Technology Arc Plasma Sintering for Utilizing Biomass Waste Around the Reactor for Making Reduced Graphene Oxide Material

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1. Background and Goal

Proper management of biomass waste around radiation sites is an important responsibility for radiation workers. This research explores the feasibility of converting waste into reduced graphene oxide (rGO) through the use of appropriate technology at 3000 °C, namely Arc Plasma Sintering (APS).

This research focuses on the implementation of arc plasma sintering APS) technology for the sintering process. APS utilizes plasma produced by the ionization of argon gas between the anode and cathode with impulse currents, resulting in temperatures exceeding 3000 degrees C. This research examines the advantages of using argon gas in industrial processes, especially in providing thermal protection to materials.

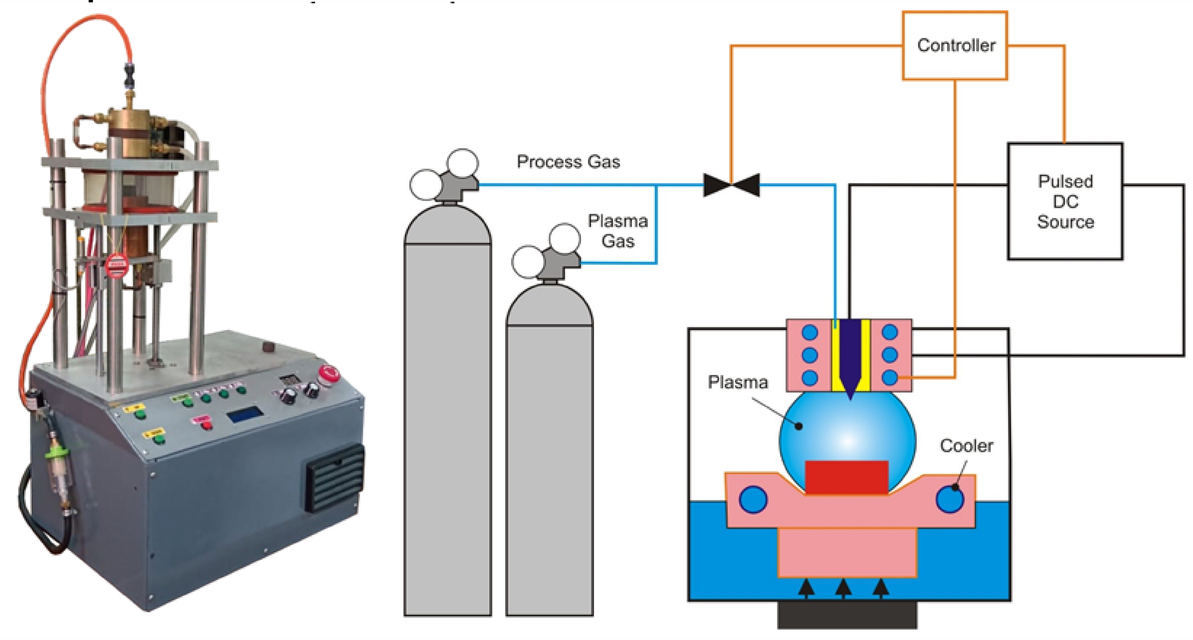
This study describes a multi-step process to obtain rGO material from biomass waste around the reactor. This research paper presents the technology used for biomass waste treatment in the G.A. Siwabessy area.

2. General experimental and Theoretical Basic

2.1. Experimental Arc Plasma Sintering

Technology Arc Plasma Sintering (APS) performs the sintering of high-temperature materials using plasma. The working principle of this tool is that the Arduino Uno functions to control stepper motors on APS. Stepper motors can rotate because there is a motor driver as an interface. The motor driver is connected to a 24V power supply. The stepper motor rotates to raise and lower the sample stand.

