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Effectiveness of purolite A500PS and A520E ion exchange resins on the removal of nitrate and phosphate from synthetic water

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ABSTRACT

Water pollution due to the excessive presence of nutrients (nitrogen and phosphorus) is a serious environmental worldwide problem, because both species are implicated in the eutrophication of receiving surface waters and elevated nitrate concentration in drinking water can be toxic to infants. The removal efficiencies of nitrate and phosphate from water spiked with different ratios and concentrations of these nutrients by two ion-exchange resins (Purolite A500PS and Purolite A520E) were studied in batch kinetics and equilibrium adsorption experiments. Both purolites were found to be selective towards nitrate removal at all ratios of nitrate to phosphate in solution. Purolite A520E showed higher (<85%) removal efficiency of nitrate than Purolite A500PS (about 65%) from a solution containing 20 mg N/L as nitrate and 10 mg P/L as phosphate at a resin dose of 1.5 g/L. However, Purolite A500PS showed higher (65%) removal of phosphate than Purolite A520E (48%). Langmuir and Freundlich isotherm models fitted well for the adsorption of nitrate on Purolite A520E ($R^2 = 0.95$–0.96). However, the adsorption of nitrate on Purolite A500PS can be explained satisfactorily only by Freundlich model ($R^2 = 0.98$). The adsorption of phosphate on the resins fitted well to Freundlich model ($R^2 = 0.90$) for Purolite A500PS as well as for Purolite A520E ($R^2 = 0.90$). The adsorption of phosphate and nitrate on both ion-exchange resins was much better described by pseudo-second-order kinetic model ($R^2 \geqslant 0.99$) than by pseudo-first-order kinetic model ($R^2 = 0.25$–0.94).

Keywords: Purolite; Ion-exchange resin; Nitrate; Phosphate; Adsorption isotherm and kinetics

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