Effects of Chaotropicity on the Efficacy of a DNA-Silica Adsorption Buffer

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In spin column-based plasmid DNA extraction, the chaotropicity of a buffer which most effectively adsorbs plasmid DNA to a silica surface with optimal elution concentration has yet to be determined quantitatively. As such, there has yet to be established a clear relationship between chaotropicity and the binding of DNA to silica at the molecular level. The experiment evaluated a correlation between quantitative chaotropic strength and adsorption efficacy of a DNA-silica adsorption buffer through the testing of buffers with varying chaotropic strengths on a controlled plasmid DNA extraction protocol. After plasmid DNA was extracted and isolated from a frozen culture of E. coli, variable buffers in addition to a control buffer were tested on each sample group. The nucleic acid concentrations following elution and intermediary flowthrough steps were spectrophotometrically measured to determine adsorption efficacy. There was shown to exist no correlation between quantitative chaotropic strength and plasmid DNA adsorption, wash, or elution. Adsorption buffers ranging in chaotropic strength yielded varying efficacies in both adsorption strength and final elution concentration, and the success of each buffer was found to be independent of chaotropicity as a general property. Overall, the results show that adsorption efficacy is dependent on other chemical variables such as charge, solution pH, and specific molecular attractions. This affirms the validity of adsorption buffer engineering examining solutes with low chaotropic strength in order to eliminate downstream application inhibition, ultimately leading towards less-interfering DNA extractions.

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