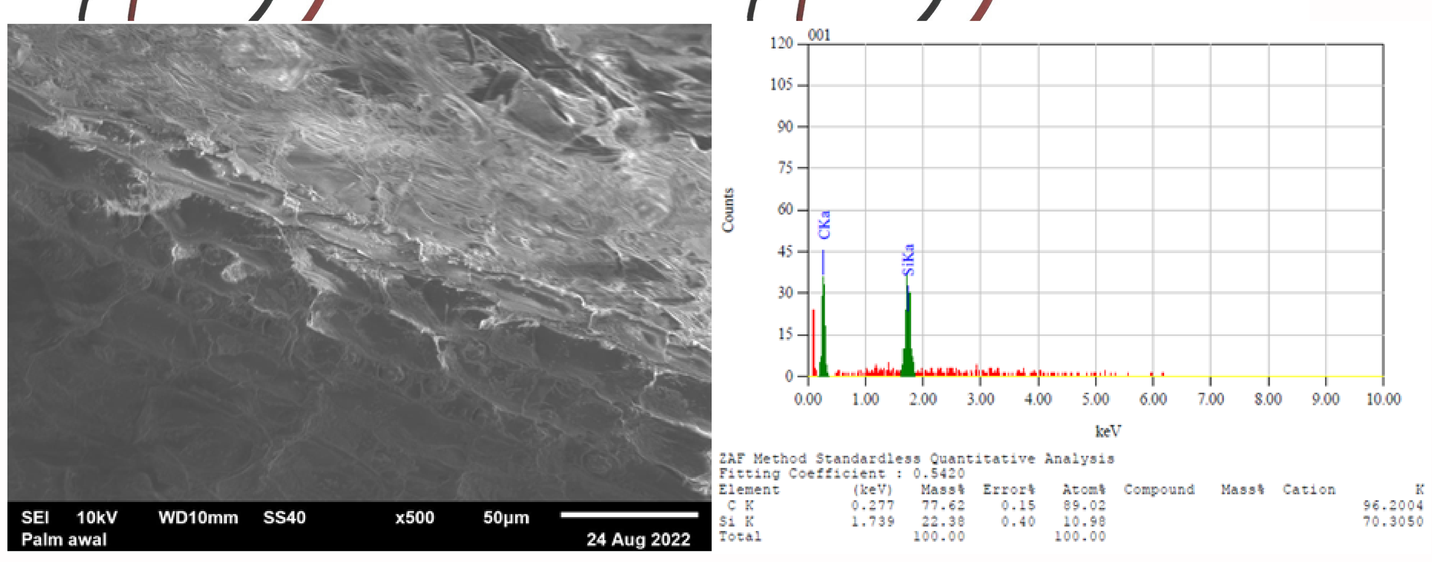
APS has low power requirements, which only require a current of less than 80 A at a fixed voltage of 12 volts. So that this technology consumes less than 1200 watts of electrical power. With this power, this technology can carry out the sintering of biomass and metal materials up to temperatures of more than 30000 Celsius.



2.2. Biomass Palm

The palm biomass sampled is palm tree trunks around the reactor G.A. Siwabessy. The palm tree is waste because it is dry and separated from the tree; therefore, instead of wasting the biomass waste, this sintering research was carried out for this waste.

The palm tree before sintering has no continuity. and after sintering at a temperature of 30000 Celsius, the material changes to have continuity.



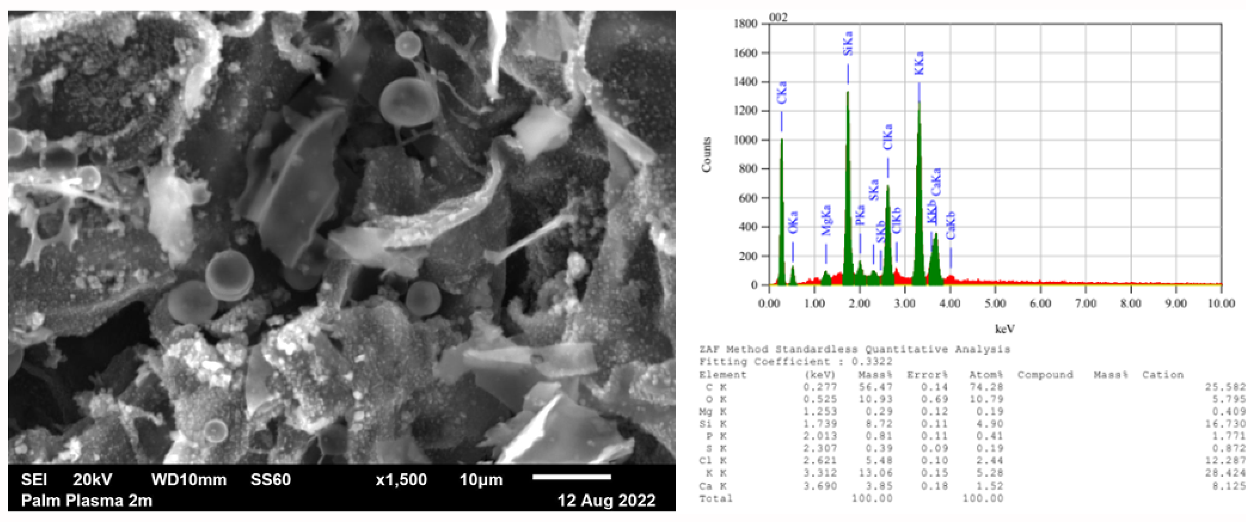
When characterized using SEM, palm fronds only have two elements, namely C (carbon) and Si (silicon), which mass 77.62% and 22.38%, respectively.

