RAPID, AUTOMATED CHARACTERIZATION OF MICROPLASTICS USING LASER DIRECT INFRARED IMAGING AND SPECTROSCOPY

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Abstract

INTRODUCTION

The presence of microplastics in the environment, drinking water, and food chains is gaining significant public interest1. To study their presence, rapid and reliable characterization of microplastic particles is essential. Significant technical hurdles in microplastics analysis stem from the sheer number of particles to be analyzed in each sample. Total particle counts of several thousand are not uncommon in environmental samples2, while well treated bottled drinking water may contain relatively few.

While visual microscopy has been used extensively, it is prone to operator error and bias3 and is limited to particles larger than 300 μm4. As a result, vibrational spectroscopic techniques such as Raman and FTIR microscopy have become more popular5, however they are time-consuming6. There is a demand for rapid and highly automated techniques to measure particle count, size, and provide high-quality polymer identification. Analysis directly on the filter that often forms the last stage in sample preparation is highly desirable as, by removing a sample preparation step, it can both improve laboratory efficiency and decease opportunities for error.

Recent advances in infrared micro-spectroscopy combining a Quantum Cascade Laser (QCL) with scanning optics has created a new paradigm, laser direct infrared imaging (LDIR). It offers improved speed of analysis as well as high levels of automation. Its mode of operation however requires an infrared (IR) reflective background, and this has, to date, limited the ability to perform direct "on-filter" analysis. This study explores the potential to combine the filter with an infrared reflective surface filter.

Keywords: Infrared QCL Automation Rapid LDIR Filter

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