

Effect of solution conditions on the recovery of uranyl ions using a metal-binding protein on silica nanoparticles

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Many methodologies have been developed to separate metal ions from water for the purpose of mining or decontamination. Most of these approaches are based on amidoxime-based polymers, hydrogels, microspheres, fibres and metal-organic frameworks [1-3]. However, such approaches are typically inefficient with low selectivity. Recently Zhou et al. [4] have reported a super uranyl binding protein (SUP) with a femtomolar affinity and a high selectivity for uranyl. Following this exciting result, SUP has been combined with different recyclable systems for the separation of uranyl ions from seawater and other sources [1, 3, 5]. Nevertheless, most of them still rely on the polymer or hydrogel-based systems which are either expensive or need complicated devices for uranyl capture. Thus, there is an unmet need to develop an efficient and yet simple system to use SUP for recovery of uranyl.

It is attractive to use low-cost matrix such as silica particles for recycling SUP. However, such matrix systems often require chemical modifications of surface; it does not only increase the cost but also decrease protein activities. In this work, we utilized a simple method to immobilize SUP on silica particles without chemical functionalization of silica surface. The binding of SUP on silica is facilitated by a high affinity silica binding peptide. In order to achieve optimal immobilization, we have included a peptide linker that connects SUP with silica binding peptide (CotB[6]). The engineered bi-functional proteins enable silica surface and uranyl ion binding at the same time. These proteins have been successfully expressed and purified, and their performance have been evaluated by determining their silica and uranyl binding abilities as well as their stability, and oligomeric state by multiple techniques that range from colorimetric assays to small angle scattering using different concentrations of sodium chloride. Results suggest that sodium chloride plays an important role for the optimal binding of uranyl ions by SUP.

References:

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Level of Expertise

Student

Do you wish to take part in the poster slam

Yes

Travel Funding

Yes

Speakers Gender

Female

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