3. Arc Plasma Sintering for biomass waste treatment

3.1. Biomass sintering technique for two minutes

The two-minute biomass sintering technique means that the palm biomass sample is sintered for two minutes. After that, the samples were analyzed using SEM tools.

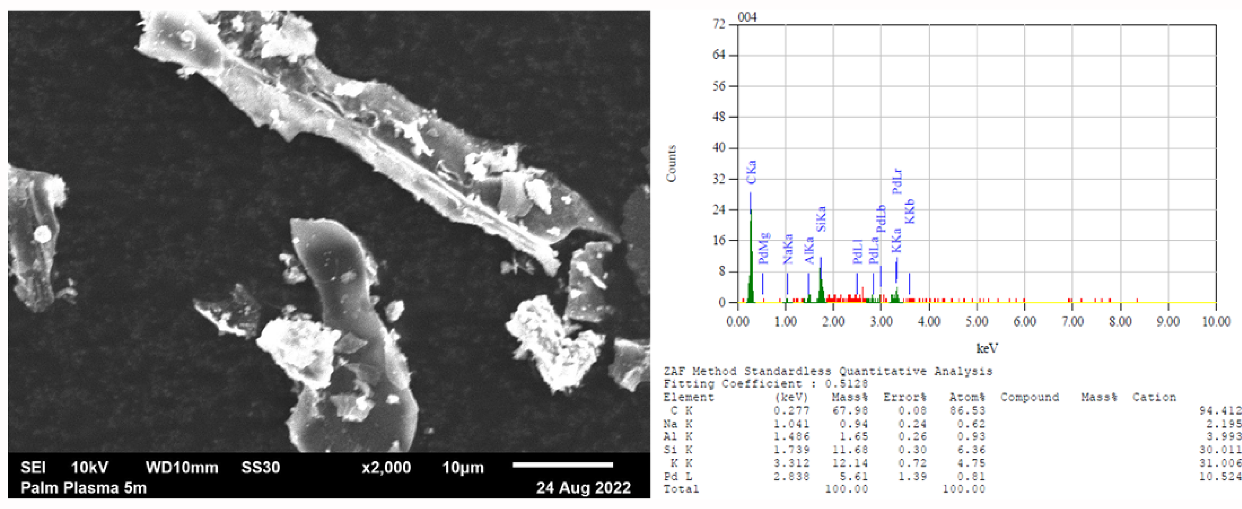
When compared with the results of SEM characterization on palm fronds before sintering, there are many additional impurities. And the mass value of C is 56.47%.



3.2. Biomass sintering technique for five minutes

The five-minute biomass sintering technique means that the palm frond biomass sample is sintered for five minutes. After that, the samples were characterized and analyzed using SEM tools.

When compared with the results of the SEM characterization of the two-minute biomass sintering technique, the elements present are less. And the mass value of C is 67.98%, higher than the two-minute sintering technique..



