New family of fungicides developed by NRC

To control mildew

Most people in Canada know it as mildew. In the tropics it's referred to as "jungle rot". But, by any name, microbiological destruction of materials containing cellulose is responsible on a world-wide basis for the loss of billions of dollars worth of goods each year.

Because cellulose is found in all vegetation and is the most common organic chemical in existence, it has been investigated more thoroughly than any other chemical. However, the problem of protecting cellulosic materials from contamination and destruction by fungi has to a large extent been ignored. Fungi are a low form of life needing fairly complex organic substances such as sugars in order to provide the energy for the operation of their life processes. Since they are not able themselves to synthesize these materials they must obtain them ready-made. They do this by producing enzymes which bring about the chemical breakdown of complex substances such as cellulose to give sugars.

A cellulose-destroying fungus attacking, for example, a cotton fibre, obtains its nourishment through the medium of a number of hair-like growths. Enzyme mixtures are excreted which first split the fibre into molecules and then destroy them one glucose unit at a time.

A common example is the well-known "diamond spot" damage to cotton tents and awnings. Attack leads to development of diamond-shaped spots in which the fabric becomes weakened and ultimately a hole forms. Starting at the centre of infection, growth of the organism is most rapid along the warp and weft direction rather than laterally from yarn to yarn. The result is formation of a parallelogram or square, the diagonal of which is usually situated vertically.

The fungal problem is particularly acute with articles such as cordage, rope, wood and paper products and yarns and fabrics. Cotton, viscose rayon, jute, hemp and linen yarns and fabrics may be made rotten very rapidly by micro-organisms upon exposure to them under conditions which favor their growth; specifically relatively moist, warm, still-air conditions.

The National Research Council of Canada maintains a continuing research program into textile damage prevention because, while it has been commonly thought that fungal damage is restricted to the tropics, it also is a large problem in Canada outdoors during summer months and all year indoors. The latest product of this program is the creation of a new family of cheap, odorless, chemically stable fungicides, resistant to water leaching.

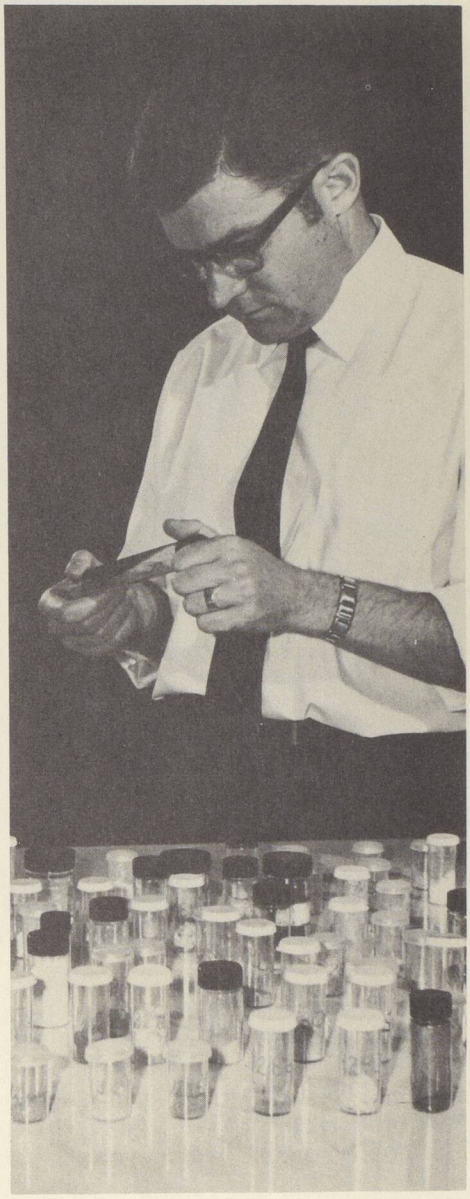
Canadian Patents and Development Ltd., a subsidiary of the NRC with responsibility for licensing of inventions of government scientists, has applied for patents for a fungicidal composition and method of application of a fungicide on behalf of Dr. David M. Wiles, head of the Textile Chemistry Section of NRC's Division of Chemistry, and Tony Suprunchuk, of the same section.

The NRC researchers discovered that the condensation products of aldehydes and ketones with the chemical thiocarbohydrazide are highly effective for inhibiting or preventing the growth of cellulolytic micro-organisms. Research indicates existing fungicides all have some limitations with regard to cost, durability, toxicity to humans or deleterious effects on the polymeric substrate.

Two of the most widely-used fungicides available today are the pentachlorophenol and pentachlorophenyl laurate types and copper 8 (copper 8 – hydroxyquinolinolate). The former is unstable to water, giving off products that damage cellulose fibres and the latter releases metallic copper during outdoor exposure.

Because they lack these limitations, Dr. Wiles believes the NRC fungicides may find immediate use in at least one area. Many fire hoses are made of a rubber liner and a fibre outer casing. Copper 8 cannot be used because metallic copper from it damages the rubber, and pentachlorophenol derivatives provide very little durable protection.

Dr. Wiles says his section used a "shotgun" approach in their research. "Because we were fibre chemists and not microbiologists – although maybe we should have been – we had to do a lot of trial-and-error work. →



Dr. David Wiles examines a test tube containing a pure fungus culture. Vials in the foreground contain chemical compounds which his section has synthesized for evaluation as potential fungicides.

Le Dr David Wiles examine une éprouvette contenant une culture de champignons. Ses collaborateurs ont fait la synthèse des composés contenus dans les tubes et les flacons au premier plan; ils les évalueront comme fongicides.