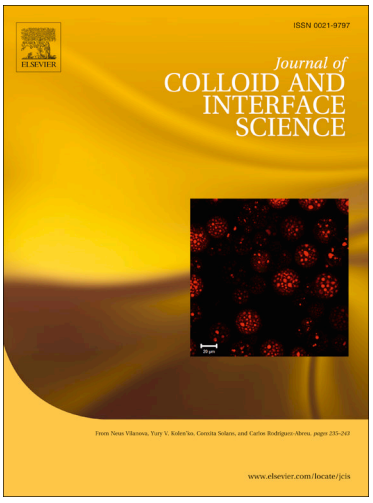

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Fabrication, Detection, and Analysis of DNA-labeled PLGA Particles for Environmental Transport Studies

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Abstract

Poly(lactic-*co*-glycolic acid) (PLGA) particle carriers of synthetic DNA have recently received increased attention for environmental applications due to their biodegradability, customizability, and nearly limitless number of uniquely identifiable "labels". In this paper, we present methodologies for the preparation of DNA-labeled particles, control of particle size, extraction of DNA-labels, and analysis via quantitative polymerase chain reaction (qPCR). Characterization and analysis of the DNA-labeled particles reveal spherical particles of diameters ranging from 60 – 1,000 nm, with consistent zeta potentials around -45 mV, that are stable to aggregation, even in the presence of concentrated mono- and divalent cations. A highly correlated and consistent relationship between particle concentration and DNA-label count was observed, with a detection range spanning 7 orders of magnitude, from 0.01 - 10,000 mg/L (10 - 10^7 particles/μL). The results of two environmental applications of the DNA-labeled particles are also presented, highlighting their feasibility for use in environmental studies. Whether exploring size-dependent transport phenomena or identifying potential pathogen transport pathways, the DNA-labeled particle approach presented here provides a powerful tool for the identification of overlapping particle signals at a range of concentrations.

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