3.3. Biomass sintering technique for eight minutes

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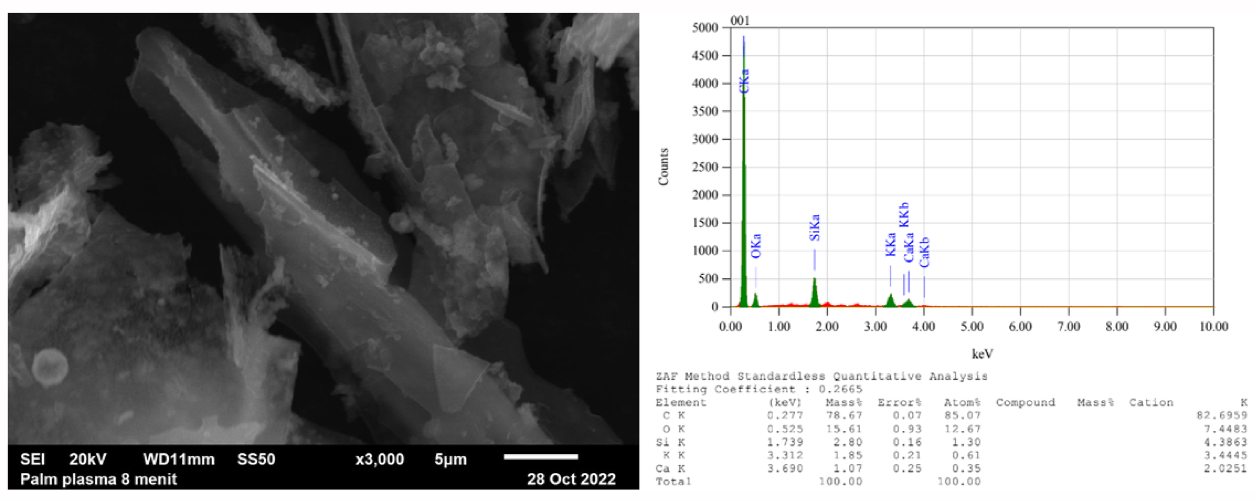
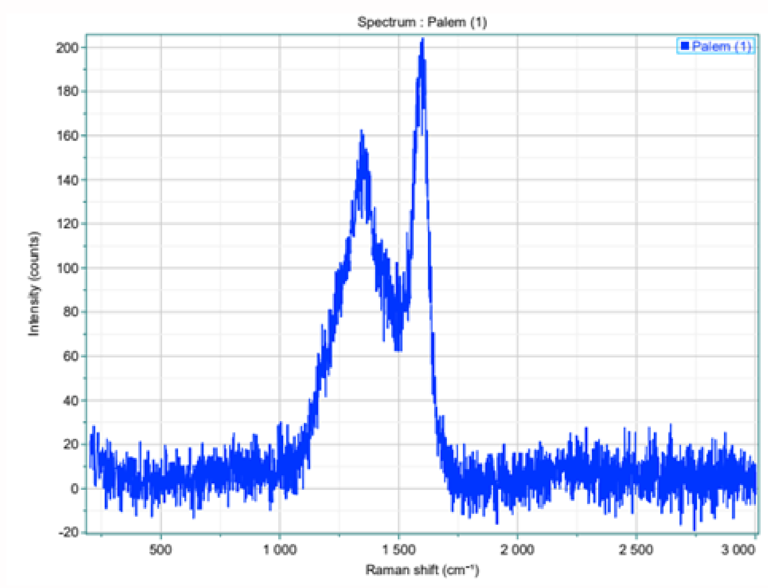
When compared with the SEM characterization results of the five-minute biomass sintering technique, the elements present are different. And the mass value of C is 78.67%, which is higher than the five-minute sintering technique.



3.4. Raman Characterization

The quality of synthesis results was investigated by performing Raman Spectroscopy (Horiba Scientific). From the spectra, the peak of the D-band at 1351 cm-1 and the G-band at 1585 cm-1. ID/IG of the spectra is about 0.85, which shows that already rGO layer is already formed.



4. Conclusions

From this study, it can be concluded that Arc Plasma Sintering technology is proven to be able to process palm frond biomass waste from the reactor area into rGO material (reduced graphene oxide).

