Determination of Fe(III)-chelates used as fertilizers in agricultural matrices

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The use of fertilizers containing synthetic Fe(III)-chelates is the most common agricultural practice to solve the iron deficiency problem in crops but the environmental concerns raised on the use of these iron fertilizers are far from being completely understood. Recently, we have developed a liquid chromatography-electrospray time of flight mass spectroscopy (HPLC-ESI/MS(TOF)) method to determine the seven major Fe(III)-chelates used in agriculture (Fe(III)-EDTA, Fe(III)-DTPA, Fe(III)-HEDTA, Fe(III)-CDTA, Fe(III)-o,oEDDHA, Fe(III)-o,pEDDHA and Fe(III)-EDDHMA). The aim of this work is to validate the HPLC-ESI/MS(TOF) method developed to determine the Fe(III)-chelates in four agricultural matrices, including nutrient solution, irrigation water, soil solution and plant xylem exudates as well as in commercial fertilizers. Recovery assays are carried out for each Fe(III)-chelate by spiking the agricultural matrices with known amounts of each Fe(III)-chelate and the corresponding isotope labeled $^{57}$Fe(III)-chelates as internal standards. Recoveries depended on the analyte, with Fe(III)-EDTA and Fe(III)-DTPA showing the lowest recoveries (average values of 87 and 88%, respectively, for all agricultural matrices used), whereas for other analytes recoveries were between 91 and 101%. The method was also used to determine the real concentrations of Fe(III)-chelates in commercial fertilizers.