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Crystal aggregation in kidney stones; a polymer aggregation problem? J. WESSON, A. BESHENSKY, P. VISWANATHAN, W. ZACHOWICZ, J. KLEINMAN, Medical College of Wisconsin — Kidney stones most frequently form as aggregates of calcium oxalate monohydrate (COM) crystals with organic layers between them, and the organic layers contain principally proteins. The pathway leading to the formation of these crystal aggregates in affected people has not been identified, but stone forming patients are thought to have a defect in the structure or distribution of urinary proteins, which normally protect against stone formation. We have developed two polyelectrolyte models that will induce COM crystal aggregation *in vitro*, and both are consistent with possible urinary protein compositions. The first model was based on mixing polyanionic and polycationic proteins, in portions such that the combined protein charge is near zero. The second model was based on reducing the charge density on partially charged polyanionic proteins, specifically Tamm-Horsfall protein, the second most abundant protein in urine. Both models demonstrated polymer phase separation at solution conditions where COM crystal aggregation was observed. Correlation with data from other bulk crystallization measurements suggest that the anionic side chains form critical binding interactions with COM surfaces that are necessary along with the phase separation process to induce COM crystal aggregation.

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