INSECTICIDES

Pyrethrin Prospects

ONE of the most promising developments in pesticides in these days of great public concern for the environment has been the development and marketing of pyrethrin analogues. Pyrethrum, a natural pesticide from the ground flowers of *Chrysanthemum cinerariaefolium* and *C. coccineum*, has been known since the early nineteenth century; six esters are found in the pyrethrum of which the most important and plentiful are known as pyrethrins I and II. They are used against houseflies, mosquitoes and cockroaches, mainly in the domestic field; their great advantage is that pyrethrin I has a high kill rate and pyrethrin II a high knockdown rate and that, once used, they degrade quickly in the light, leaving no appreciable toxic residues.

Pyrethrum has never been cheap; today a kilo of 100 per cent active pyrethrum costs about £38 compared with about £0.2 for DDT. Work was begun years ago to find a synthetic analogue but only recently have really significant advances been made. Since 1962, work on pyrethrin analogues has been carried out at Rothamsted supported by the National Research Development Corporation and two analogues, resmethrin and bioresmethrin, have recently been produced which are a considerable advance on the analogues previously available, notably tetramethrin and bioallethrin.

The new synthetic products have a kill rate many times higher than the natural product. Their knockdown rate is, however, lower although high when compared to other insecticides. This has been overcome by mixing them with the natural pyrethrin and a synergist which increases their effect.

The synthetic products appear to have all the advantages of the natural pyrethrins, without the drawback of the natural pyrethrins of causing nasal irritation if present in the air in sufficient quantities (pyrethrins are often used in aerosols). Indeed, the synthetic pyrethrins seem to be safer; the acute oral toxicity (LD50, rat) of bioresmethrin is approximately 8,500 mg per kg of body weight, that of resmethrin approximately 2,000 and that of natural pyrethrin approximately 600. In feeding trials conducted by Cooper McDougal and Robertson, one of the two companies marketing bioresmethrin in Britain, no ill effects have so far appeared.

Where the potential of synthetic pyrethrins may lie is in agricultural applications where cost has so far prevented the use of natural pyrethrins. At present synthetic pyrethrins are even more expensive than the natural product (about £40 a kilo for resmethrin and about £65 for bioresmethrin), but their relative non-toxicity, allied to their high kill rate, could make them a viable substitute for organochlorine and organophosphorus insecticides, many of which tend to break down less quickly than the pyrethroids.

The only known drawback to pyrethrin, both natural and synthetic, is that it is highly toxic to fish. This may not limit its use near rivers, however, as both water and light produce rapid breakdown, and tests may well prove that the quantities in which it will be used will present no danger to life in nearby water, should it be used for agricultural applications.

At present, however, the analogues are competitive with pyrethrum for a wide variety of largely domestic uses, and will be used overseas to replace other insecticides in household aerosols.

The development of synthetic pyrethrins has led to speculation that the market for the natural product may disappear, and Coopers admit that that was their first reaction, but the present need to mix synthetic with natural pyrethrins to achieve rapid knockdown, plus the expected expansion of the market, may well mean that the natural product is safe for some time to come. Kenya produces a large share of the world's natural pyrethrum and a spokesman at the Kenya High Commission said this week, "We think that synthetic pyrethrum will have some effect."

Ironically it was a world shortage of pyrethrum, caused by a fall of exports, that brought about the rapid commercial exploitation of the analogues, although Kenya claims that its output is now rising again. But whether the market for natural pyrethrum disappears—and experience with other synthetic substitutes for a natural product, for example, quinine, suggests it might—the future for the pyrethrum analogues looks bright.

COAL

Robens Recollects

LORD ROBENS's first public address since leaving the Coal Board surveyed the position of coal during this century and speculated on the uses of coal in future years. His address, the twentieth, and possibly the last, Coal Science Lecture of the now defunct Coal Utilization Research Association, was given on Monday to 400 scientists—most of them employed in coal research.

Lord Robens declared that more efficient use of man's resources must be made. In particular, it is now becoming clear that coal, which was considered the poor relation of gas and oil until very recently, has an important part to play in the future energy equation of Britain. Coal is Britain's only indigenous energy source and, although the rich veins are being fully mined, a large supply of low quality coal is, as yet, unexploited.

One of the chief efforts of the coal board to this end has been directed towards the efficient burning of low grade coal and coal dust by fluidized combustion. In this process a mixture of coal and ash constitutes the fluid bed and the NCB effort has been devoted to obtaining a high efficiency of heat exchange between this and immersed boiler tubes. The practicability of such systems has been established in the laboratory and future effort will be devoted to making the system work on a large scale. A further advantage of the fluidized bed combustion is, as Lord Robens pointed out, its ability to suppress the emission of sulphur into the atmosphere when limestone is mixed with the fuel. This aspect of the process has interested scientists in the United States where there are large undeveloped supplies of low grade fuels and Lord Robens issued a warning that this might yet be another technique developed in Britain but exploited in the USA.

One of the problems that will face Britain towards the end of the century will be the gradual decrease in supply of North Sea gas. Lord Robens pointed out that efforts should be made to supplement this by synthesizing a gas that can be blended with supplies from the North Sea. At present the Gas Council is devoting considerable research effort to synthesizing gas from oil and Lord Robens stressed that in view of the uncertain future of oil—which is obtained mostly from politically unstable countries—efforts should be made to obtain such a gas from coal. Historically the way to achieve this has been by coking but this process is not efficient. Also the gas obtained has a low calorific value that is not commensurate with natural gas. The British effort towards achieving this end is at present concentrated solely in a combined Gas Council–NCB working party.

The NCB was, in Lord Robens's view, caught unawares in the early 1960s by the full implications of the Clean Air Act. The board was faced with having to develop in a short time either a smokeless solid fuel or appliances that would burn bituminous coal smokelessly. The board's quandary was finally resolved when it was decided to proceed with making smokeless fuels but Lord Robens stressed that this was no easy decision and, as he aptly put it, "the choice between the two approaches was by no means a simple black and white one." He added that it took ten years to solve all the technical problems of making smokeless fuels, after a smaller research effort into the design of appliances to burn bituminous coal smokelessly.