International Conference on the Safety of Radioactive Waste Management, Decommissioning, Environmental Protection and Remediation: Ensuring Safety and Enabling Sustainability, CN-318
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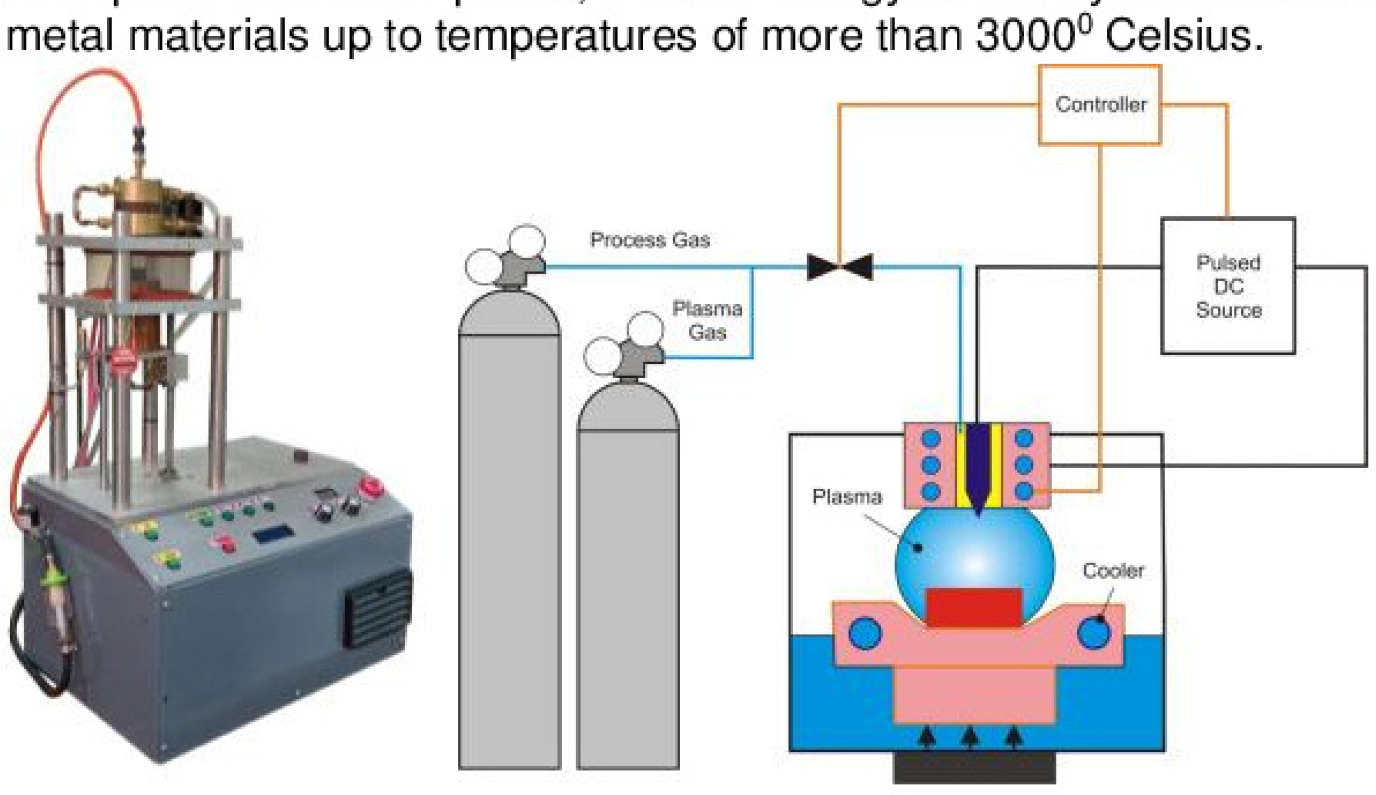

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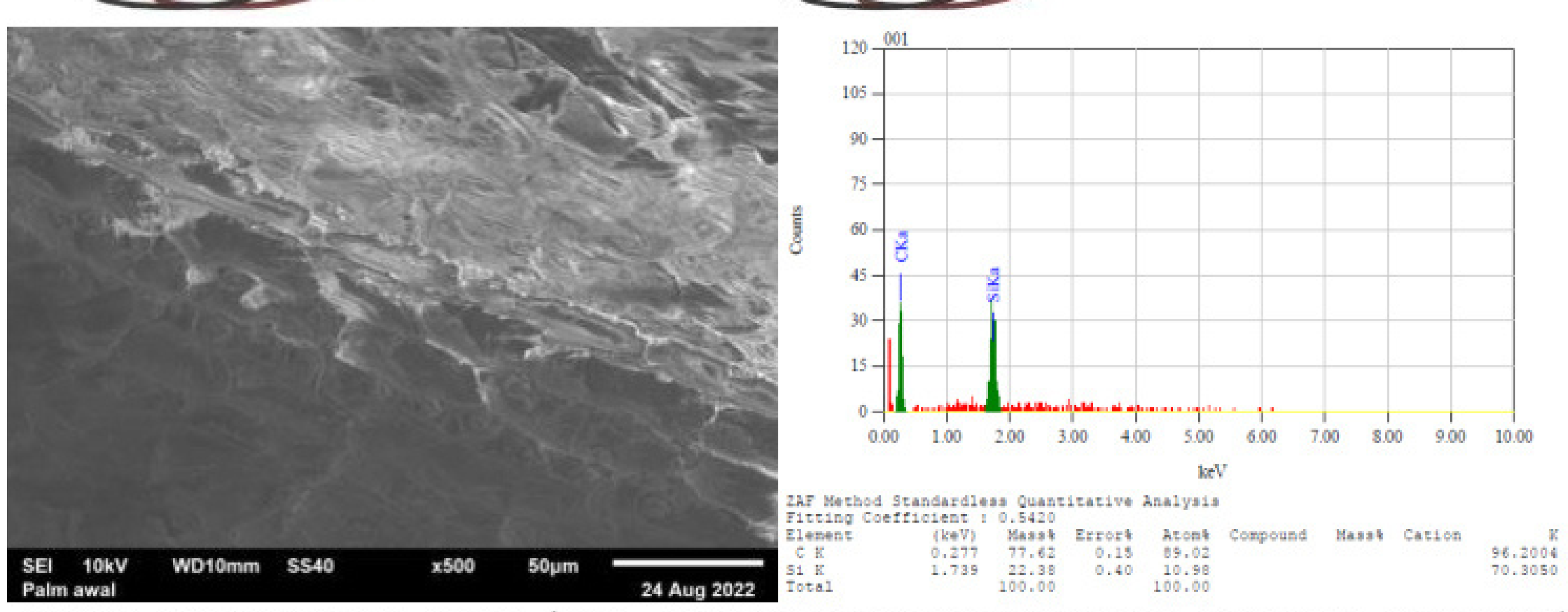

