# Nanostructured carbon-based column for LPS/protein adsorption

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The absence of a general method for endotoxin removal from liquid interfaces gives an opportunity to find new methods and materials to overcome this gap. Activated nanostructured carbon is a promising material that showed good adsorption properties due to its vast pore network and high surface area. The aim of this study is to find the adsorption rates for a carboneous material produced at different temperatures, as well as to reveal possible differences between the performance of the material for each of the adsorbates used during the study (hemoglobin, serum albumin and lipopolysaccharide, LPS). The initial kinetic studies using these three proteins have been done in batch mode. After mathematical processing, the data were used for design and production of a carbon material-filled column. The column packed with activated carbon was used to measure breakthrough curves and adsorption performance of the materials under study in flow-through mode. Two methods were used for the detection of the adsorbates concentration after the interaction with the activated carbon, Lawry protein method was used for protein concentration determination and LAL (Limulus Amebocyte Lysate) in the microplate modification used to measure the LPS concentration. In both cases the data were collected spectrophotometrically and statistically analyzed. In the frames of this series of experiments, a comparison between adsorption in a closed system experiment and a flow through setup was done.
Some results are presented in Figures 1 and 2:

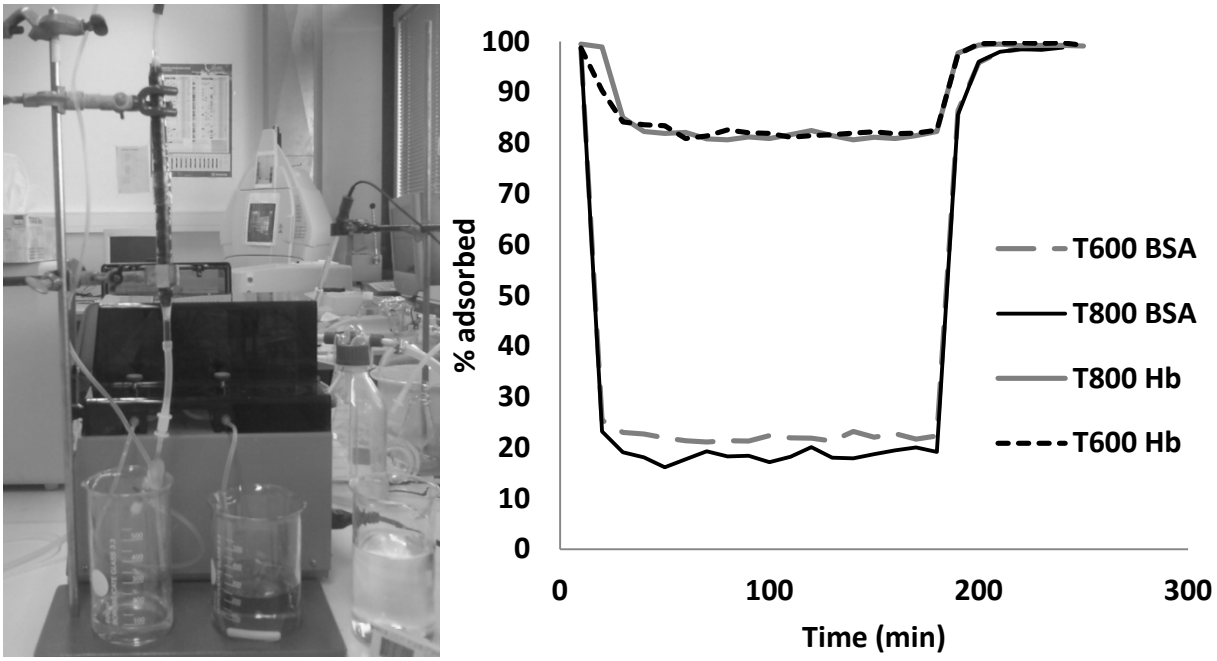


**Figure 1**. Left: The column used in the experiments. Right: The adsorption behavior of the column in respect of blood proteins (BSA: serum albumin, Hb: human hemoglobin, T800 and T600 are adsorbent types having different pore size.

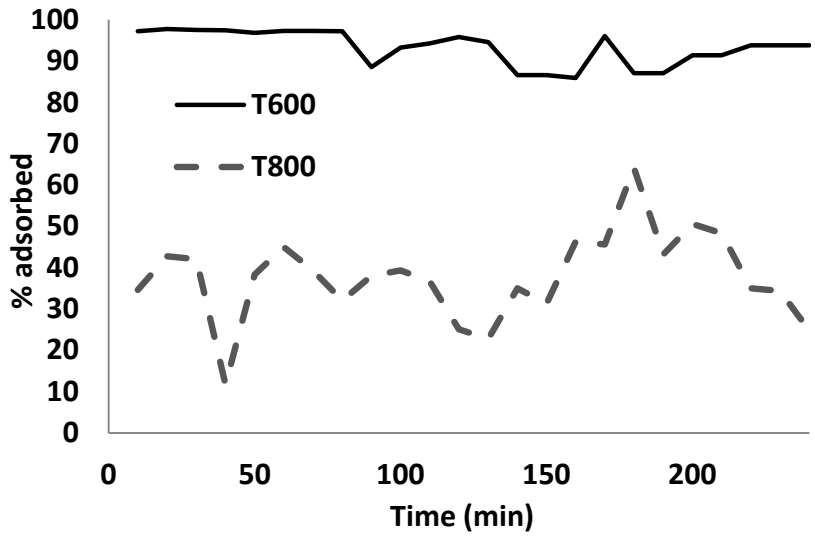


**Figure 2**. Adsorption dynamics of microbial (*E.coli*) lipopolysaccharide in the column under usage of two different adsorbent types.

Conclusions: Both materials exhibit high adsorption rates for human hemoglobin in both experimental setups, where in the column experiments the rates were around 80% compared to the 60% in the batch experiments, in the case of BSA the rate was around 20% for both experimental setups. In the case of LPS the batch experiment showed a high dependence on diffusion kinetics according to the experimental setup. As in the case of the column experiments T600 was a better adsorbent as it adsorbed almost the 100% of the LPS.