MSc thesis project proposal 2021/2022

Non-Exhaust Emissions

Introduction

A cocktail of emerging environmental pollutants such as micro- and nanoparticles, microplastics, toxic trace metals, and organic pollutants is released into urban environments and emissions are particularly high in heavily trafficked areas. Historically, the harmful emissions originated mainly from combustion engines (tailpipe emissions). During the last decade, advanced Exhaust gas Aftertreatment systems and the electrification of the vehicle fleet has made the situation very different. The emissions of Particulate emissions (PM) from the combustion engine have been reduced and the particle emissions from tyres, brakes and road wear are now dominating the emissions from transport for modern vehicles. The mixture of tailpipe emissions and non-exhaust emissions is a complex task and puts great challenges to the society, legislation bodies and the automotive industry. A large proportion of the pollutants emitted from traffic are transported from roads by runoff and further by stormwater to receiving watercourses. Only a small percent of the stormwater generated in our urban environment is treated, and the treatment systems available today are not designed to effectively remove small particles and pollutants. Recent studies showed surprisingly high concentrations of both microplastics from tyre and road wear as well as pollutants both on the street and in the nearby stormwater. Tyre and road wear microplastic particles in urban runoff are estimated to be the largest emission source of microplastics in Sweden and account for the highest proportion of microplastics loads into European rivers .

Project description

In this project you will collect different PM emissions in liquid phase for further analysis of size distribution and chemical composition. Chemical analysis possible to measure in the liquid phase at the Chalmers laboratory are particles size distribution from the nano- to micrometer range by dynamic light scattering and zetapotential by electrophoretic light scattering; total and dissolved metals analyzed by inductively coupled plasma mass spectrometry (ICP-MS), total and dissolved organic carbon by catalytic oxidation. A few selected samples will be sent to commercial laboratories for analysis of microplastics, polycyclic aromatic hydrocarbons (PAHs), phthalates and aliphatic hydrocarbons.

The long-term objective is to bring new knowledge about how PM emissions interact with the water system and will thus provide an understanding of how particles are transported from vehicle emission via runoff to receiving watercourses.

About you:
The project will be performed at the division of Water Environment Technology, Department of Architecture and Civil Engineering, Chalmers. The project is suitable for two students with the ability to work independently and creatively. Suitable Background is a Master's program in Chemical Engineering, Infrastructure and environmental engineering or similar. A strong interest in contributing to improved environment and human health is of course necessary.

Project start: January 2021.

Contact persons:
Ann-Margret Strömvall, ann-margret.stromvall@chalmers.se and Jonas Sjöblom, jonas.sjoblom@chalmers.se