Carbon-based nanomaterials for the development of anti-leukemic drugs

Rita A. M. Barros*, Sónia A.C. Carabineiro, Mara G. Freire, Joaquim L. Faria, Valéria C. Santos-Ebinuma, Ana P. M. Tavares, Cláudia G. Silva, Raquel O. Cristóvão

*Email: up201604653@edu.fe.up.pt

The enzyme in study is currently used in the pharmaceutical sector as an anticancer drug to treat acute lymphoblastic leukemia and in the food industry for the mitigation of acrylamide production. Enzyme immobilization is an exciting option for both industries, allowing a more straightforward recovery and increased stability under certain conditions. High surface area and adsorption capacity, together with the ability to precisely customize its porosity, make nanostructured carbon materials promising supports for this purpose. In this work, the influence of the contact time, pH, and enzyme concentration on the yield and relative recovered activity of the immobilized enzyme was studied using the Central Composite Design methodology for three different nanostructured carbon materials with distinct pore sizes. The most promising results were obtained using the material with the smaller pore size, reaching yields and relative recovered activities of 100%. Stability of free and immobilized enzyme was studied at various temperatures and pH. The immobilized enzyme showed 71% recovered activity after 6 continuous reaction cycles and a 3.9-fold increase in the affinity for the substrate. Regarding the enzyme purification from a cellular extract, the results indicate a 2.8-fold increase in its specific activity through adsorption of unwanted proteins onto the nanostructured carbon materials, keeping the enzyme free in solution. These findings will certainly be helpful towards the search for a simpler, cost-effective and scalable purification process of biopharmaceuticals.