Identification and Assessment of Photo Transformation Products of the UV Filter Ethylhexyl Methoxycinnamate Present in Grey Water Intended for Water Reuse

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Especially in arid areas decentralized grey water reuse is an important measure to save scarce fresh water resources. Grey water has a low load of pollutants and therefore has a high potential for reuse such as for irrigation, toilet flushing or laundry. Classical biological treatment of grey water is not able to eliminate micro pollutants such as UV filter substances that originate from personal care products (PCP) (ERIKSSON 2010). However, the discharge of UV filters in the environment should be prevented due to their hormonal activities (KUNZ & FENT 2006) and potential of bioaccumulation (BALMER 2005). For this reason the UV-C treatment as potential post treatment method of UV filters in grey water was investigated. As long as full mineralization is not achieved, the applied photo-oxidation process can result in the formation of new unknown transformation products (TP). As TPs can be more toxic and accumulate in the environment at higher concentrations than the parent compound, this study identified and assessed the primary elimination of the UV filter ethylhexyl methoxycinnamate (EHMC) and its photo-TPs.

Photolysis studies were carried out in a photo reactor by exposing spiked solutions to ultraviolet light of a medium pressure mercury vapor lamp that emits in the range from 200 – 400 nm. The primary elimination of the UV filter was analyzed by HPLC-UV/VIS. Moreover, the formation of TPs was followed by HPLC-UV/VIS while the structure elucidation of the generated TPs was ensued via LC-MS/MS analysis. The biodegradability, sorption and toxicity were assessed for the proposed photo-TPs using computer models exploiting quantitative structure activity relationships (QSARs).

The poster presents the primary elimination of EHMC as well as the formation, degradation and identification of TPs. Based on these results, the applicability of photo-oxidation of EHMC was evaluated by investigation of the degree of mineralization, biodegradability, structure and toxicological assessment of the formed TPs. The newly derived information on the degradation efficiency of the selected PCPs as well as the risk assessment of the formed transformation products extends the knowledge on sustainable grey water treatment options.

References

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