Accumulation of pesticides residues in oil during the storage of rapeseed

Sylvie Dauguet[1], Jacques Evrard[1], Jérôme Fritsch[2], Jean-Philippe Loison[1]

[1]CETIOM, rue Monge, Parc industriel 33600 Pessac, France
[2]National laboratory for stored seeds, INRA Domaine de la Grande-Ferrade, 33883 Villenave-d'Ornon, France
Email: evrard@cetiom.fr

Abstract

Although pesticides residues are rarely present in crude rapeseed oils and are eliminated during the different steps of refining, it is important to know the origin of these contaminations to minimize the risks through good management practices and education. A study led between 2003 and 2005 showed that the main contaminants were organophosphate compounds (dichlorvos, chlorpyriphos-methyl, pyrimiphos-methyl, malathion) and pyrethrinoids (deltamethrin) which are insecticides traditionally used for cereal grain treatments during storage. The French regulation does not authorize these insecticides for the treatment of stored oilseeds which have however an affinity for liposoluble chemicals and can pick these up from storages which have previously been treated or used to store treated cereal grains.

We have measured the uptake of pesticides from treated cell walls by stored rapeseeds, using an experimental model : spraying of pyrimiphos-methyl (0,2 g of active material/m^2) on metal sheets covered by a single layer of rapeseeds or wheat after a drying period of 24h and measure of pyrimiphos-methyl residues in seeds and grains after 8 and 29 days. The pyrimiphos-methyl content in rapeseed was 0,028 mg/kg at the beginning of the experience, 15 mg/kg at J+8 and 15 mg/kg at J+29 (MRL 0,05 mg/kg). The pyrimiphos-methyl content in wheat was 0,062 mg/kg at the beginning of the experience, 15 mg/kg at J+8 and 17 mg/kg at J+29 (MRL 5 mg/kg). It was concluded that the transfer of pyrimiphos-methyl is fast (the values are equal at J+8 and J+29 and similar in rapeseed and wheat). Extrapolation studies in small storage silos (capacities 10 and 30 tons) are in progress for evaluating the average values of pesticides that can be really detected in seeds and grains.

Key words: pesticide residues, rapeseed, wheat, storage, pyrimiphos-methyl

Introduction

European consumers expect food safety and are particularly concerned about pesticide residues in food. Grains and seeds storage is a risky step because insecticides are used in a confined space where these molecules are not much damaged, unlike in a field. Insecticide treatments are applied on stored foodstuffs (cereals) in order to fight against pests : organophosphate compounds (dichlorvos, malathion, pyrimiphos-méthyl) or pyrethrinoids (deltamethrin). Such treatments are also applied on empty grain silos walls and on empty handling and storage equipment for the same reason. But, for oilseeds, no insecticide is allowed directly on seeds during storage, so MRLs (Maximum Regulatory Limits) for insecticides used in elevators are very low or do not exist on oilseeds. Some industrial specifications require no insecticide residues in cereals. Thus, foodstuffs, stored in elevators where are used insecticides, can be contaminated by contact with treated walls and equipment These insecticide residues in oilseeds can be a trade disagreement when MRLs are exceeded. The insecticide residues are removed in rapeseed oil after crushing and oil extraction because of the liposolubility. But refining steps eliminate theses residues, so that marketed refined oil is pesticide residue free and does not mean a risk for consumer health.

Studies have been led in Canada on insecticide residues transfer in stored rapeseed or cereals on various surfaces (plywood, galvanized steel surfaces, concrete) from 1976 to 1985. The molecules studied were organophosphorous (malathion, pyrimiphos-methyl, fenitrothion, bromophos, iodenphos) and pyrethrinoids (cypermethrin, fenvarelate, permethrin). Results showed that modification of each parameter (surface, seed, molecule) change residues levels obtained. Indeed, the uptake of insecticides is higher on plywood and galvanized steel surfaces than on concrete. Depending on the seed, uptake of insecticide from surface changes ; Watters (1982) showed that bromophos uptake is higher by rapeseed than wheat. The kind of molecule applied on surfaces, temperature and moisture can also modify insecticide residues concentrations in seeds. Insecticide residues movement through seeds layer is slight (White 1984) and malathion in stored barley is present no more than 2 cm from treated steel surfaces.

A survey led in France between 2003 and 2005 showed that the main contaminants in rapeseed were organophosphate compounds (dichlorvos, chlorpyriphos-methyl, pyrimiphos-methyl, malathion) and pyrethrinoids (deltamethrin), with low content (few hundreds of µg/kg found in rapeseed, versus few mg/kg when seeds are directly treated). Our hypothesis is that these seeds contaminations come from contact with treated surfaces, or contact with handling and storage system previously used by treated cereals. The aims of this study in 2005 were to measure this insecticide residues transfer in laboratory conditions and to compare with previous results obtained on cereals in order to extrapolate to small lots of stored seeds.

Materials and methods

Galvanized steel panels of 200 cm^2 were arranged in a random way on 10 m² polyethylen sheets. Each sheet was treated