DEVELOPING EXPOSURE AND TOXICITY DATA FOR TRACE ORGANIC CHEMICALS IN WASTEWATER AND BIOSOLIDS

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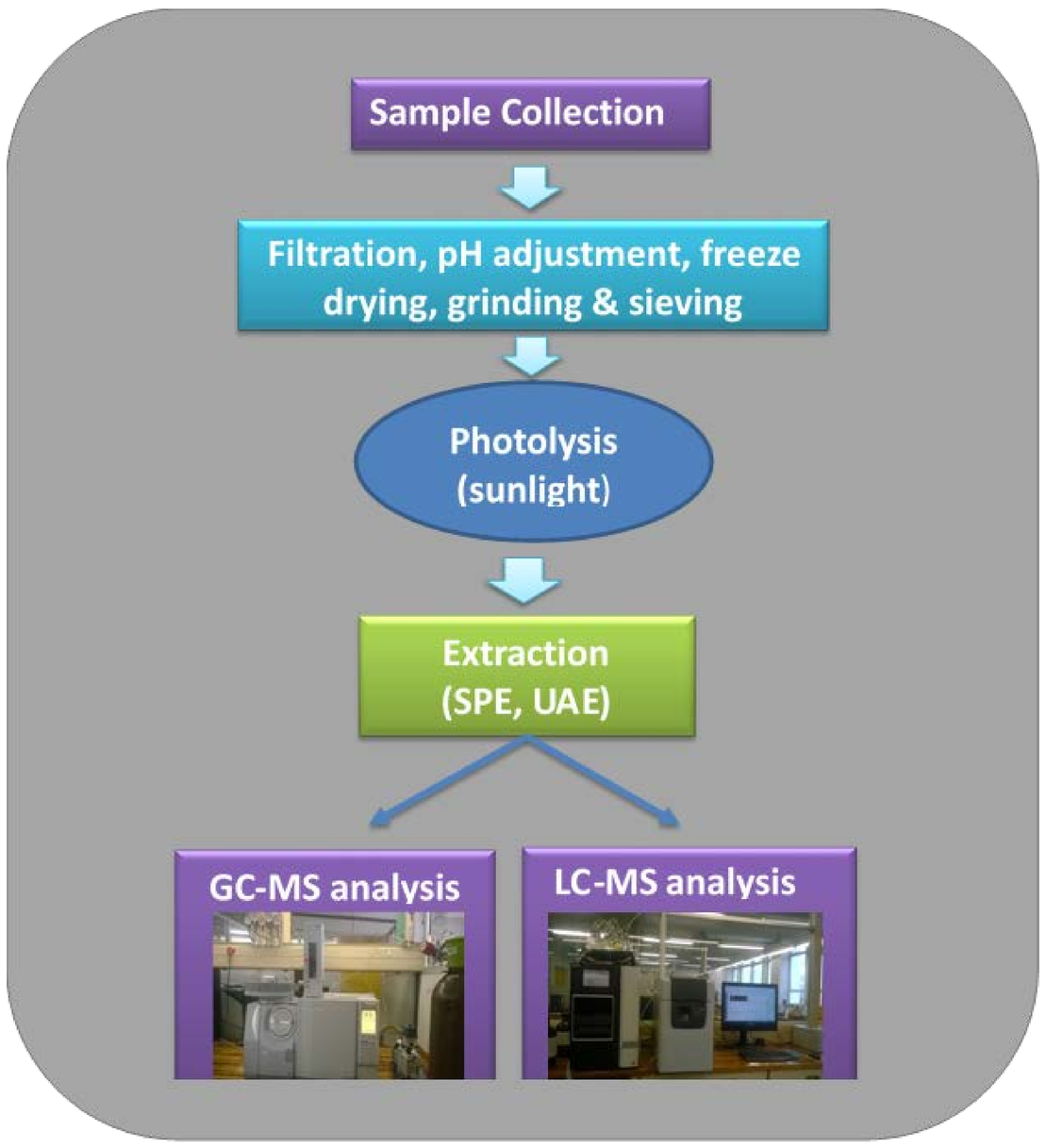
INTRODUCTION

Man's modern lifestyle and extensive use of organic chemicals in personal care and consumer products (PCCPs) has led to the constant discharge of chemical residues from industries and homes into wastewater streams, and ultimately the environment. This has stemmed a growing concern as a number of these trace organic chemicals (TOrCs) are bioaccumulative and persistent environmental pollutants and have been identified to adversely affect human and environmental health. Studies have shown that some TOrCs and their metabolites can escape wastewater treatment process intact, and, based on their physico-chemical properties, partition in biosolids and aqueous media. Therefore, an in-depth knowledge of the chemical constituents present in environmental media is essential for assessing associated risks to the environment and human health. Under the climatic context of South Africa, very little is known about the fate of these chemicals. This project aims to characterize TOrCs in effluents from wastewater treatment plants within the eThekwini municipality and their levels in biosolids (sewage sludge).

The specific objectives include:

1. To develop comprehensive target and non-target analytical techniques to detect and quantify three classes of compounds (antibiotics, HIV-ARVs and flame retardants) in the selected matrices.
2. To study the photolysis of the environmentally most abundant HIV-ARV (zidovudine) in effluent.

EXPERIMENTAL



RESULTS AND DISCUSSION

- Good GC-MS separation of one class of flame retardants, namely, polybrominated diphenyl ethers (PBDEs) has been achieved (see **Fig. 1**).
- The UV/Vis spectra of zidovudine (AZT) in effluent monitored at hourly irradiation intervals for 5 hours are shown in **Fig. 2**. It was observed that AZT photodegraded with increasing exposure time. We propose that this results from the elimination of nitrogen to generate a nitrene as a reactive intermediate, which may further undergo intermolecular interaction with water to form a new photoproduct as shown in **Fig. 3**.
- Photodegradation of the effluent was more significant in the unspiked solution than the spiked solution. This shows that AZT was not the only compound responsible for the photodegradation, since the effluent contains many compounds that are photodegradable and also biodegradable.

