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DEGRADACIJA ALAHLORA U PRIRODNOJ I SINTETIČKOJ VODI PRIMENOM DIREKTNE UV FOTOLIZE I UV/H₂O₂ PROCESA

DEGRADATION OF ALACHLOR IN NATURAL AND SYNTHETIC WATER USING DIRECT UV PHOTOLYSIS AND UV/H₂O₂ PROCESS

APSTRAKT

Alahlor pripada grupi hloroacetanilid herbicida i jedan je od često primenjenih pesticida u poljoprivredi. Zbog značajnog rizika po akvatične ekosisteme, a samim tim i ljudsko zdravlje, alahlor je svrstan na listu prioriternih supstanci prema Okvirnoj Direktivi o vodama EU. U radu su prikazani rezultati ispitivanja degradacije alahlora u prirodnoj (površinskoj) vodi, ali i u sintetički pripremljenom vodenom matriksu u prisustvu huminskih kiselina primenom direktne UV fotolize i UV/H₂O₂ unapređenog oksidacionog procesa. Primenom UV fotolize postignut je sličan stepen degradacije alahlora (oko 85%) u prirodnoj vodi i sintetičkom matriksu. Kombinacijom UV zračenja i vodonik-peroksida (UV/H₂O₂ proces) postignuta je gotovo potpuna oksidativna degradacija alahlora (do 99%) nakon 5 min. tretmana u oba matriksa. Konstanta brzine pseudo prvog reda ukazuje da se brzina degradacije alahlora u vodi povećava sa uvođenjem H₂O₂ u proces, kao i sa povećanjem njegove koncentracije. Pored visokog stepena degradacije alahlora u ispitivanim vodama, primenom UV/H₂O₂ procesa postignuto je i smanjenje sadržaja ukupnih organskih materija, izraženo preko DOC i UV₂₅₄ vrednosti (do 20 i 34% smanjenja, redom).

Ključne reči: alahlor, UV fotoliza, UV/H₂O₂ proces, površinska voda, huminske materije

ABSTRACT

Alachlor belongs to the family of chloroacetanilide herbicides and is one of the most frequently used pesticides in agriculture. Due to the significant risk it poses to aquatic ecosystems, and consequently human health, alachlor was added to the list of priority substances according to the EU Water Framework Directive. In this work, the degradation of alachlor by direct UV photolysis and UV/H₂O₂ advanced oxidation process was investigated, in natural (surface) water and a synthetically prepared aqueous matrix containing humic acids. UV photolysis achieved a very similar degree of alachlor degradation (about 85%) in both the natural water and synthetic matrices. UV radiation combined with hydrogen peroxide (UV/H₂O₂ process) achieved almost complete oxidative degradation of alachlor (up to 99%) after 5 min. in both matrices. The pseudo first order rate constants indicate that the degradation rate of alachlor increases as more H₂O₂ is applied in the process. In addition to the high degree of alachlor degradation, application of the UV/H₂O₂ process also reduced the content of total organic matter, expressed as DOC and UV₂₅₄ values by up to 20 and 34%, respectively.

Keywords: alachlor, UV photolysis, UV/H₂O₂ process, surface water, humic matters

1. UVOD

Poslednjih nekoliko decenija veliko interesovanje se pridaje organskim mikropolitantima u životnoj sredini jer predstavljaju značajan rizik za kvalitet kako površinskih, tako i podzemnih voda. Organski polutanti obuhvataju veliki broj različitih jedinjenja uključujući pesticide, herbicide, kao i proizvode njihove degradacije, farmaceutike, proizvode za ličnu higijenu, usporivače gorenja i dr. koja se kontinualno ispuštaju u životnu sredinu usled njihove primene u industriji, medicini i poljoprivredi. Shodno tome, u životnu sredinu dospevaju prirodnim ili antropogenim

1. INTRODUCTION

In recent years, a great deal of interest has been attached to organic micropollutants in the environment because they represent a significant risk to the quality of surface and ground waters. Organic pollutants include a large number of different compounds like pesticides, herbicides and their degradation products, pharmaceuticals, personal care products, fire retardants etc., which are continuously released into the environment as a result of their use in industry, medicine and agriculture. These substances are subsequently

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