



Preparation of Bi_2S_3 and CeO_2 for photoactive disinfection of *Escherichia coli* and *Staphylococcus aureus*.

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Introduction

Surface contamination by microorganisms is one of the day-to-day global challenges that existed for many years due to poor environmental and health management by the government and humans in public and residential areas. Bacteria on surfaces have become a major problem due to their ability to survive environmental stresses, form protective biofilms and spreads to human through high-touch objects. Traditional disinfection methods (chemical, UV radiation, ozone) were often used but they cause respiratory effects, produce cacogenic products, and provide temporary effects. Photoactive disinfection using semiconductor materials is one of the efficient methods that works in combination with light to degrade bacteria.

Aim and Objectives

Aim

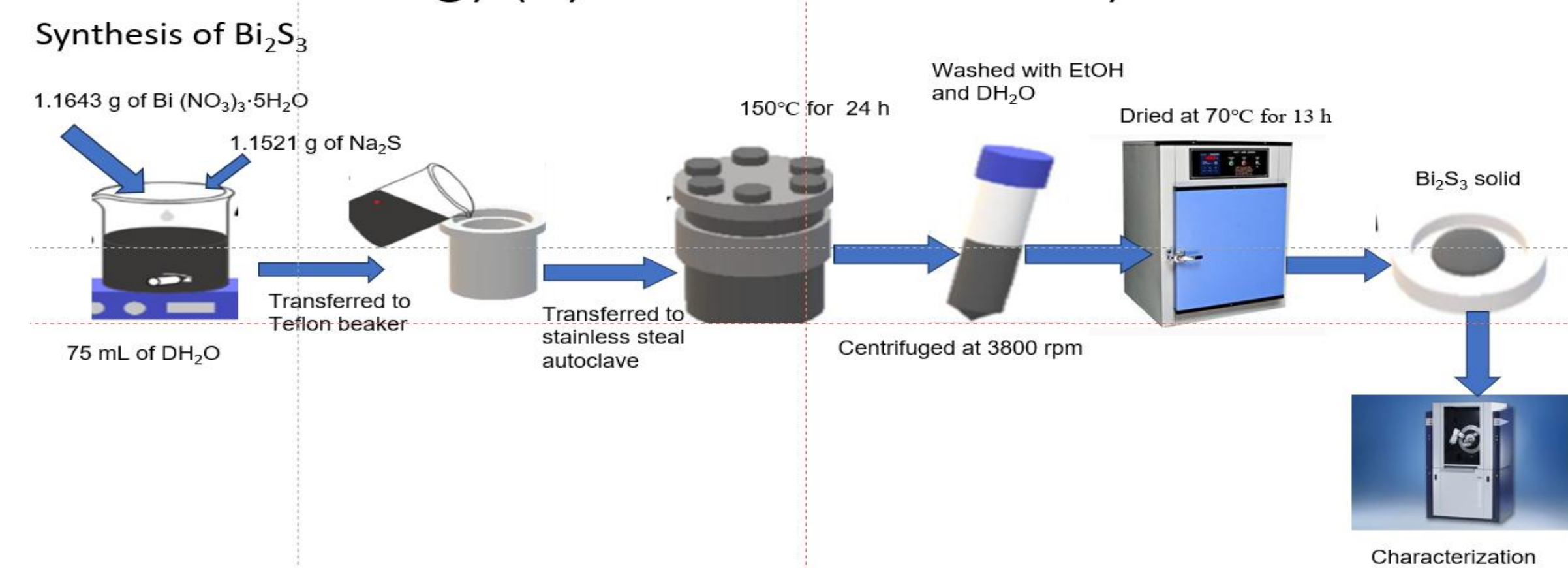
The aim of is to prepare Bi_2S_3 and CeO_2 using hydrothermal method.

Objectives

- ✓ Synthesize Bi_2S_3 using hydrothermal method
- ✓ Synthesize CeO_2 using hydrothermal method
- ✓ Characterize Bi_2S_3 and CeO_2 using FTIR, XRD, SEM, EDX

Methodology

Methodology (hydrothermal method)



Methodology (hydrothermal method)

