Conclusions
CONCLUSIONS

The results obtained from the Adsorption, Dissipation, effect of background electrolytes, Surfactants, Temperature on adsorption were discussed, and Groundwater ubiquity score, The free energy ($\Delta G$) of adsorption of the herbicide were discussed in this chapter. Metabolite identified during the dissipation analysis also discussed in this research. By using batch equilibrium experiments, the adsorption-desorption of Bispyribac sodium, Halosulfuron methyl, Ethoxysulfuron and Pyrazosulfuron ethyl herbicides was determined in 21 types of soil collected from different locations in the U.S., Italy, Spain, Greece, France, U.K., the Netherlands, Germany, and India were evaluated under laboratory conditions. Statistical analysis against a wide range of soils and herbicides were used to identify the best combination of properties that describes the variation in adsorption. After a careful analysis of the results, some trends clearly appeared.

The adsorption of herbicides in soils is strongly influenced by soil organic matter, clay, silt, CEC and soil pH. The adsorption of Bispyribac sodium, Ethoxysulfuron, Halosulfuron methyl and Pyrazosulfuron ethyl in soils is influenced by the pH and this effect depends on soil composition and the characteristics of the compound. This pH depends derives mainly from the different properties of ionic and neutral forms of the herbicides present at each level and from differences in their strength of sorption. A decrease in adsorption with increasing pH was observed for Bispyribac sodium, Ethoxysulfuron and Pyrazosulfuron. However, the increase in adsorption was observed for Halosulfuron methyl. Soil organic matter, Clay, Silt are generally increasing the adsorption of herbicides in soils. From the adsorption results,
the soil organic matter, clay, silt and cation exchange capacity were positively influenced the adsorption of the all Bispyribac sodium, Halosulfuron methyl, Ethoxysulfuron and Pyrazosulfuron ethyl herbicides in 21 global soils. The free energy ΔG of Bispyribac sodium, Halosulfuron methyl, Ethoxysulfuron and Pyrazosulfuron ethyl in the soils were less than 40 kJ/mol and negative values were obtained. This indicates that the adsorption of all the herbicides is mainly a physical and spontaneous process.

Experimental and climatic factors influence on adsorption of Bispyribac sodium, Halosulfuron methyl, Ethoxysulfuron and Pyrazosulfuron ethyl by two soils were increased when the electrolyte concentration was increased. This was possibly due to electrostatic interactions between Bispyribac sodium, Halosulfuron methyl, Ethoxysulfuron, Pyrazosulfuron ethyl and the background electrolyte concentration. The sorption coefficient values varied with the electrolyte and the electrolyte concentration in the order of CaCl2 > MgCl2 > KCl > NH4Cl > KH2PO4. The variation may explained by the valency of the cations in the solution. Surfactants were influenced by the sorption coefficient of Bispyribac sodium, Halosulfuron methyl, Ethoxysulfuron and Pyrazosulfuron ethyl in two types of soils. The sorption coefficient value decreased when anionic and nonionic surfactants were used at the three surfactant concentrations in two types of soil but increased with cationic surfactants. The difference is possibly due to electrostatic interactions between cationic surfactant CTAB and anionic pesticides Bispyribac sodium, Halosulfuron methyl, Ethoxysulfuron and Pyrazosulfuron ethyl. The sorption coefficient values decreased when temperature increased was observed in all the 4 herbicides.
There were marked differences between the soils in their ability to degrade the herbicides in 21 soils. The parameters selected to explain variations in degradation rates depended on soil-herbicide combination, the Degradation is the results of complex interaction between different processes and the lack of consistent behavior renders a global approach to prediction of degradation unrealistic. On the other hand, a correlation analysis permitted to identify distinct types of behavior of the herbicides. Bispyribac sodium and Ethoxysulfuron seemed mainly more persistent in the soils with low OM, low clay, low silt and higher pH, sand. Halosulfuron methyl seemed mainly more persistent in the soils with higher pH, degradation rates of this compound were very sensitive to soil bioactivity level. Pyrazosulfuron ethyl seemed mainly more persistent in the soils with low OM, low clay, low silt, low pH and higher sand. All the four herbicides degradation was followed first order-kinetics in tested soils. The GUS values were less than 3.2 in all the soil types studied, and the residues of Bispyribac sodium, Halosulfuron methyl, Ethoxysulfuron and Pyrazosulfuron ethyl were low to high potentiality to mobile in the soils was identified. The soil samples showed the breakdown products/metabolites were analyzed using LC-MS/MS.
HIGHLIGHTS

- Sorption characteristics of bispyribac sodium, halosulfuron methyl, ethoxysulfuron and pyrazosulfuron ethyl were evaluated in 21 global soils.
- Dissipation characteristics of bispyribac sodium, halosulfuron methyl, ethoxysulfuron and pyrazosulfuron ethyl were evaluated in 21 global soils.
- The amount of electrolytes significantly influenced the adsorption characteristics of bispyribac sodium, halosulfuron methyl, ethoxysulfuron and pyrazosulfuron ethyl herbicides.
- Cationic surfactants increased the adsorption phenomena of bispyribac sodium, halosulfuron methyl, ethoxysulfuron and pyrazosulfuron ethyl herbicides.
- Effect of temperature increased the desorption of bispyribac sodium, halosulfuron methyl, ethoxysulfuron and pyrazosulfuron ethyl herbicides.
- Ground water ubiquitous scores for the herbicides of bispyribac sodium, halosulfuron methyl, ethoxysulfuron and pyrazosulfuron ethyl plausible leaching.
- The metabolites / breakdown products formed during the dissipation study were identified using liquid chromatography electrospray tandem mass spectrometry (LC-ESI-MS/MS).