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Chemosphere

Volume 195, March 2018, Pages 201-211

Determination of priority and other hazardous substances in football fields of synthetic turf by gas chromatography-mass spectrometry: A health and environmental concern

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<https://doi.org/10.1016/j.chemosphere.2017.12.063>

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Highlights

- 40 target compounds were analysed in several football fields of synthetic turf.
- The presence of PAHs and other hazardous substances was confirmed in the rubber crumb.
- The runoff water and the air above the fields were analysed by SPME.
- Partial compounds transfer from the field to the water and air has been demonstrated.
- The environmental risk arising from the incineration of scrap tires was assessed.

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Due to the high concern generated in the last years about the safety of recycled tire rubber used for recreational sports surfaces, this study aims at evaluating the presence of forty organic compounds including polycyclic aromatic hydrocarbons (PAHs), phthalates, adipates, vulcanisation additives and antioxidants in recycled tire crumb of synthetic turf football fields.

Ultrasound Assisted Extraction (UAE) was successfully employed to extract the target compounds from the crumb rubber, and analysis was performed by gas chromatography-mass spectrometry (GC-MS).

The transfer of the target chemicals from the crumb rubber to the runoff water and to the air above the rubber surface has also been evaluated employing solid-phase microextraction (SPME).

Samples from fifteen football fields were analysed, and the results revealed the presence of 24 of the 40 target compounds, including 14 of the 16 EPA PAHs, with total concentrations up to $50 \mu\text{g g}^{-1}$. Heavy metals such as Cd, Cr and Pb were also found. A partial transfer of organic compounds to the air and runoff water was also demonstrated. The analysis of rain water collected directly from the football field, showed the presence of a high number of the target compounds at concentrations reaching above $100 \mu\text{g L}^{-1}$. The environmental risk arising from the burning of crumb rubber tires has been assessed, as well, analysing the crumb rubber, and the air and water in contact with this material, showing a substantial increase both of the number and concentration of the hazardous chemicals.

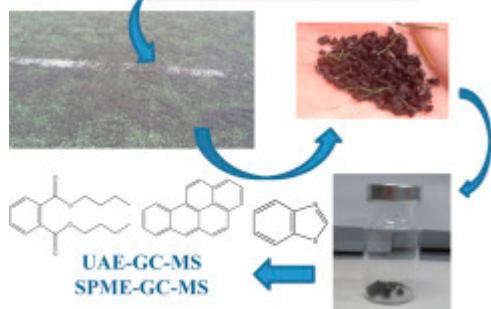
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Keywords

Scrap tire rubber; Synthetic turf; Synthetic football fields; Polycyclic aromatic hydrocarbons (PAHs); Plasticizers; Health and environmental concern

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