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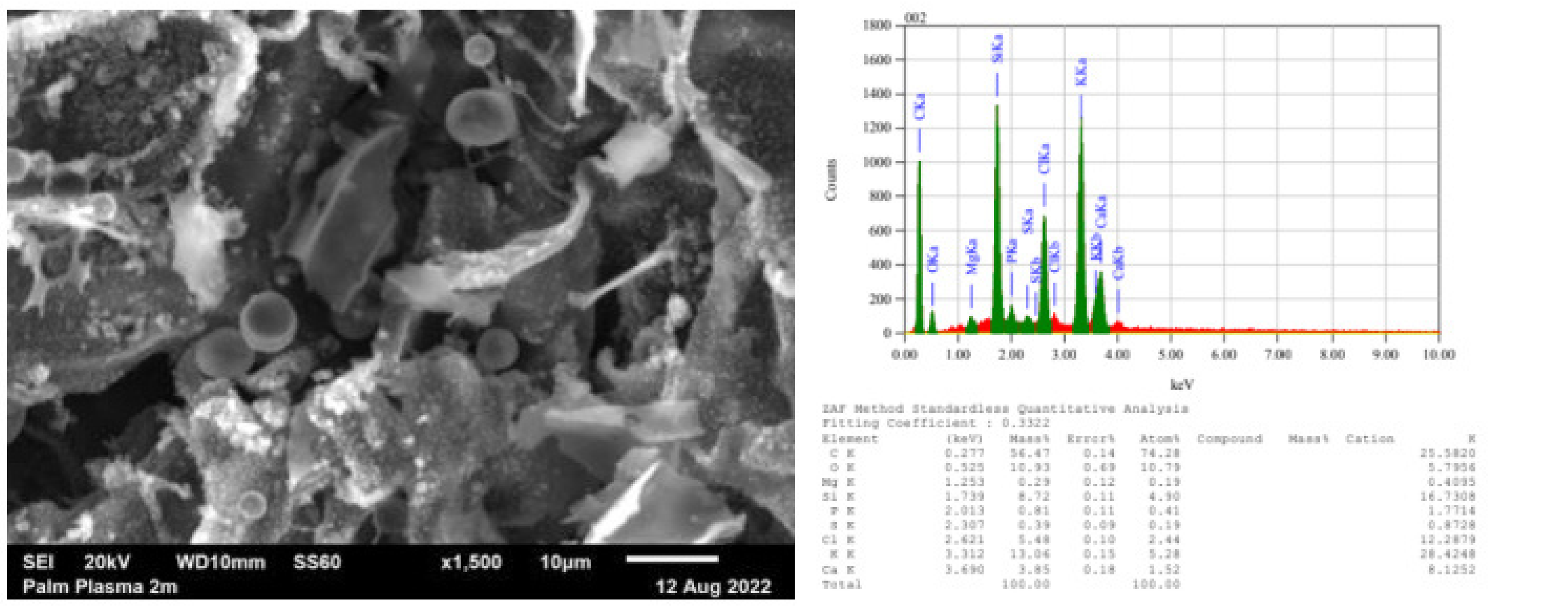

