KAPLAT Achievement Report

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1. Scope of Research

The visiting research is aiming to facilitate the learning of ideas, knowledge and best practices in the formulation community, to facilitate incorporating novel nanostructured materials into formulated measurement. As a result, this program brought together various measurement labs in ISIR, including academic and research institutions of Osaka University. This report contains an overview of the outcomes of KAPLAT program, to provide a general view on the activities carried out during **"the synthesis of polymer based nanoparticle as green synthesis of chitosan-graphene oxide nanoparticle"** project and the lessons learned as a result of them. In this program, characterization of particles with an optical microscope, field emission scanning electron microscope (FE-SEM), dynamic light scattering (DLS), and X-ray diffraction (XRD) were carried out on synthesized nanoparticle project.

2. Characterization of Research

The first research activity of the optical microscope STZ-171 with Moticam U 2.0 MP, Shimadzu which captured the images. involved learning the operation procedure. To determine the sample condition and rough size, optical microscope observation was made on all samples. Observed images were shown in Figure 1. As seen in Figure 1, the size were varied sample to sample and the largest sample was CS-GO0.5 as large as 1000 mm x 1000 mm. The method of measurement for particle size by optical microscopy was also useful for observing the aggregation evolution over time, specifically when fine particles agglomerate to form new, larger aggregates [1].

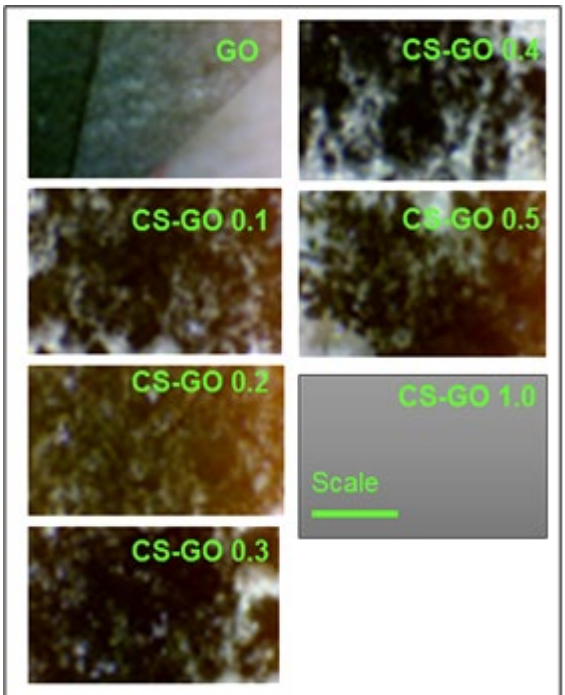

Fig.1. Optical micrographs images

Next, to determine finer structure of samples, FESEM measurements were carried out. Figure 2 is one of FESEM image on CS-GO. As seen in figure 2, the edges of the sample was presence of the biopolymer Chitosan with its porous, rough and granular morphology, and the GO with its layered morphology could be seen presence of exfoliated GO is also clearly seen as a fibrous network on the surface of the Chitosan matrix indication of good adhesion and interaction between chitosan and graphene oxide in the composites.

To determine degree of insertion of CS in GO plane, XRD measurement was carried out . As seen figure 3, as seen in Figure 3, the diffraction peak assigned to CS-GO were observed at 23° for all sample and there was no diffraction of graphene which has diffraction peaks at 12° reported in literature. After the formation of CS/GO hydrogel, the intensity of all the reflections decreases. This

