UDK: 628.316.13

Jelena MOLNAR JAZIĆ, Tajana ĐURKIĆ,
Marijana KRAGULJ ISAKOVSKI, Malcolm WATSON,
Snežana MALETIĆ, Aleksandra TUBIĆ, Jasmina AGBABA[1]

UTICAJ pH VREDNOSTI I VODENOG MATRIKSA NA UV/H_2O_2 OKSIDATIVNU DEGRADACIJU 1,2,3-TRIHLORBENZENA

IMPACT OF pH AND WATER MATRIX ON THE UV/H_2O_2 OXIDATIVE DEGRADATION OF 1,2,3-TRICHLOROBENZENE

APSTRAKT

Hlorovani benzeni predstavljaju značajnu grupu polutanata životne sredine, što ih svrstava na listu prioritetnih supstanci prema Okvirnoj Direktivi o Vodama (2000/60/EC). Trihlorbenzeni se koriste kao intermedijeri u proizvodnji herbicida, pigmenata i boja, a u životnu sredinu dospevaju tokom proizvodnje, upotrebe, odlaganja otpada ili kao posledica razlaganja organohlornih pesticida. U radu su prikazani rezultati ispitivanja uticaja pH vrednosti i vodenog matriksa (huminskih kiselina i hidrogenkarbonata) na oksidativnu degradaciju 1,2,3-trihlorbenzena (TCB). Primenom direktne UV fotolize postignuto je 4-48% degradacije TCB, pri čemu pH vrednost nije imala značajniji uticaj na efikasnost fotolitičkog razlaganja ispitivanog polutanta. Najveća efikasnost degradacije TCB u sintetičkoj vodi (>99%) postignuta je primenom UV/H_2O_2 unapređene oksidacije pri nižoj pH vrednosti (pH 5) i prati kinetiku pseudo-prvog reda. Prisustvo huminskih kiselina i hidrogenkarbonata značajno smanjuje efikasnost unapređenog oksidacionog tretmana u odnosu na fotodegradaciju TCB u sintetičkom matriksu bez dodatka interferirajućih agenasa.

Ključne reči: 1,2,3-trihlorbenzen, UV/H_2O_2, UV fotoliza, huminske materija, uticaj matriksa

ABSTRACT

Chlorinated benzenes represent a significant group of environmental pollutants which have been identified as priority pollutants by the European Water Framework Directive (2000/60/EC). Trichlorobenzenes are used as intermediates in the production of herbicides, pigments and dyes, and are found in the environment during the production, usage and disposal of waste, or as the result of organohlorine pesticides decomposition. This paper investigates the influence of pH and water matrix (humic acids and carbonate species) on the oxidative degradation of 1,2,3-trichlorobenzene (TCB). Under direct UV photolysis 4-48% of TCB degradation was achieved wherein the pH did not have a significant effect on the photolytic decomposition efficiency of the investigated pollutant. The highest efficacy of TCB degradation in synthetic water (> 99%) was achieved using UV/H_2O_2 advanced oxidation at a lower pH (pH 5), following pseudo-first order kinetics. The presence of humic acids and hydrogen carbonates significantly reduces the efficiency of the advanced oxidation treatment relative to the photodegradation of TCB in the synthetic matrix with no scavengers added.

Key words: 1,2,3-trichlorobenzene, UV/H_2O_2, UV photolysis, humic matter, matrix effect

1. UVOD

Prisustvo velikog broja zagađujućih materija u životnoj sredini, uključujući prioritetne supstance i emergentne polutante, predstavlja veliki rizik za kvalitet kako površinskih, tako i podzemnih voda. Prioritetni polutanti regulisani su na međunarodnom i nacionalnom nivou usled toksičnosti, perzistentnosti i bioakumulativnog potencijala, a samim tim i visokog rizika po ljudsko zdravlje i akvatičnu biotu. Uzimajući u obzir prioritetni status navedenih polutanata i njihov značaj, uklanjanje ovih susptanci iz vode predstavlja veliki izazov. Proces pripreme vode mora se optimizovati tako da odgovori zahtevima kvaliteta sirove vode, koja je podložna varijacijama usled klimatskih promena, korišćenja zemljišta u poljoprivredne svrhe, ispuštanja nedovoljno prečišćenih otpadnih voda itd. (*Teodosiu i sar., 2018*).

1. INTRODUCTION

The presence of a large number of pollutants in the environment, including priority substances and emerging pollutants, poses a significant risk to the quality of surface and groundwater. Priority pollutants are regulated at international and national levels due to the toxicity, persistence and bioaccumulative potential, and they can pose a high risk to human health and aquatic biota. Considering the priority status of the listed pollutants and their significance, drinking water treatment plants face great challenges in terms of optimizing technologies that will enable efficient removal of the priority substances. Water preparation needs be optimized to meet the requirements of raw water quality in the source, which is subjected to variations due to the climate change, use of land for agricultural purposes,

1 Jelena MOLNAR JAZIĆ, Tajana ĐURKIĆ, Marijana KRAGULJ ISAKOVSKI, Malcolm WATSON, Snežana MALETIĆ, Aleksandra TUBIĆ, Jasmina AGBABA, Univerzitet u Novom Sadu, Prirodno-matematički fakultet, Departman za hemiju, biohemiju i zaštitu životne sredine, Trg Dositeja Obradovića 3, 21000 Novi Sad, Republika Srbija, e-mail: jelena.molnar@dh.uns.ac.rs