



Iron oxides in eroded sediments from two representative catchments from South Spain: an example of its environmental implications

I Diaz (1), MC del Campillo (2), V Barrón (2), and A Delgado (3)

(1) Dpto. Ingeniería Aeroespacial y Mecánica de Fluidos, ETSIA, Universidad de Sevilla, Ctra. Utrera km 1, 41013 Seville, Spain, (2) Dpto. Agronomía, Universidad de Córdoba, Edificio C4, Campus de Rabanales, 14071 Córdoba, Spain, (3) Dpto. Ciencias Agroforestales, ETSIA, Universidad de Sevilla, Ctra. Utrera km 1, 41013 Seville, Spain

Iron (Fe) oxides accounts for one of the most important sorbent compounds in soil and sediments. Nutrients such as P and organic and inorganic pollutants can be retained in soils through its adsorption on these compounds. Particles of Fe oxides can act as a source of sorbed pollutants when these particles are eroded and transported into the bottom of lakes or water as a result of desorption of sorbed compounds or after reduction of Fe oxides under anaerobic conditions. The main target of this work was to study Fe oxides in sediments eroded from two representative catchments from South Spain and how the content and type of oxides in sediments can be affected by the soil properties. One catchment had an extension of 60 ha and soils were mainly classified as Vertisols, with 44–50 % clay in the upper horizon and pH ranging from 7.4 to 7.9. Soils in the other catchment, with an extension of 25 ha, were mainly Alfisols, with 6–33 % clay in the upper horizon and pH between 7.4 and 8.0. Phosphorus and Fe fractions in soil (18 and 10 sampling points in the Vertisol and Alfisols catchment, respectively) and sediments in runoff samples (taken during two consecutive agricultural years, 2000–2002) were studied by means of a sequential fractionation method involving extraction with: NaOH, citrate-bicarbonate (CB), citrate (C), citrate-ascorbate (CA), citrate-bicarbonate-dithionite (CBD), acetate, and HCl. Iron extraction involved sequential extraction with of CB, C, CA and CBD. The two former step in the Fe fractionation dissolve the poorly crystalline and crystalline Fe oxides, respectively.

The concentrations of all the Fe and P fractions were similar in sediments (sum of fractions were 11.5 g Fe/kg and 509 mg P/kg) and soil (sum of fractions were 10.5 g Fe/kg and 586 mg P/kg) from the Vertisol catchment. In this highly calcareous soil, the relevance of Fe oxides in the dynamics of applied P fertilizer was secondary when compared with the precipitation of poorly soluble Ca phosphates, as revealed by the significance of citrate extractable P. In the Alfisols catchment, however, the total free Fe (sum of fractions) was much higher in the sediments (19 g/kg) than in the soil (7.9 g/kg) which explains the increased amounts of P fractions related to oxides (NaOH, CB, CA, and CBD) in sediments (425 mg/kg) when compared with soils (183 mg/kg). Also, the ratio of CA to CBD extractable Fe was higher in sediments (0.22) than in soils (0.15). It can be concluded that in the Alfisol catchment, the content of sorbent surfaces sensitive to reductant conditions are increased in the sediments eroded when compared with soils, and thus, the potential release of pollutants (in this case P) adsorbed or occluded in them. In contrast, in the Vertisol catchment, where P dynamics is dominated by precipitation of Ca phosphates, these forms accounts for the dominant one in soils and sediments, without an increase in the proportion of sorbent surfaces or P forms sensitive to redox conditions.