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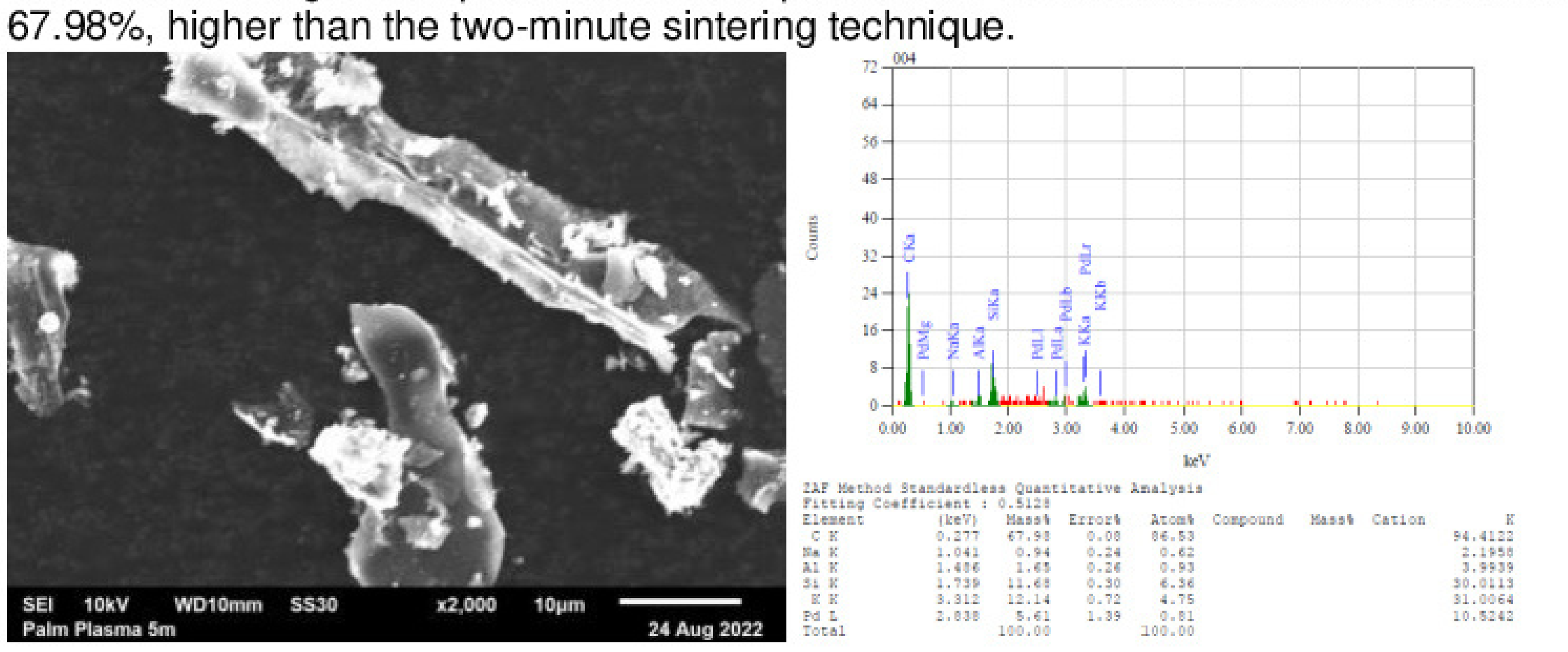