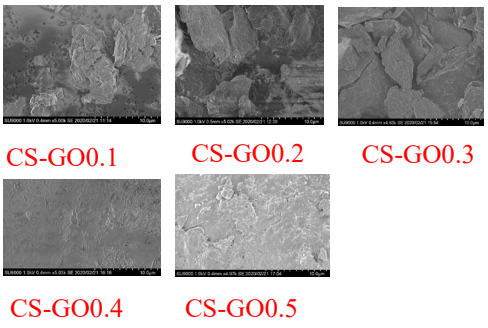

Fig 2. FESEM micrograph of CS-GO samples

is because of the decrease in the degree of crystallinity of CS due to the addition of GO. Formation of new interactions between GO and CS reduces the interactions among CS chains. the XRD pattern of the CS/GO nanocomposites shows only the CS diffraction peaks from CS and the diffraction peak of GO disappears, which clearly demonstrate the formation of fully exfoliated structure of GO sheets in the polymer matrix [2] . In this particular case, the electrostatic interaction and hydrogen bonding may contribute to a relatively ordered arrangement of the attached CS chains along the rigid template offered by GO [3].

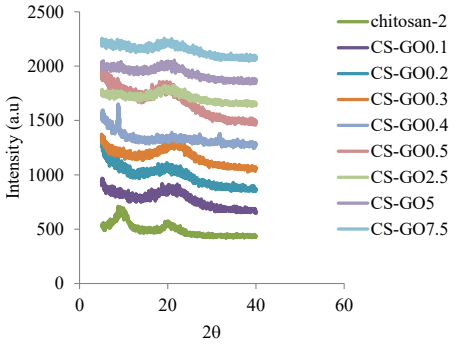

Fig 3 XRD patterns of chitosan and CS-GO compositees

Determination of particle size, distribution of the size, and dispersion properties of the sample in acidic aqueous solvent, DLS and Zeta potential measurement were carried out using a Zetasizer Nano ZS (Nano ZS90, Malvern, UK). Sample was diluted to 0.01 w/v % and measured in 1% acetic acid. At the preparation of the sample solution, the most of the sample were not gave good suspension and the most parts were sink down to the bottom of cuvette. Therefore, the measurements were done supernatant of each sample. From figure 4 ,this caused the very diluted condition and the result of DLS and Zeta potential measurement were result in insufficient quality. The ζ potential of the synthesized GO is – 25 mV. Accordingly, particles with zeta potential lower than – 30 mV are strong enough to maintain a stable colloidal solution because of repulsion forces between them This dispersion character was different from literature.

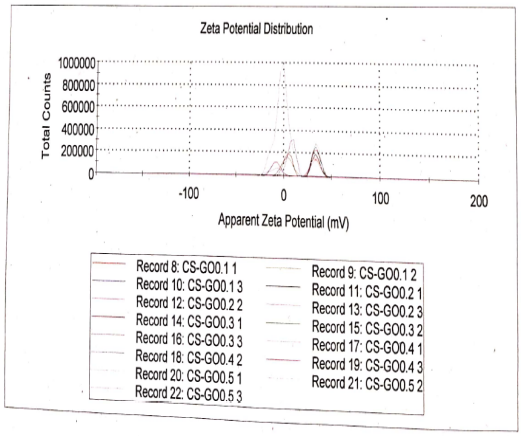

Fig 4 Zeta potential of CS-GO composites

Following the conclusion of the KAPLAT Program, I will continue to analyze the data collected here using multilevel modeling and hope to continue collaborating with Prof Yoshida's lab on a laboratory experiment of similar research questions to extend the current project.

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Reference

[1] M. Quilaqueo , M. Gim-Krumm , R. Ruby-Figueroa , E. Troncoso and H. Esta. "Determination of Size Distribution of Precipitation Aggregates Using Non-Invasive Microscopy and Semiautomated Image Processing and Analysis", *Minerals* , 2019, **9** (724), 1-14; doi:10.3390/min9120724

[2] M. Sabzevari, D. E. Cree, and L. D. Wilson. " Graphene Oxide- Chitosan Composite Material for Treatment of a Model Dye Effluent", *ACS Omega*, 2018,3,13045-13054; doi:10.102/acsomega.8b01871

[3] X. Yang, Y. Tu, L. Li, S. Shang, and X. Tao. "Well-Dispersed Chitosan/Graphene Oxide Nanocomposites", *ACS Applied Materials & Interfaces*,2010, 2(6),1707-1713; DOI: 10.1021/am100222m