A comparison of emerging contaminant fingerprinting techniques to assess the impact of human wastewater on karst groundwater quality

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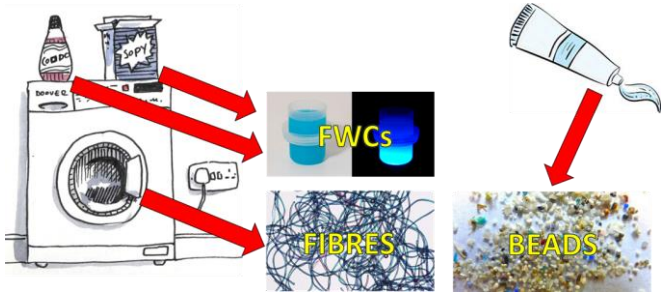

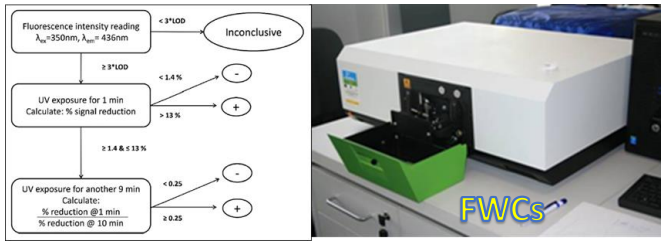

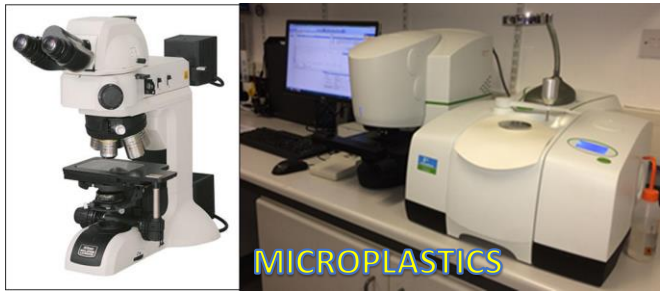

- **Fluorescent whitening compounds (FWCs)** can be detected at karst springs using relatively simple and inexpensive fluorometric methods. This means that labour intensive, costly and complex approaches/methods (e.g. high-performance liquid chromatography (HPLC)) can be avoided at karst springs.
- The majority of **microplastics** in rural karst aquifer systems in Ireland were linked to **decentralized wastewater treatment systems (DWTSs)** on the basis of their properties and detection of FWCs (i.e. FWC signals generally correlate very well with microplastic concentrations at karst springs).
- **More than 97% of microplastic particles** in samples taken at karst springs in Ireland were classified as **fibres**. **Polyethylene (PE) fibres** were dominant in all analysed samples.
- Different methods exist for the analysis of microplastic particles, however, most of them are labour intensive and time-consuming. For example, microplastics are still mostly counted using the microscope while identification of microplastic particles can be done with **Fourier-transform infrared spectroscopy (FTIR)** and other techniques. More recent studies suggest that **flow cytometry (FCM)** can be used for rapid counting of microplastics.
- In terms of microbiological analysis, **FCM** technique provides several advantages (e.g. in terms of cost and time) over more conventional microbiological methods. If combined with other methods/techniques could provide useful information for the development of conceptual and possibly numerical models.
- **Cl : Br ratio** can be useful as a cheap indicator of DWTS pollution at karst springs but only to additionally confirm DWTS impacts on karst groundwater, not as a single tracer.
- In order to analyse **faecal sterols and stanols** in samples taken at karst springs (using GC-MS) an expensive as well as time and labour intensive extraction procedure must be followed. Because total sterol content has to be above certain benchmark in order to be sufficient for the interpretation, a large volume of samples must be taken at karst springs which is generally not practical nor recommended. Nevertheless, this method may be useful if costs, necessary time and labour can be justified.