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Statistical optimization of carbon nanotubes production by DS-CVD and its application in protein purification

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Abstract

Carbon nanotubes (CNTs) have been successfully synthesized by using in-house fabricated Double Stage Chemical Vapor Deposition (DS-CVD) technique, using acetylene (C_2H_2) and hydrogen (H_2) as the precursor gases. The purity, morphology and structure of CNTs were then characterized using Field Emission Scanning Microscope (FESEM), Transmission Electron Microscope (TEM) and Thermogravimetric Analysis (TGA). The effect of the process parameters were examined whereby the experimental design of the investigation was conducted using Design Expert? Version 6.08. The statistical analysis reveals that the optimized conditions for the best CNTs yield production is at 850°C reaction temperature, 60 mins reaction time, with gases flow rates at 40 and 150 ml/min for C_2H_2 and H_2 respectively. The CNTs produced were successfully used as column chromatographic media. Due to its nano-sized structured dimension, CNTs has tremendously large surface area, which leads to highly efficient protein purification. Skim latex protein has been used as the model protein and we aim to recover useful proteins and enzymes from this known wasteful material. During the purification, the process parameters such as pH and ionic strength of the running buffer were optimized to enhance protein purification. Results reveal that CNTs behaves efficiently as a hydrophobic interaction chromatographic media.

Key words: *CNTs, DS-CVD, Functionalization, Skim latex serum, Protein purification*

1. Introduction

Ever since CNTs discovery by (Iijima, 1991) they have been treated as the most promising nanostructured materials. The prospect of developing novel carbon-based nano-material has excited worldwide interest among researchers. CNTs have been of great interest; both from fundamental point of view and for potential applications because of their amazing mechanical (Yakobson and

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