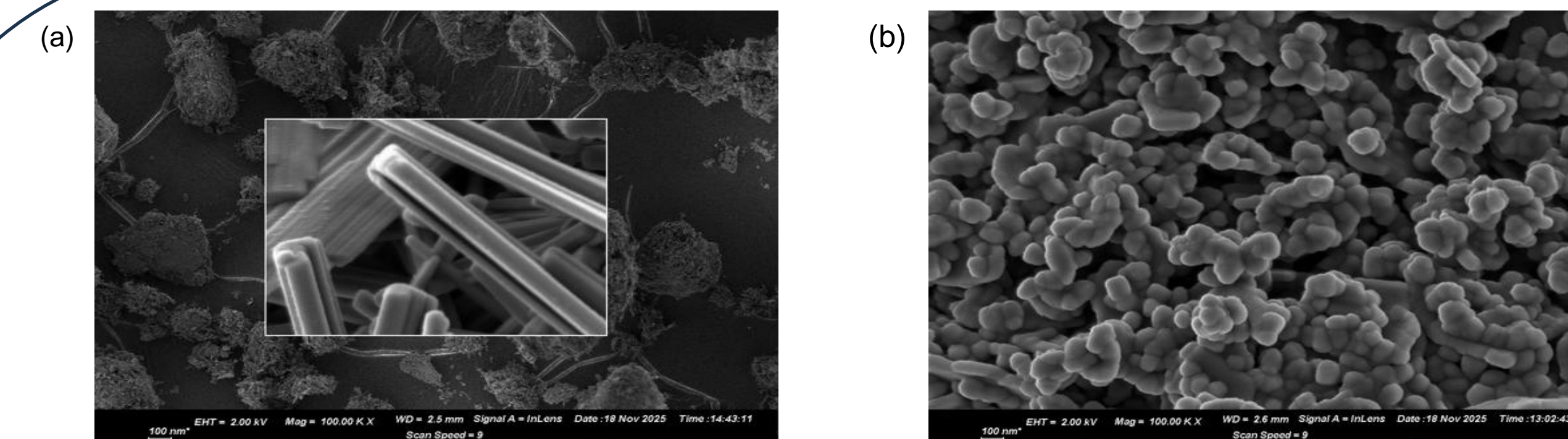
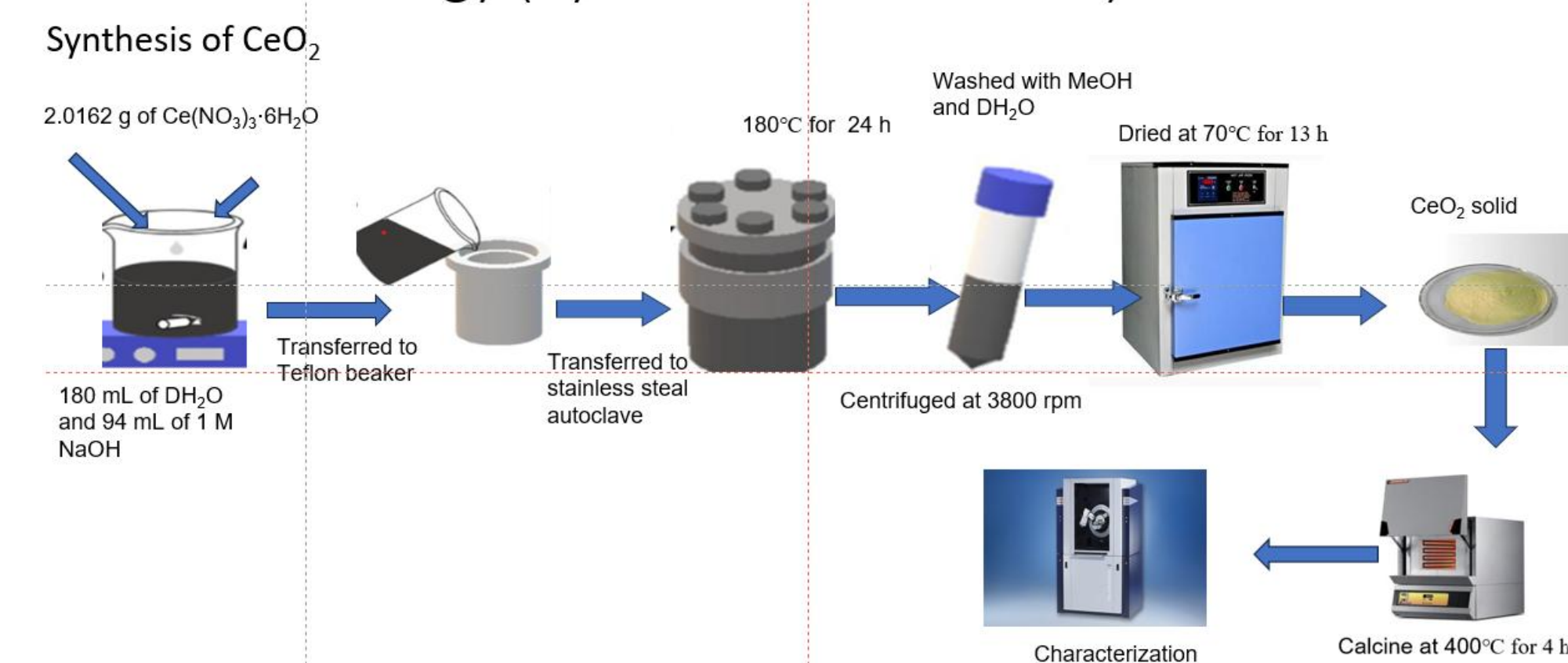


