Analysis of oxidative stress biomarker 8-iso-prostaglandin $F_{2\alpha}$ in wastewater by liquid chromatography-mass spectrometry coupled with immunoaffinity clean-up

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The analysis of selected biomarkers in sewage has a potential to deliver valuable information on public health, since the excreted biomarkers found in wastewater may directly reflect exposure of the population to various stressors. This approach, wastewater-base epidemiology (WBE) has been internationally studied and accepted as a complementary tool to traditional epidemiological methods. Thus far WBE has been mostly used through the analysis of exogenous biomarkers of legal or illegal drug use at the community level. However, there is large potential for WBE to be extended to human health biomarkers for the assessment of community-wide health and disease. Among a range of candidate health biomarkers in sewage, F_2-isoprostanes have been conceptually evaluated as a prototype for a class of sewage biomarkers to study cumulative oxidative stress at a community level [1,2]. F_2-isoprostanes are a prostaglandin-like free-radical catalysed oxidation products from arachidonic acid, which have been accepted as a reliable indicator of total systematic oxidative stress.

In this work, a robust and specific method by LC-MS coupled with an immunoaffinity clean-up step was developed and validated for the determination of the oxidative stress biomarker 8-iso-prostaglandin $F_{2\alpha}$ in sewage. The immunoaffinity clean-up effectively removed interfering matrix constituents in sewage, allowing low method quantification limit (0.3 ng/L). The method has been applied to the determination of 8-iso-$PGF_{2\alpha}$ in 24 hr-composite sewage samples collected from Norwegian and other European cities in 2014 and 2015. The patterns of 8-iso-$PGF_{2\alpha}$ in the different cities were then compared. This is the first analytical method to quantify the endogenous biomarker of oxidative stress 8-iso-$PGF_{2\alpha}$ in sewage for the community-wide assessment of health status.

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