Light induced motion manipulation of micro-sized colloids in external flow - aggregation, fractioning and analysis

Marek Bekir

University of Potsdam

marek.bekir@uni-potsdam.de

All in one: What connects the interfacial sensitive fractioning and population-based interface analysis of micro-sized colloids between the mimicking blood clogging with inorganic particles. All those features are possible by light induced motion manipulation of micro-sized colloids in external fluid flows via microfluidics. This is possible with a photosensitive azobenzene containing surfactant, where the more surface-active trans-isomer adsorbs stronger on interfaces in comparison to the less surface active cis-isomer counterpart. This yields under illumination into dynamic exchange between *trans* - and *cis* -isomers making interfaces upon illumination phoretically/osmotically active – its phoretic strength is proportional to illumination parameters and more important also to interfacial properties.
In this sense sedimented colloids can be brought into a vertical displacement from solid-liquid interfaces. We show that this control of light induced chemical activity yields either to model representative of controlled blood coagulation for inorganic particles[1] or into simple and versatile population-based analysis[2] and fractioning of equally sized particles[3,4] varying only by their interfacial properties (porosity, material, surface coating or surface charge).

Keywords:
active colloids, photosensitive surfactants, interface based fractionation, population based porosity analysis, aggregation, microfluidics

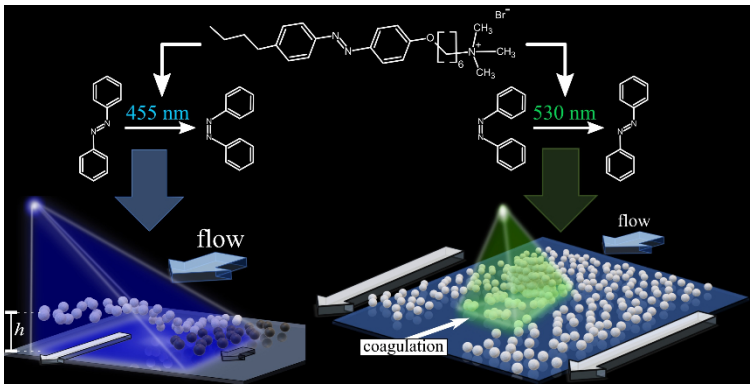

Figure 1. Light-induced control of microscale colloids with azobenzene surfactants. Blue light induces particle levitation and altered motion, enabling fractionation[3,4] and population-based porosity analysis [2]. Green light induces aggregation, causing localized, remotely controlled clogging.

References:

[1] Daniela Vasquez-Muñoz, Fabian Rohne, Anjali Sharma, Nino Lomadze, Svetlana Santer, Marek Bekir, *Small* **2024** , *20* , 2401144.
[2] Fabian Rohne, Daniela Vasquez Muñoz, Isabel Meier, Anne Nitschke, Florian Schmitt, Nino Lomadze, Martin Reifarth, Andreas Taubert, Svetlana Santer, Marek Bekir, *Small Methods* **2026** , *10* , e02329.
[3] Daniela Vasquez-Muñoz, Mihail Nicola Popescu, Anjali Sharma, Fabian Rohne, Isabel Meier, Phillip Ortner, Sarah Loebner, James Robert Benson, Nino Lomadze, Stephan Eickelmann, Svetlana Santer, Marek Bekir, *Small* **2025** , *21* , 2500012.
[4] Marek Bekir, Marcel Sperling, Daniela Vasquez Muñoz, Cevin Braksch, Alexander Böker, Nino Lomadze, Mihail N Popescu, Svetlana Santer, *Advanced Materials* **2023** , *35* , 2300358.