Preliminary steps in the modelling of heavy metals phytoremediation

L.J. Alvarez-Vázquez[*], A. Martínez[†], C. Rodríguez[‡] and M.E. Vázquez-Méndez[§]

[*] Departamento de Matemática Aplicada II, E.I. Telecomunicación
Universidade de Vigo, 36310 Vigo, Spain
E-mail: lino@dma.uvigo.es, Web page: https://gscpage.wordpress.com

[†] Departamento de Matemática Aplicada II, E.I. Telecomunicación
Universidade de Vigo, 36310 Vigo, Spain
E-mail: aurea@dma.uvigo.es

[‡] Departamento de Matemática Aplicada, Facultad de Matemáticas
Universidade de Santiago de Compostela, 15782 Santiago, Spain
E-mail: carmen.rodriguez@usc.es

[§] Departamento de Matemática Aplicada, Escola Politécnica Superior
Universidade de Santiago de Compostela, 27002 Lugo, Spain
E-mail: miguelernesto.vazquez@usc.es

ABSTRACT

In this work we present the first results obtained in the mathematical modelling of the different processes related to phytoremediation methods applied to heavy metal-contaminated environments. Within the framework of water pollution, biosorption - which uses the ability of biological materials to remove and accumulate heavy metals from aqueous solutions - has received considerable attention in recent years because of its advantages compared to traditional methods. Biosorption uses cheaper materials (in our case, for instance, the naturally abundant micro- and macro-algae) as biosorbents, since they have shown their ability to take up toxic heavy metals from the environment.

In order to analyze this environmental problem, we propose a bidimensional mathematical model coupling the system of partial differential equations for shallow water hydrodynamics with the system of coupled equations modelling the concentrations of heavy metals, algae and nutrients in large waterbodies. In this first mathematical approach to the problem from the viewpoint of environmental control, we present a numerical algorithm for solving the system, and several preliminary computational examples for a simple realistic case.