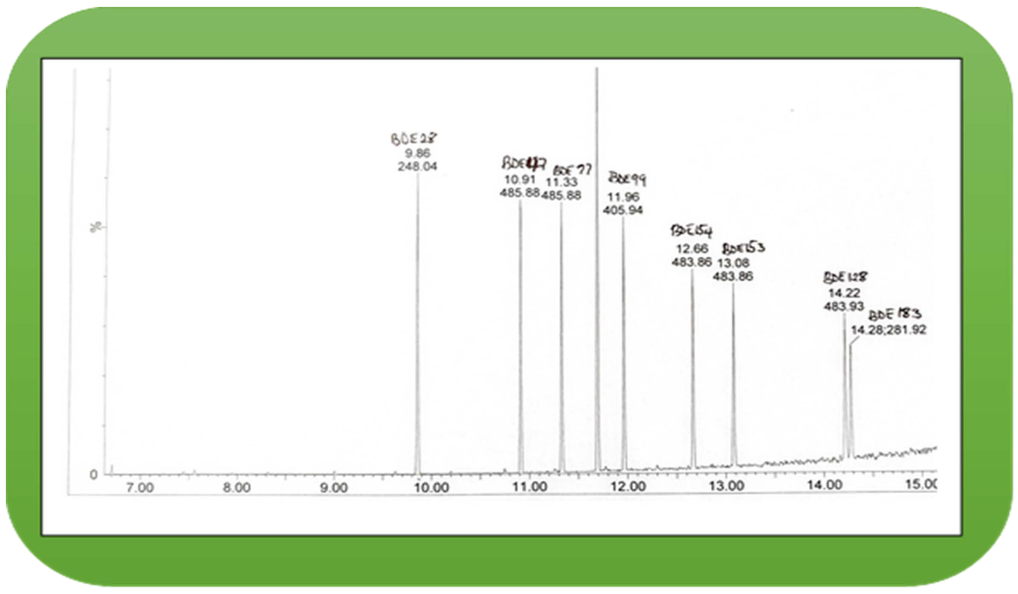


Figure 1: GC-MS separation of PBDEs.

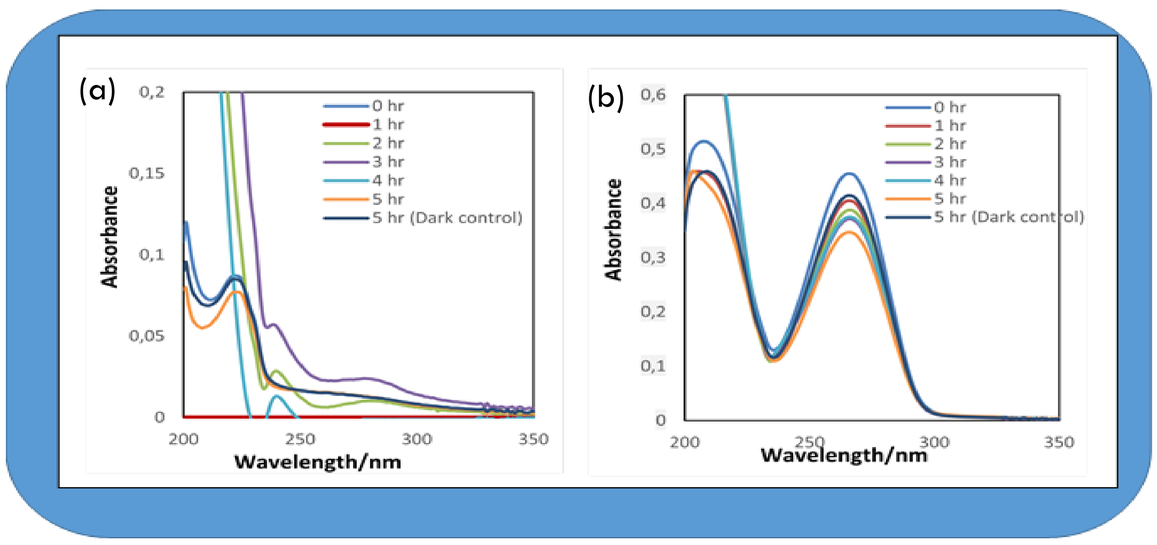


Figure 2: UV absorption spectra monitored at hourly intervals for the photolysis of zidovudine in water (a) unspiked and (b) spiked solution.

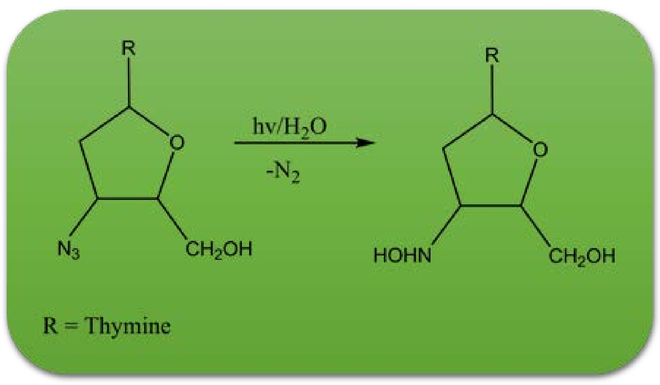


Figure 3: Photolysis of AZT

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