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主　論　文　の　要　旨

論文題目　**Synthesis and Surface Modification of Graphite Oxide-Cellulose Composites for Solid Phase DNA Extraction Applications (DNA 固相抽出法への応用に向けた酸化グラフェン-セルロース複合材料の合成と表面改質)**

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論　文　内　容　の　要　旨

The extraction of DNA is the most crucial method used in molecular biology. It is the starting point for downstream processes and product development including diagnostic kits. Generally silica matrices are the most utilized solid support material because of their unique properties for selective DNA binding. The major advantage of silica matrices is they can fix to a solid support provides a quick, convenient, nontoxic method. However, adsorption force of Si-OH functional groups is much greater than that of desorption force, the DNA extraction efficiency of silica surfaces is limited.

Chapter 1 begins with a general introduction to the DNA extraction methods, protocol types, fundamentals and application. The purpose of this study is to invent a new material with a suitable functional groups for high extraction efficiency and yield. Therefore, in this study, we synthesized and progress Graphite oxide (GO)/Cellulose composite material. In chapter 2, our study focused on preparing GO/Cellulose composite and applying single strand DNA (ssDNA) on the surface. The concentration of GO within the composites were ranged from 0 – 4.15 wt. %. The highest binding capacity was achieved with 4.15 wt. % GO, where the extraction efficiency was

reported as 660.4 ng/μl. The results compared with commercial silica spin column and showed that the extraction efficiency was 50% higher than that of conventional silica column with similar DNA purity.

In order to compare extraction efficiency and yield of various DNA types, Chapter 3 researches to Genomic DNA performance on GO/Cellulose composite. Genomic DNA samples are obtained from forensic DNA sources like cigarette bud paper, nail, chewing gum, animal tissue and hair. The total weight % of GO was fixed at 4.15% in GO/Cellulose composite and among all types of samples, the extraction efficiencies were 4 to 12 times higher than that of commercial silica spin column. On the other hands, magnetic particles have been used increasingly for the purification of genomic or plasmid DNA from different biological sources due to its less rigorous application, direct use and rapid recovery. Hence, in chapter 4, GO/Cellulose/Magnetic composites are prepared. The total weight % of GO was fixed at 4.15% and concentration of magnetite inside the composite ranged between 0.2 – 3.98 wt. %. The results compared with commercial magnetic beads and showed that extraction efficiency was 150 times higher than magnetic beads.

Finally, chapter 5 summarized the performance, extraction efficiency and yield of GO/Cellulose composite on each type of DNA samples and it might be a promising and efficient solid phase material for DNA extraction applications. In this study, GO/cellulose composite is one of the first researches in the field of applying carbon based material for DNA extraction. Compared the most common used DNA extraction material, silica films, graphite oxide-cellulose composite showed higher DNA binding capacity and extraction yield with a simple and environment friendly production. The results observed that (1) It was found that the binding capacity of DNA increased with increasing weight percentage of GO inside the composite, (2) GO/Cellulose composite showed high extraction efficiency and yield not only for ssDNA also with Genomic DNA and (3) GO/Cellulose/Magnetite composite exhibits superior extraction efficiency than commercial magnetic bead product.