

## Abstract

UV-visible spectroscopic measurements were used to characterize the formation of two ammonium-molybdate complexes, to elucidate its kinetics, and to carry out spectrophotometric quantitation of percent phosphate content in selected commercially available fertilizers. The kinetic study of ammonium-molybdate  $[(\text{NH}_3)_6\text{Mo}_7\text{O}_{24}]$  reaction with hydrazine ( $\text{N}_2\text{H}_2$ ) yielding ammonium-hydrazine-molybdate complex (AHM) and that of reaction of AHM with phosphate  $[\text{PO}_4]^{3-}$  to give phospho-ammonium-hydrazine-molybdate (AHPM) complex revealed that both proceed via zero-order kinetics ( $R^2 = 0.99$ ) with rate constants in the order of  $10^{-5}$  and  $10^{-4}$  M/s respectively. The kinetic experiments revealed that the rate of formation of the AHM complex is sensitive to an increase in  $\text{N}_2\text{H}_2$  ligand concentration. For both reactions, the highest complexation rates were observed within the first 1000 s. Complex dissociation and association equilibria events were observed at extended reaction periods in the kinetic experiments. The AHPM system (containing complexed phosphates) used in spectrophotometric quantitation of phosphate levels in fertilizer samples was found to obey the *Beer-Lambert* equation in the visible region at  $\lambda_{\text{max.}} = 820$  nm within the concentration range of 5 – 90% phosphate content ( $R^2 = 0.99$ ). Of the fertilizer randomized sampled from Nakuru Municipality in Kenya, and analyzed the percent phosphate content among the inorganic fertilizers was found to range between 61.7% - 82% with a mean of 72.86%  $\pm$  6.98 SD. Whereas in the organic fertilizer samples investigated, it was found to range between 43.8% - 58.2% with means of 52.55%  $\pm$  6.77 SD. The organic fertilizers were found to have significantly lower phosphate levels based on an unpaired *t*-test revealing that the mean percent concentrations between the two groups of fertilizer samples tested are significantly different at 95% CI ( $P$  value  $< 0.05$ ).