

Supplementary materials

Experimental Section

The in-situ synthesis of ammonia was carried out in the 10-liter constant stirring tank reactor, shown in Figure 1, filled with 2 L of distilled water. The plasma discharge head was installed inside the reactor.

The distance between the discharge head and the liquid surface was 3 to 4 cm. The plasma was formed and dispersed onto the liquid surface by an atmospheric corona discharge plasma generator (Enercon Industries, USA). The discharge head consisted of two electrodes separated by a distance of 3 cm.

Nitrogen gas was supplied to the system at a flow rate of 57 standard liter per minute (SLPM). The high flow rate of the gas allowed the plasma to spread out through the nozzle and disperse onto the liquid surface. A well-insulated electric cord connected the high voltage electrode to a step-up transformer located in the main console outside of the reactor, which amplified the 120 V, 60 Hz utilities alternate current (AC) power supply to 4.4 kV. The UV irradiation was produced using a 15 W lamp supplied by Technical Precision Inc. (USA). The NO_x concentration in the gas outlet was determined by an IMR gas analyzer (IMR Inc. USA) and the concentration of N₂ was verified using a Varian CP-4900 gas chromatography (Agilent, USA). The liquid samples collected from the reactor were analyzed using a DR 5000™ UV-Vis Spectrophotometer (Hach Technology Inc. USA).

