

Effect of Adding Pectin to the Controlled-release Formulation of Alachlor and Diuron

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Introduction

Improved technology through the use of controlled-release formulation (CRF) enables efficient and economical application of the active agent. A controlled-release system by encapsulation of pesticide in polymer sodium alginate was commonly used. However, the initial release was relatively slow compared with the conventional formulation. The following studies prepared the CRF using pectin as a substitution to alginate. The release rates of the active ingredient (a.i.) from the formulations were determined and evaluated for their efficacy against *D. ocimifolia* and *P. conjugatum*.

Materials and Methods

Preparation of CRF The CRF of diuron and alachlor were prepared by monolithic system. The solution was dripped into calcium dichloride solutions with the aid of peristaltic pump for gelification. After 5 minutes, the granules were removed, rinsed and air dry at room temperature.

Release rate of diuron and alachlor The release of a.i. from CRF was determined by chemical assay using a high performance liquid chromatography with UV detector. The determination of release rate by bioassay technique was conducted in the glasshouse using *Cucumis sativus* and *Brassica juncea* seedlings as bioindicators for alachlor and diuron, respectively.

Effect on germination of weeds The seeds of *D. ocimifolia* and *P. conjugatum* used to evaluate the efficacy of CRF were sown at 1 and 2 months after application. Percent mortality was determined at 14 days after sowing.

Results and Discussion

The texture of pectin CRF granules was softer than the alginate CRF. Addition of alginate increased the mechanical resistance of the pectin CRF granules. Chemical assay using a high performance liquid chromatography with ultraviolet detector showed the pectin-kaolin CRFs (P1K1, P2K1, P1K and P2K) release a.i. faster compared with alginate:pectin-kaolin CRFs (AP1K1, AP2K1, AP1K and AP2K) and alginate-kaolin CRFs (AK1 and AK2) six hours after placement in water. The release reached a constant level at three, five and seven days after placement in water for pectin-kaolin, alginate:pectin-kaolin and alginate-kaolin CRFs, respectively.

The determination of release rate by bioassay technique showed the CRF of alachlor (AP1K1, AP2K1, P1K1 and P2K1) showed a better performance in inhibiting a shoot and root length of *C. sativus* compared to AK1 at 3 days after treatment (DAT). Similar result was observed for the fresh weight of *C. sativus* at 15 DAT. The AP1K1, AP2K1, P1K1 and P2K1 also showed a similar performance with the conventional spray formulation of alachlor (CF1) at the initial treatments. These indicated that the present of pectin in the CRF improved the initial release of alachlor. At 160 DAT, all the CRFs showed a better effect compared to CF1 indicating the prolonged activity of alachlor through the CRF. Similar result was observed for the CRFs of diuron in inhibiting the germination of *B. juncea*. At 7 DAT, the pectin-kaolin CRF (P1K and P2K) showed similar performance with the conventional spray formulation of diuron (CF) and significantly higher mortality was recorded from the CRFs of diuron compared to CF at 120 and 160 DAT.

At 7 week after treatments (WAT), all the CRFs of alachlor except P1K1 and P2K1 showed a significantly lower on germination of *P. conjugatum* compared to CF1. In contrast, only AK1, AP2K1, P1K1, P2K1 and ALSAW1 showed a significantly lower germination of *D. ocimifoli* compared to CF1. The effectiveness of diuron CRFs on *P. conjugatum* showed a significantly lower germination for all CRFs compared to CF except AK2, P1K, and APISAW. On *D. ocimifolia*, only APISAW, APIPH and AP2PH showed a significantly lower germination compared to CF. In general, the alachlor alginate:pectin-kaolin CRF of AP2K1 showed a better control on germination of both weeds.

Conclusions

Pectin increased initial release of CRF but further works are needed to improve the texture and residual preemergence activity.

Benefits from the study

The CRF prolongs the activity of alachlor and diuron compared with the conventional spray formulation and increases the safety due to no hazard of spray drift.

Patent(s), if applicable:

Nil

Stage of Commercialization, if applicable:

Nil

Project Publications in Refereed Journals:

Nil

Project Publications in Conference Proceedings:

Nil

Graduate Research

| Name Graduate | of Research Topic | Field of Expertise | Degree Awarded | Graduation Year |
|------------------|--|----------------------|----------------|-----------------|
| Sofiah Baseri | Modification with pectin of alginate controlled-release formulation of alachlor and diuron: their release kinetics and efficacies. | Pesticide Toxicology | MSc | 2003 |

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