Materials chemistry and applications

Supported ionic liquid materials for L-asparaginase bioconjugation

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Since the average life expectancy is increasing, several fatal diseases usually related to aging, such as cancer, heart and neurological diseases have become predominant. Biopharmaceuticals, namely nucleic-acid-based products, antibodies, recombinant proteins and enzymes are fundamental to overcome these age-related diseases. Actually, the gold standard enzyme for the treatment of acute chronic lymphoblastic leukemia (ALL) is L-asparaginase (ASNase). Hence, the reusability of this high-priced drug enables the cost reduction of treatments, which allows its routinely use by a widespread population.

In this work, functionalized nanomaterials, namely supported ionic liquid materials (SILs) based on silica, formerly described in the literature for the separation of natural compounds from vegetable biomass [1], were studied as a cost-effective support for ASNase immobilization and reuse. Commercial ASNase was used for preliminary tests. Several experimental immobilization conditions, such as pH, contact time, ASNase concentration and SILs recyclability were assessed and optimized, regarding the immobilized ASNase activity, assessed by Nessler reaction, which quantifies the amount of ammonium released after the enzymatic reaction with L-asparagine [2] and immobilization yield. In fact, ASNase immobilization onto the SILs was successfully achieved with an immobilized ASNase activity ranging from 0.6 to 0.9 U of enzyme per mg of SILs under the optimum immobilization conditions. Moreover, all SILs allowed 5 cycles of reaction, while keeping more than 75% of initial ASNase activity. Through the envisioned immobilization strategy, process costs will be considerably reduced, which can lead to a wider use of ASNase in diverse fields of application.

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