Figure 1 : (a) and (b) SEM image of Bi_2S_3 and CeO_2 , respectively

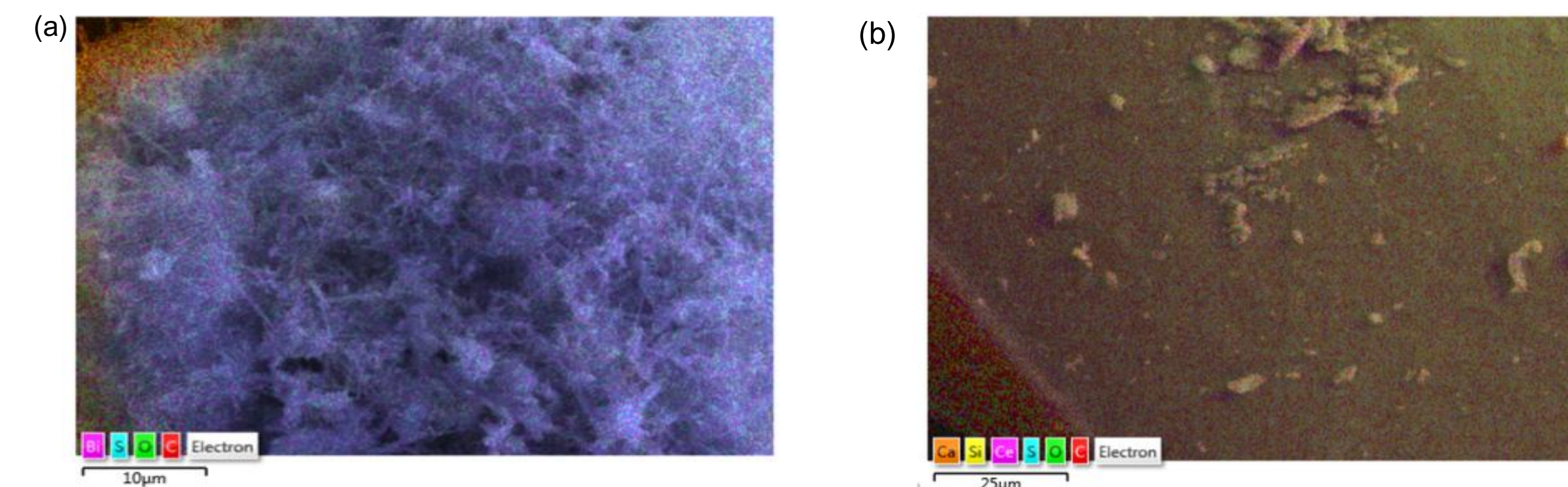


Figure 2 : (a) and (b) EDX mapping of Bi_2S_3 and CeO_2 , respectively

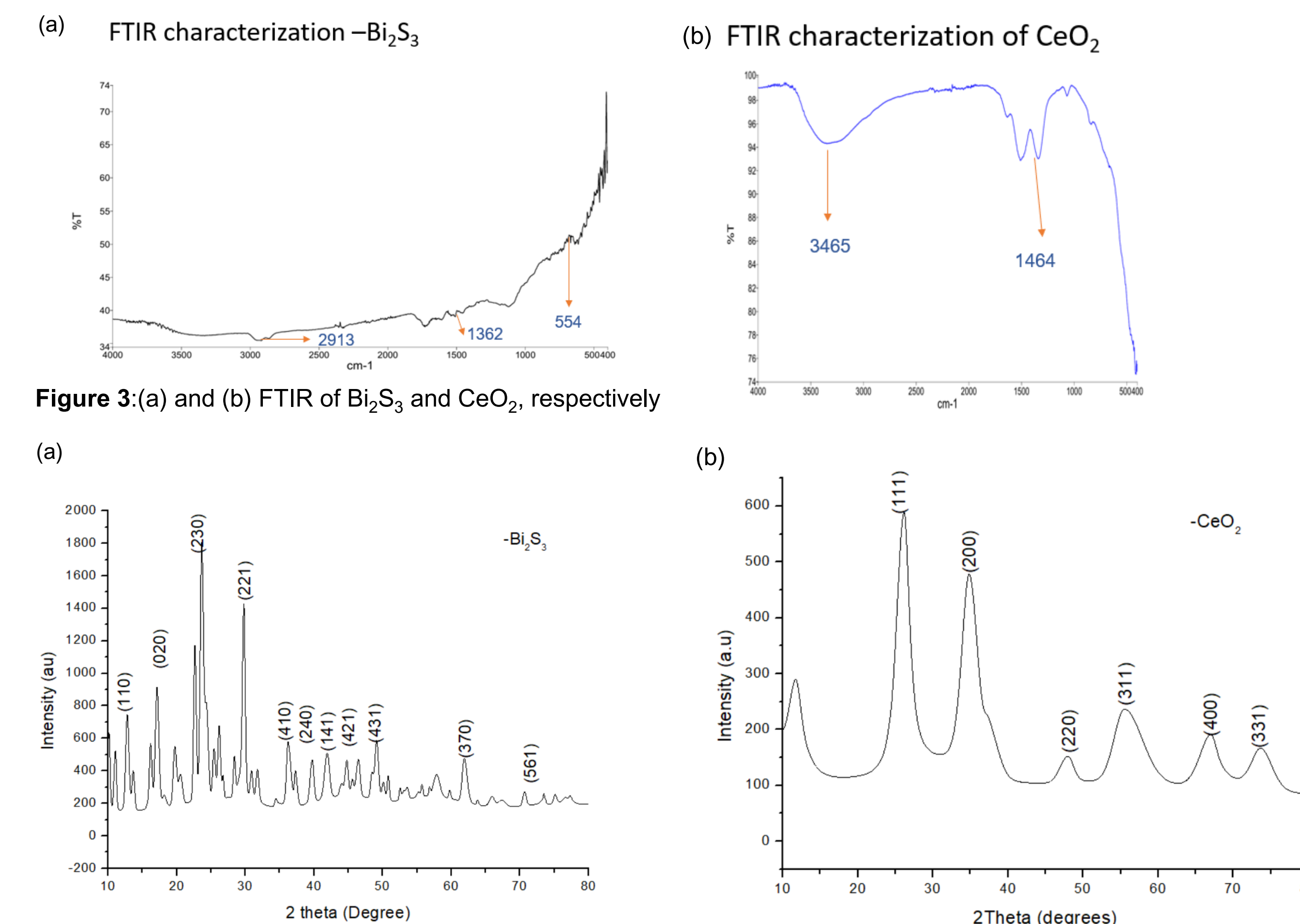


Figure 4 : (a) and (b) XRD pattern of Bi_2S_3 and CeO_2 , respectively

Results

Figure 1(a) shows the SEM images for Bi_2S_3 which is well defined, rod-like structure, with smooth surfaces.

Figure 1(b) shows the SEM images of CeO_2 with a near-spherical agglomerated morphology.

Figure 2 (a) shows EDX mapping for Bi_2S_3 showing presence of Bi and S, minor signal of C and O are attributed to substrate background and surface oxidation.

Figure 2(b) EDX mapping of CeO_2 showing presence of Ce and O, signal of C and Si are attributed to the substrate and sample holder.

Figure 3(a) is the FTIR for Bi_2S_3 which shows Bi-S: 554 cm^{-1} stretch, S-O: 1362 cm^{-1} stretch indicate if oxidation occurred, -H: 2913 cm^{-1} stretch from organic residue. Figure 3(b) show the FTIR of CeO_2 which show C-O: 1464 cm^{-1} stretch, -H: 3465 cm^{-1} stretch.

Figure 4(a) is the XRD pattern of the Bi_2S_3 exhibits sharp diffraction peaks that can be indexed to orthorhombic with the dominant (230) and (221) planes.

Figure 4(b) is the XRD pattern for CeO_2 which shows the peaks that are indexed to (111), (200), (220), (311), (400). and 331) planes. These match the face centered cubic fluorite structure of CeO_2 .

Conclusion

- ✓ Bi_2S_3 nanorods and CeO_2 nanoparticles were successfully synthesized using hydrothermal method.
- ✓ SEM and XRD confirmed the rod-like orthorhombic structure of Bi_2S_3 and the nanocrystalline cubic fluorite structure of CeO_2 .
- ✓ EDX and FTIR analysis verified the elemental composition and surface chemistry, with minor signals attributed to substrate and surface oxidation.
- ✓ The results indicate high crystallinity and good phase purity for both materials.

References

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