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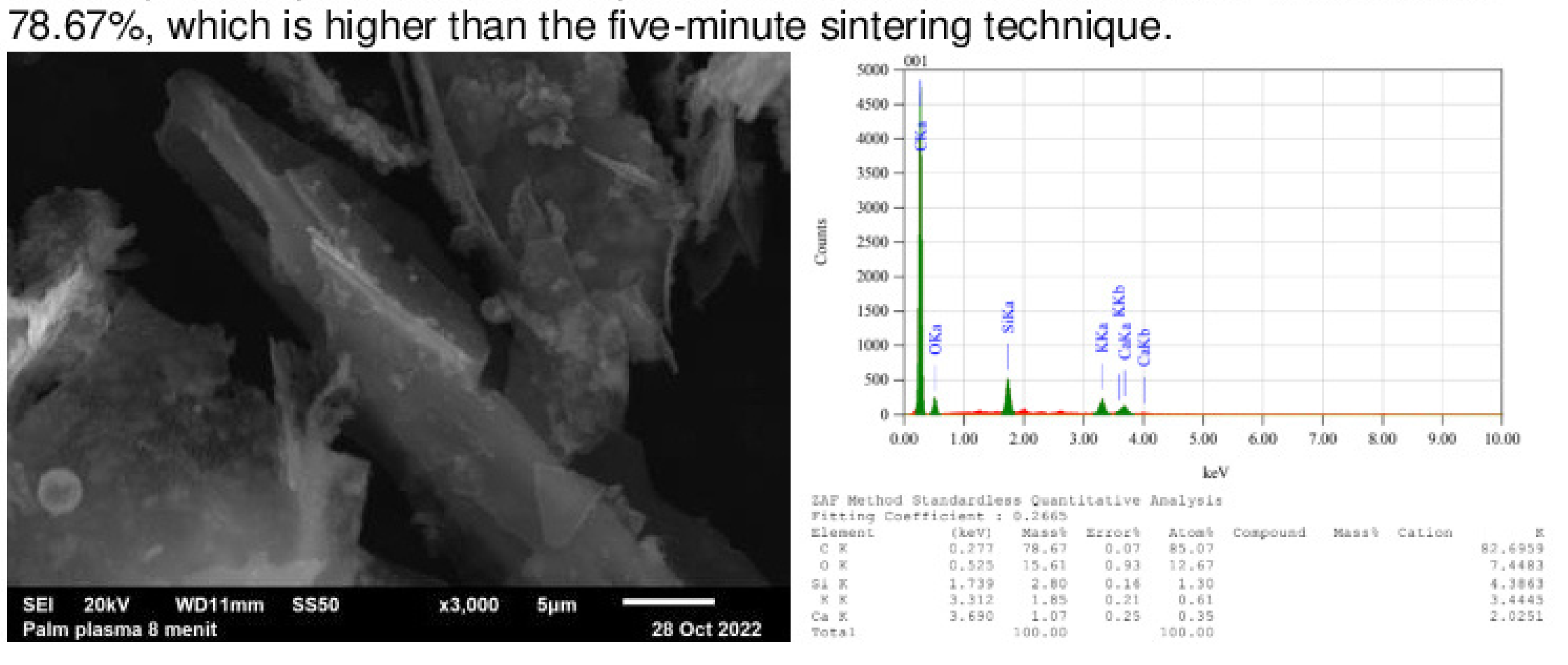

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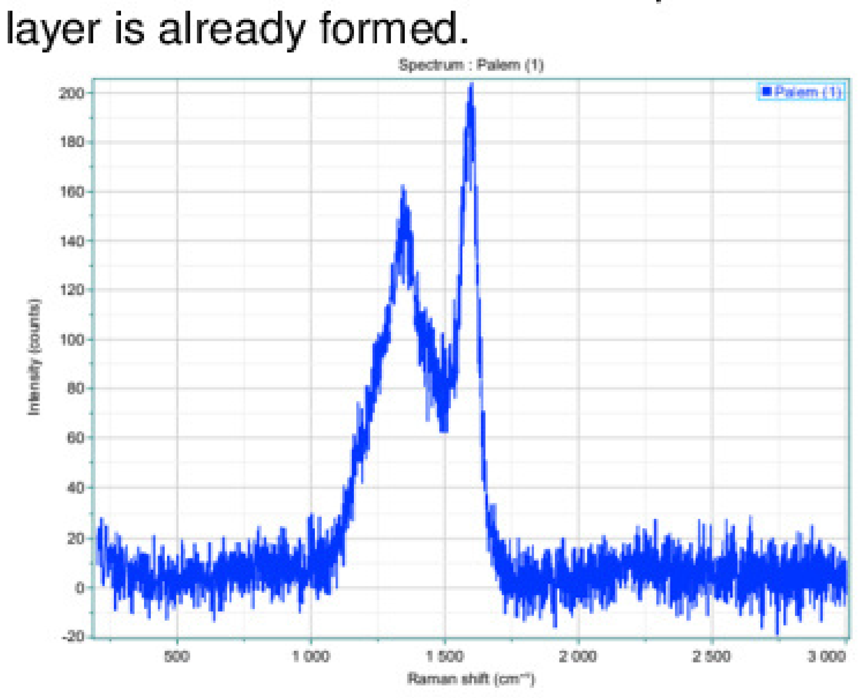

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