contain enough active ingredient (at practical loadings) to deter further attack.

The major drawbacks with putting chemicals in the soil are that they can harm non-target organisms, and are dangerous to handle.

The soft insulating sheath of this cable has succumbed to giant termite (*Mastotermes darwiniensis*) soldiers and workers.

The Telecom Research Laboratories consider that, with the right formulation, a common plastic may turn out to have all the desired properties of toughness and flexibility.

Termite biology and behaviour is the speciality of Dr Tony Watson of the Division of Entomology in Canberra, and one of his major fields of study has been the termite resistance of cables.

Over several years he has tried out the ability of many different types of plastics to repel termite attack. Most of them have been found wanting. However, the most recent round of tests has proved encouraging.

These tests began with the notorious *Coptotermes formosanus* — the South China termite. This was made possible by an exchange visit to the Guangdong Entomological Institute in Guangzhou, China.

This termite has been accidentally introduced into many countries, and it is now a major pest in several. Our quarantine officers periodically encounter it, and the ever-present risk of it getting a foot-hold here was one of the motivations for Dr Watson's visit to China. Tests of cables against this termite could also bear on the export of Australian cables to Asia, where Telecom specifications are widely used.

Dr Watson selected samples of six classes of plastics (14 formulations) for testing, including some polyvinyl chloride formulations developed specially by Telecom and ICI Australia Ltd as possible replacements for nylon-12. Others tested comprised polyethylenes, polyamides (nylon-12), and a polyester, a polypropylene, and a polyurethane. Some are presently used as cable jackets, whereas others are pipeline coatings (which are also susceptible to termite attack).

Dr Watson tested the samples by placing them in containers each holding 3000–4000 termites and leaving the termites to do their worst for 12 weeks. In follow-up tests back in Australia, Dr Watson used *Coptotermes acinaciformis* — in economic terms the most important of the Australian termites.

The results of the tests showed that termite damage ranged from none to complete perforation of the sheath. Destructiveness appeared to be about the same in the two species. Yet in more recent tests, the Australian one badly damaged a cable of a kind that has been in service for many years in China, where it has survived attack by the South China termite. However, the voracity of insects may well depend on how hungry they are, and this factor could help explain the result.

As to the termite resistance of individual plastics, the best performance was by the hardest samples (and the worst was by the softest). Smoothness can give an extra degree of immunity, and composition of the material also plays a part.

Encouragingly, some of the specially formulated PVC materials performed as well as did nylon-12 in resisting termites, and all possessed satisfactory flexibility. Subsequent field tests have also given pleasing results, and now lengths of cable coated with one of the formulations are undergoing production testing. Watch out, termites!

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