Development of hydrodynamic sequential injection system for determination of phosphate and ammonium in natural water

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Abstract: A compact hydrodynamic sequential injection (HSI) spectrophotometric system was designed and fabricated on an acrylic plastic platform. The laser engraving method was used to create a manifold pattern on an acrylic block and sealing with another flat acrylic plate to form a microfluidic channel. Teflon tubings were connected to the platform for inlet and outlet of the solutions. Small solenoid valves were embedded onto the platform to obtain a portable setup for programmable control of the liquid flow into the channel according to the HSI principle. As a model, the determination of phosphate and ammonium based on molybdenum blue method and Berthelot method, respectively, were demonstrated. Under the optimum conditions, a linear calibration graph in the range of 0.1-6 mg L⁻¹ and 0.5-5 mg L⁻¹ were obtained for phosphate and ammonium, respectively. The detection limits were 0.1 and 0.3 mg/L for phosphate and ammonium, respectively. The system gained durability, portable, less space, cost-effective instruments, and low chemical consumption. The developed system was applied for the determination of phosphate and ammonium in natural water samples.

Keywords: Hydrodynamic sequential injection; Phosphate; Ammonium; Natural water