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Bioconjugation Efficiency of Plasma-Functionalized Graphite-Encapsulated Magnetic Nanoparticles Tested with Biotin-Avidin System for Bacterial and Viral Detections

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Graphite encapsulated magnetic nanoparticles (GrMNP) were synthesized by DC arc discharge method and were functionalized with amino group for biomedical applications. Amino groups were introduced by Ar plasma pre-treatment and NH3 plasma post-treatment [1,2]. Through the conventional chemical methods we have found out that the amino group population is roughly 5-7×104 molecules per nanoparticles. From the surface analysis of the synthesized nanoparticles by transmission electron microscopy indicates that the structural and morphological damages were nil, indicating that this technique can be used for high-efficiency surface modification of GrMNP's. To examine whether the amino functionalized GrMNP's are efficient for bioconjugation, we have biotinylated the nanoparticles. The biotinylated nanoparticle is quantified calorimetrically by HABA/Avidin competitive binding assay (Fig.1).

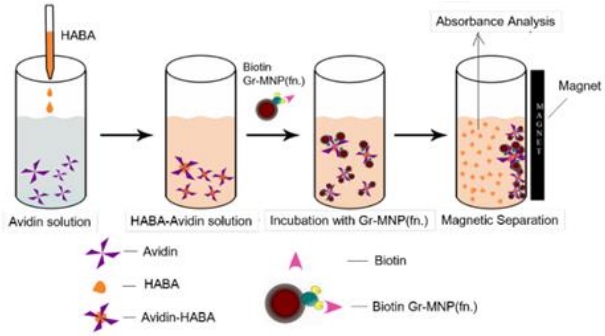

Figure 1: Illustration of HABA/Avidin competitive assay.

This test make use of the formation of avidin-biotin complex, the strongest known non-covalent interaction (Kd = 10-15 M). Once the bond is formed between them, it is unaffected by extreme conditions. Thus from the decrease in the absorbance peak at 500 nm of HABA/Avidin complex (Fig.2,3), we are able to confirm that when the amino group population on GrMNP's increases, the biotin immobilization efficiency also increases, which in turn proves efficiency of amino functionalized GrMNP in bioconjugation. Then we have carried out the bacterial and viral detection studies and got highly significant results. The details of these results will be presented at the conference.

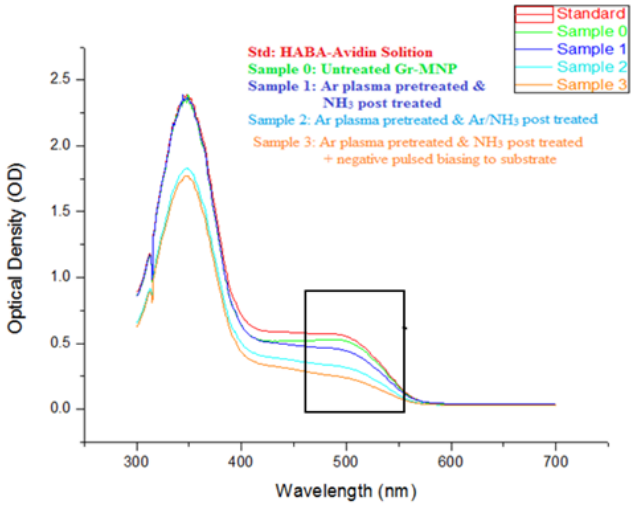

Figure 2: Absorbance spectrum of HABA/Avidin competitive assay. Here, sample 0: 0 amino group/particle, sample 1: 20000~40000, sample 2: 40000~60000, sample 3: 60000~80000.

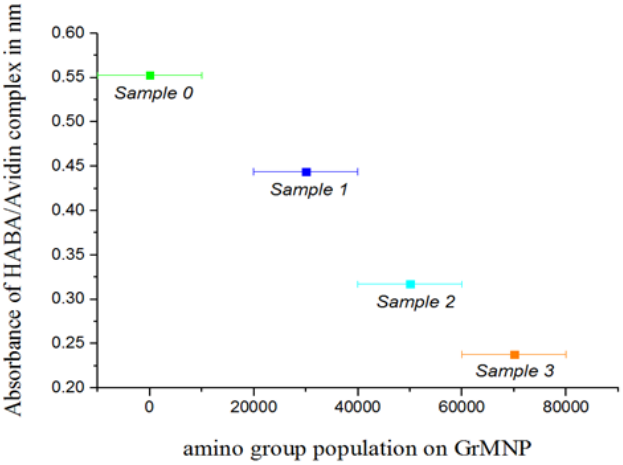

Figure 3: absorbance versus amino group population

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References

[1] T. E. Saraswati, A. Ogino, M. Nagatsu, Carbon 50 (2012) 1253.
[2] M. Nagatsu, R. V. Bekarevich, etc., MRS Online Proceedings Library, 1469 (2012)