MEASUREMENT OF RELEASE RATES OF GOSSYPLURE FROM CONTROLLED RELEASE FORMULATIONS BY MINI-AIRFLOW METHOD

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Abstract—The use of the mini-airflow apparatus for the measurement of gossyplure release rates is described. The method involves the passage of air over controlled-release dispensers containing radiolabeled pheromone, through a coarse frit, and entrapment of the gossyplure on glass beads. Desorption of the beads with solvent is followed by quantification by liquid scintillation counting. The results of release rate measurements from hollow fibers, red rubber septa, and red rubber wicks are discussed.

Key Words—Gossyplure, release rates, formulations, controlled release, hollow fibers, septa, wicks.

INTRODUCTION

The development and field testing of pheromone-based insect pest control products has advanced rapidly in the recent past. Such strategies involve the use of controlled release formulations to dispense the pheromone. In several areas, the development of a technology to evaluate the pheromone formulations has lagged behind the design and development of the formulations themselves. This has especially been the case where the measurement of the release rates from controlled release devices has been concerned. Indeed, as noted by Roelofs (1979) many field tests had, in the past, been conducted without any knowledge whatsoever of the release rate of the pheromone from the formulation used. While release rates measured under the controlled conditions of the laboratory will vary from the actual release rates under field conditions, laboratory data obtained from different substrates at different
conditions and wind speeds assist greatly in the design and evaluation of formulations.

In particular, a reliable, reproducible method of measuring the effluent from the controlled release devices was needed. An earlier paper by Weatherston et al. (1981) described the various methods currently in use for the measurement of the release rates and discussed some of the problems associated with these methods and measurements. One problem which arises frequently (Bierl and DeVilbiss, 1975; Rothschild, 1978) is lack of agreement when rates are measured by different methods. In the case of measurements by the airflow methods, one manifestation of this problem was in inability to achieve a mass balance. In the cited paper, Weatherston and coworkers introduced an apparatus and a technique which has been used to measure the release rate of \([\text{acetyl}-1-^{14}\text{C}]\text{gossyplure}\) from hollow fiber formulations and demonstrated that a mass balance could be achieved with this method. This paper reports on further measurements of the release rate of \([\text{acetyl}-1-^{14}\text{C}]\text{gossyplure}\) from hollow fiber formulations and on the extension of the method to include other types of release devices.

**METHODS AND MATERIALS**

Liquid scintillation counting was done either in a Nuclear Chicago Isocap 300 scintillation counter, at an efficiency of 80%, or a Tracor Analytic Mark III model 6881 scintillation counter, at an efficiency of 97%, except as noted. Liquid scintillation counting (LSC) cocktail was prepared either by mixing PPO, 2 g, and POPOP, 50 mg, in liquid-scintillation-grade toluene, 500 ml, or by mixing 1 Gal-Pak of Omnifluor® with 1 gallon liquid-scintillation-grade toluene. The PPO was obtained from Amersham/Searle, Oakville, Ontario; the POPOP from Sigma Chemical Company, St. Louis, Missouri; and Omnifluor from New England Nuclear, Boston, Massachusetts.

Gossyplure [the 1:1 mixture of \((Z,Z)\) and \((E,Z)\)-7,11-hexadecadien-1-yl acetate] was purchased from Albany International Chemicals Division (formerly Chemical Samples Company), Columbus, Ohio. Gas chromatography was performed on a Bendix model 2500 equipped with an FID, at an oven temperature of 180°C and N₂ flow rate of 40 ml/min through a glass 1.8-m × 4-mm ID column packed with 3% OV-17 on 80/100 WNP Chromosorb.

Molecular sieves were Linde 13X pellets purchased from Ventron Corporation, Danvers, Massachusetts, and Amberlite® XAD-4 was purchased from Mallinckrodt Chemical Works, St. Louis, Missouri. Flowmeters equipped with a differential regulator were purchased from Kontes, Vineland, New Jersey. Glass beads, 1.00–1.05 mm diameter, were manufactured by B.