ABSTRACT

The field of droplet-based microfluidics is gaining huge recognition and interests in many biological- and chemical related researches. In this thesis, a droplet-based setup was optimized to explore the solvent polarity of binary and ternary solvent mixtures. Therefore, the absorbance of Reichardt's dye as the solvatochromic probe was used to optimize the fluidic system as well as the procedural process steps. The setup was composed of a droplet generator connected to a computer controlled syringe pump system. Spectroscopic data were recorded by an attached flow through spectrometer. Two different fluidic operational methods for the generation of the solvent mixtures were explored and their accuracy investigated: 1.) Continuous flow and stop flow modes, were used to optimize the accuracy of the received solvent mixtures for binary phases, and 2.) A comparison between "meander" and "spiral" fluidic methods was done to explore the differences in the sequence mode of screening ternary phases by different fluidic procedure. After optimization, the solvent dependent absorbance of Photo-switchable DASA-derivatives was studied in mixtures of 1,4-Dioxane, Methanol and Dimethylformamide (DMF). The shift of the spectral bands (λ_{max}) at maximum absorbance of the Reichardt's betaine as solvatochromic dye with a strong solvatochromism and photo switchable DASA-derivatives with low solvatochromic effect were explored. The DASA derivatives show a shift of about 20 nm in spectrum. In comparison to the Reichardt's betaine with shifts up to 200 nm, the DASA solvatochromism is low. The photo-switching effect works on both investigated DASA compounds (no. 6 and 2.2) and was observed in 1,4-Dioxane but not in more polar solvents such as Methanol or DMF. This thesis focuses on the improvement and optimization of the fluidic system, the process parameters and data analysis methods to prove the system in general as tool to study solvatochromic effects of ternary solvent mixtures.

Keyword: DASA (Donor-Acceptor Stenhouse Adducts), Microfluid system, Reichardt's dye, Solvatochromic behavior, UV-vis Spectroscopy