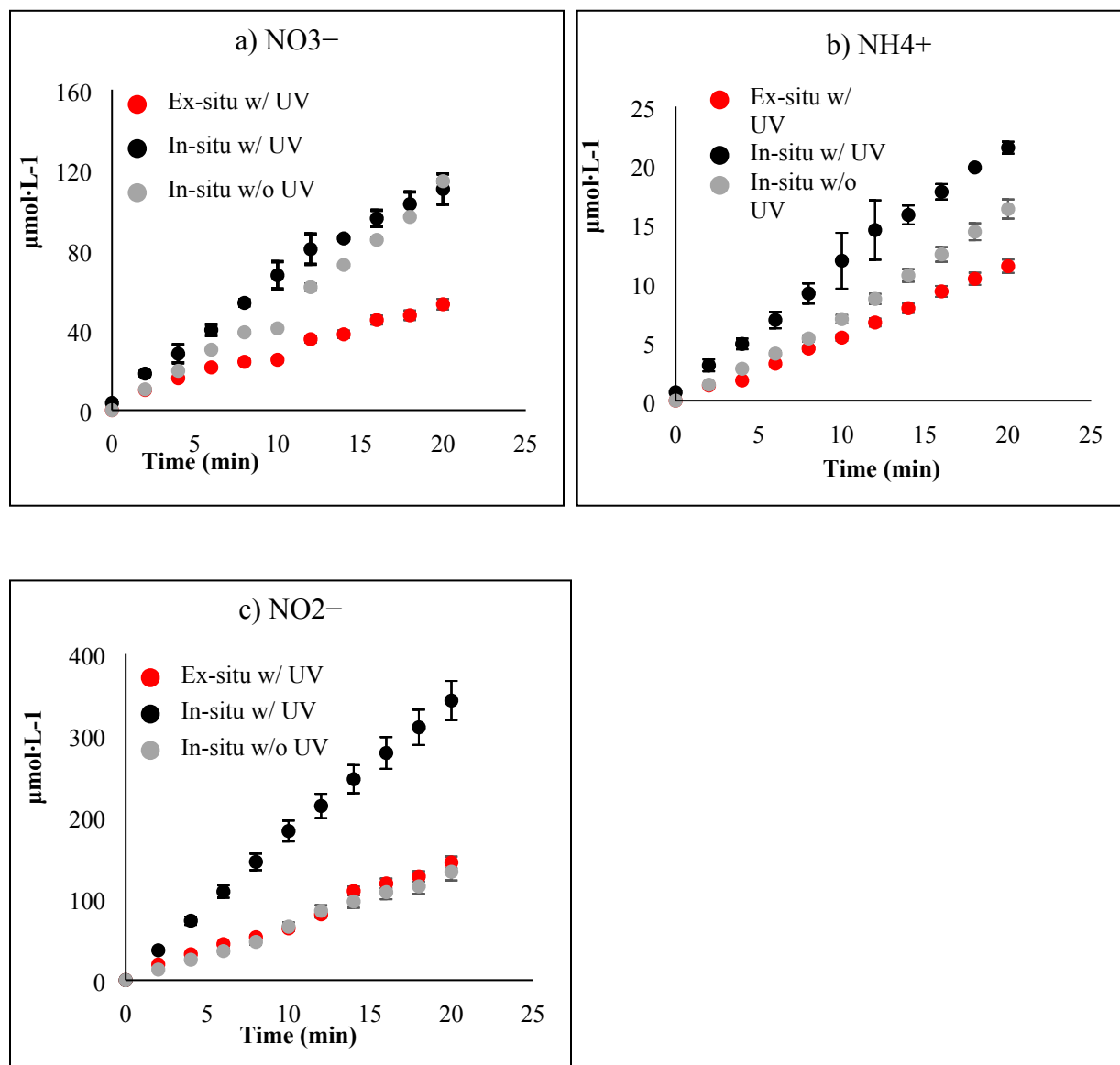


Figure 5 Concentrations of nitrate, nitrite and ammonium at different experimental conditions at 30 °C

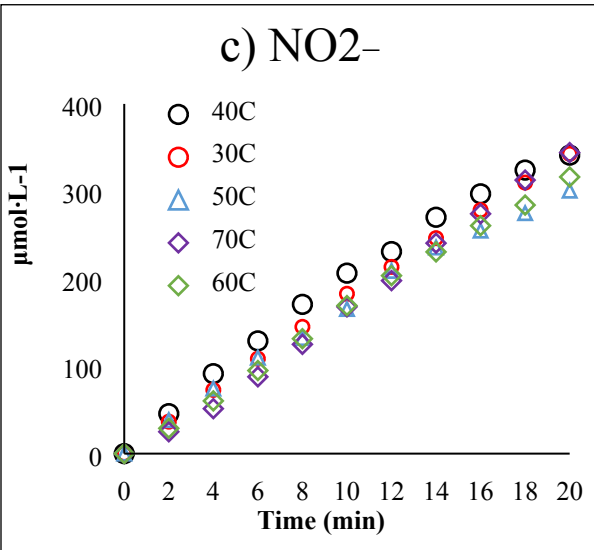
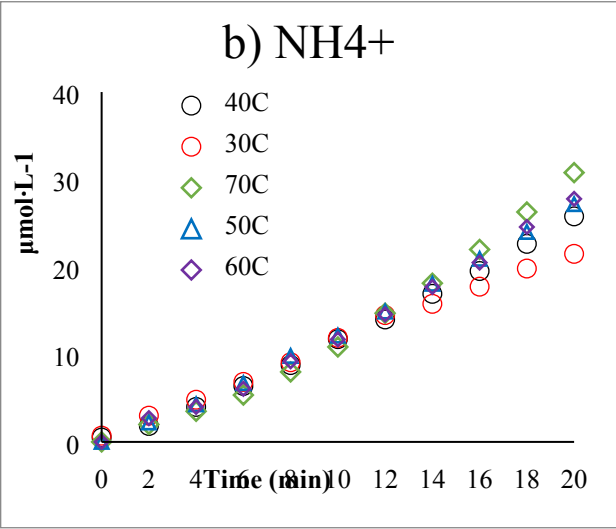
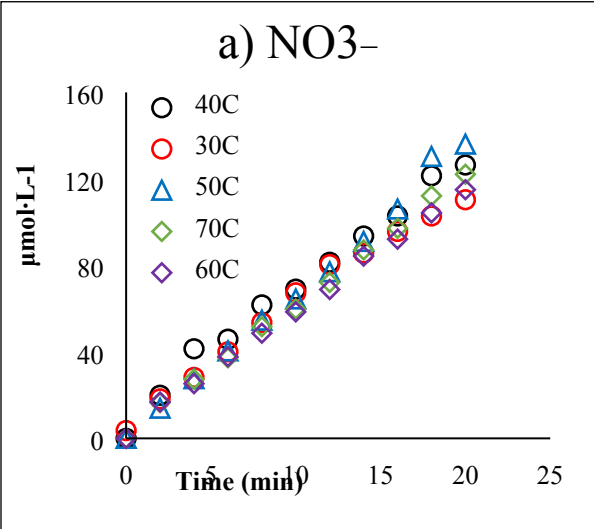


Figure 6 Concentrations of nitrate, nitrite and ammonium of the in-situ reactor at different temperatures