

1. Introduction:

Soils are considered to be a significant sink of organic pollutants in the environment. The knowledge of the *distribution and localisation* of aged pesticide residues to the soil constituents is of great importance for *assessing the mobility and availability* of these entities to the soil environment.

2. Aims:

- To *characterise the distribution* of three radiolabeled pesticides in the solid phase and humic acid fractions of two soils.
- To *describe the sorption capacities of the isolated soil constituents* in relation to their respective particle size and organic carbon content.

3. Methodology:

- ^{14}C -isoproturon, diazinon and cypermethrin residues were subjected to aqueous extraction (CaCl_2 , 0.01M) to remove the labile ^{14}C -pesticide residues.
- Soil fractions were collected according to sedimentation rates (Stoke's Law).
- Soil fractions (>20 μm : 5g, 20-2 μm : 3g and <2 μm : 1g) were subjected to sequential alkaline extraction (0.1 M NaOH) and hydrogen peroxide treatment for complete organic matter destruction/oxidation. The methods used in this study are described in Figure 1 schematically.

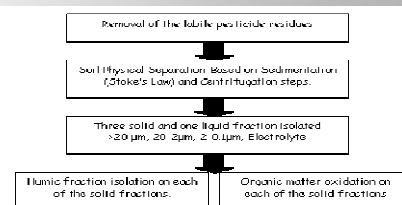


Figure 1: Fractionation procedure

4. Results:

4.1 ^{14}C Non-extractable residues distributions:

Largest proportion of non-extractable residues reside mainly in the 20-2 μm solid phase fraction (Figure 2).

Accumulation in coarsest fraction (>20 μm) was very low compared to the 20-2 μm fraction.

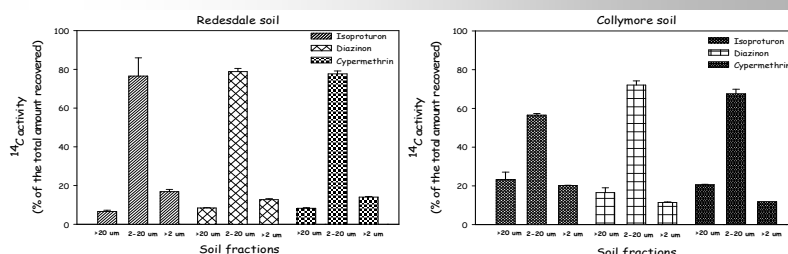


Figure 2: Distribution of non-extractable ^{14}C pesticide residues in two soils. Errors bars are SEM.

4.2 Soil solid phase grain size distribution:

The grain size enrichment factor (E_{GS}) was very high for the 20-2 μm and <2 μm soil fractions. This is evident in both of the soils and all the pesticide applications (Figure 3).

The grain size enrichment factor (E_{GS}) is defined as the distribution of the ^{14}C -pesticide residue in the solid phase to the distribution of the ^{14}C -pesticide to the whole soil (Equation 1).

$$E_{GS} = \frac{D_{\text{Fraction}}^C}{D_{\text{Soil}}^C} \quad (1)$$

Pesticide non-extractable residues preferentially localized in the smallest fraction (20-2 μm and <2 μm) in the Redesdale soil, while in the Collymore soil, localization of the residues in the 20-2 μm grain size fraction is slightly superior than the <2 μm fraction.

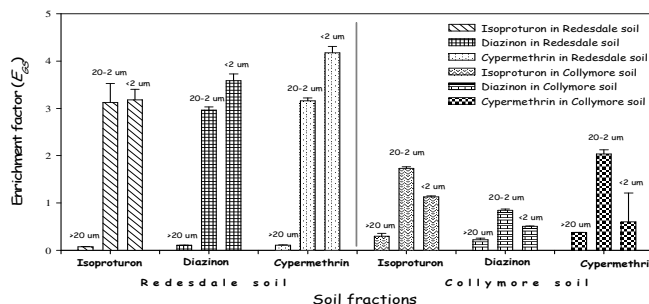


Figure 3: Enrichment factors (E_{GS}) for ^{14}C -ipu, diaz, and cyper. in soil fractions. Error bars are SEM.

4.3 Humic acids fraction distribution:

Non-extractable ^{14}C -Pesticide residues had a greater affinity with the fulvic acid than the humic acid fractions (Figure 4).

Organic carbon enrichment factor (E_{OC}) is defined as the distribution of the non-extractable ^{14}C -pesticide residues to the distribution of organic carbon in the humic extracts (Equation 2)

$$E_{OC} = \frac{D_{\text{H.Acids}}^R}{D_{\text{H.Acids}}^{OC}} \quad (2)$$

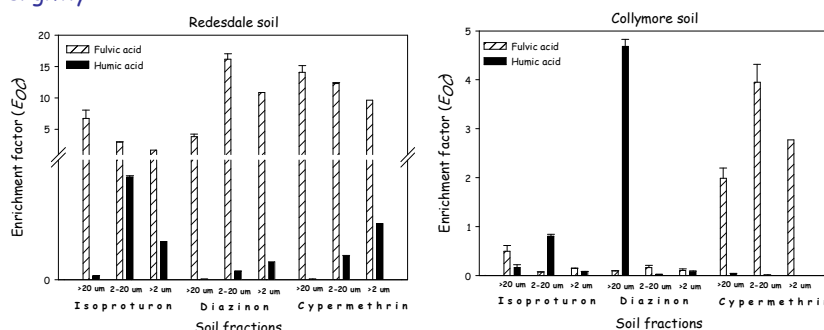


Figure 4: Enrichment factor (E_{OC}) for humic acids in soil fractions from Redesdale and Collymore soil. Errors bars are SEM.

5. Conclusions:

- The largest proportion of the non-extractable ^{14}C -pesticide residues was recovered from the 20-2 μm size fraction. Residues on the smaller size fraction (<2 μm) were limited.
- Different soil constituents have different capacities to form non-extractable residues. Soil solid fractions of 20-2 μm and <2 μm had far greater affinity to the ^{14}C -pesticide residues than the coarser fraction (>20 μm). Humified organic matter is predominately localised in the finest fractions while fresh organic matter is localised in coarser fractions >50 μm .
- Fulvic acid showed to play a vital role in the formation and stabilisation of non-extractable ^{14}C -pesticide residues in most cases.

6. References:

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