Soil speciation and residue analysis for decontamination of imidacloprid: a sustainable resource management model for cotton crop

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Received 19 March 2013; Accepted 1 April 2013

ABSTRACT

Cotton is an important commercial fiber crop in the world. Its production is limited by various factors among which pest infestation causes deterioration in lint quality and 10–40% losses in production. To overcome the losses, pesticides are irrationally applied, that in turn, deteriorate the soil quality through residue accumulation. The research is an attempt to present a decontamination model for removal of imidacloprid using soil (as sustainable resource). For this purpose, three composite samples each of soil and field water were analyzed for physicochemical parameters. Soil was sequentially extracted for background concentration of metal species prior to selection of the soil type for adsorption process. Composite soil (KCF2) depicted higher concentration of species bound to organic matter due to low $K_{oc}$. Residue concentration and degradation pattern was analyzed on GC–MS. Series of batch adsorption experiments were conducted at varying pH as a function of time. Results revealed attainment of adsorbent–adsorbate equilibrium in 45 min following a zigzag pattern and are reasonably approximated by an instantaneous and closed-system equilibrium. Soil provides effective resource management by removing 99.5% of imidacloprid at optimum pH 7. The good fit of Freundlich equation (0.969) approximates for heterogeneous surface energies and exponential distribution of active sites.

Keywords: Residue analysis; Speciation; Adsorption; Imidacloprid; Sustainable approach