DEVELOPMENT OF CONTROLLED-RELEASE FORMULATIONS OF DIURON

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Introduction

Most conventional formulations immediately release the herbicide into the environment and the released herbicide is subjected to loss by evaporation, run-off and degradation. An effective way to minimise the environmental loss of herbicides and providing more efficient weed control is through the use of controlled-release formulation. The formulation enables efficient and economical application of the active agents and at the same time reduces the danger of undesirable side effects such as environmental pollution. A controlled-release system by encapsulation of pesticide in polymers such as sodium alginate is commonly used (Connick, 1982; Hussain, 1992). Alginate was used as binder and kaolin or clay as inert material. In direct seeded rice, the alginate controlled-release formulation of thiobencarb gave comparable yield as the conventional granular formulation (Omar and Mohamad, 1994). In the present study, the controlled-release formulation was prepared using agricultural by-products as a substitute to kaolin. The release rates of the active ingredient (a.i.) from the formulations were determined and evaluated for their efficacy against *Paspalum conjugatum* and *Diodia ocimifolia.*

Materials and Methods

The polymer used was sodium alginate of 2% viscosity, the herbicide was diuron. Agricultural waste by-products (AWP) were oil palm empty fruit bunch (EFB), sawdust (SAW) and paddy husk (PH). The controlled-release formulations of diuron were prepared by monolithic system. The ratios of sodium alginate and inert materials used were 1:1 and all formulations contained 20% diuron. The quantity of diuron released from the controlled-release formulations into distilled water was determined using a high performance liquid chromatography with ultra-violet detector. Two hundred and fifty mg of controlled-release formulation was placed into the 50 mL of distilled water. Twenty uL were removed from each flask at 3, 6, 10, 15, 20, 25, 30, 40, 50 and 60 days after placement of the formulations in the water and injected into the chromatograph. The effect of controlled-release formulations on germination of *P. conjugatum* and *D. ocimifolia was* conducted in a glasshouse. The AWP-CRF, alginate based kaolin (AK) and conventional formulation of diuron (CF) were applied at a mass application rate of 2.0 Kg a.i./ha. The seeds were sown at 1 and 2 months after application of the formulations (MAA) and the percent mortality was determined at 14 days after sowing. Data were subjected to analysis of variance and means were separated by Tukey test.

Results and Discussion

The granules of controlled-release formulation obtained from the preparation using agricultural by-products were round in shape with a rough texture and the size was about 1.5 mm. The agricultural by-product controlled-released formulations also differed in their colours; the EFB was dark brown, SAW was light brown and PH was yellow. The retention time of diuron from HPLC was 3.8 minutes. The release rates of AWP-CRF at 3 days following placement of the formulation into water showed that PH-released diuron was higher than with EFB and SAW. The PH released 14.1% of diuron from the formulation compared with 10.2% and 9.31% for EFB and SAW respectively. However, when all AWP-CRF were compared with AK formulation, the AK gave a higher release (16.1%). The release of diuron from all formulations reached a maximum at 20 days after placement in water; the highest was with the AK formulation (28.6%), followed by SAW (24%), PH (23.8%) and EFB (22.8%). At 1 MMA the percentage mortality of emerging seedlings of *D. ocimifolia* following treatment with AWP-CRF, was between 80.67 and 97.1% for the CF, AK and SAW and 51.8% and 59.3% for PH and EFB respectively. At 2 MAA, mortality of *D. ocimifolia* was lowest with CF and highest with AK. Among the AWP-CRF, the mortality was 82% for SA 62.5% for PH and 71.3% for EFB. No significant difference existed on mortality of *P. conjugatum* between the formulations at 1 MAA. However significant higher mortality of seedlings was observed in the CRF treatments (except for the PH formulation) in comparison with the CF.

Conclusions

This study has demonstrated that agricultural waste by-product could be used to substitute kaolin in controlled-release formulations. Further studies are required to verify the resistance of release of diuron from these formulations.

References

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