COMPARATIVE ANALYSIS OF STRUCTURE, SYNTHESIS, AND PROPERTIES OF POLYANILINE AND POLYPYRROLE: INSIGHTS INTO CONDUCTIVE POLYMER VARIABILITY

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Viktorija Lisyte, Anton Popov

NanoTechnas – Center of Nanotechnology and Materials Science, Faculty of Chemistry and Geosciences, Vilnius University, Vilnius, Lithuania

viktorija.lisyte@chgf.stud.vu.lt

INTRODUCTION

In the broader realm of polymers, while they find numerous applications, conducting polymers (CPs) hold immense promise for the future, particularly in the context of their use across a wide spectrum of technological applications in various fields [1]. The ability of some polymers to conduct electric current has led to the term "conducting polymers. There are natural, synthetic, and semi-synthetic polymers: conducting polymers are synthetic “metallic” polymers [2]. The synthesis of CPs can be carried out using chemical, electrochemical, enzymatical, and other methods. Commonly encountered CPs encompass polyaniline (PANI) and polypyrrole (PPy). PPy, in particular, stands out due to its remarkable characteristics, including its ease of synthesis, adaptability in structure, lack of toxicity, exceptional electrical conductivity, and strong redox capabilities. On the other hand, PANI boasts advantages such as straightforward synthesis, impressive stability in varying environmental conditions, favorable electrical conductivity (of the p-type), and affordability [3].
In this study, we have chosen various synthesis approaches for producing nanomaterials of PANI and PPy, and subsequently carried out the synthesis procedures. Additionally, the obtained materials are investigated by scanning electron microscopy (SEM), UV-VIS spectroscopy, dynamic light scattering (DLS), and Fourier transform infrared spectroscopy (FTIR). Obtained results allow to control synthesis of PPy and PANI nanostructures.

RESULTS

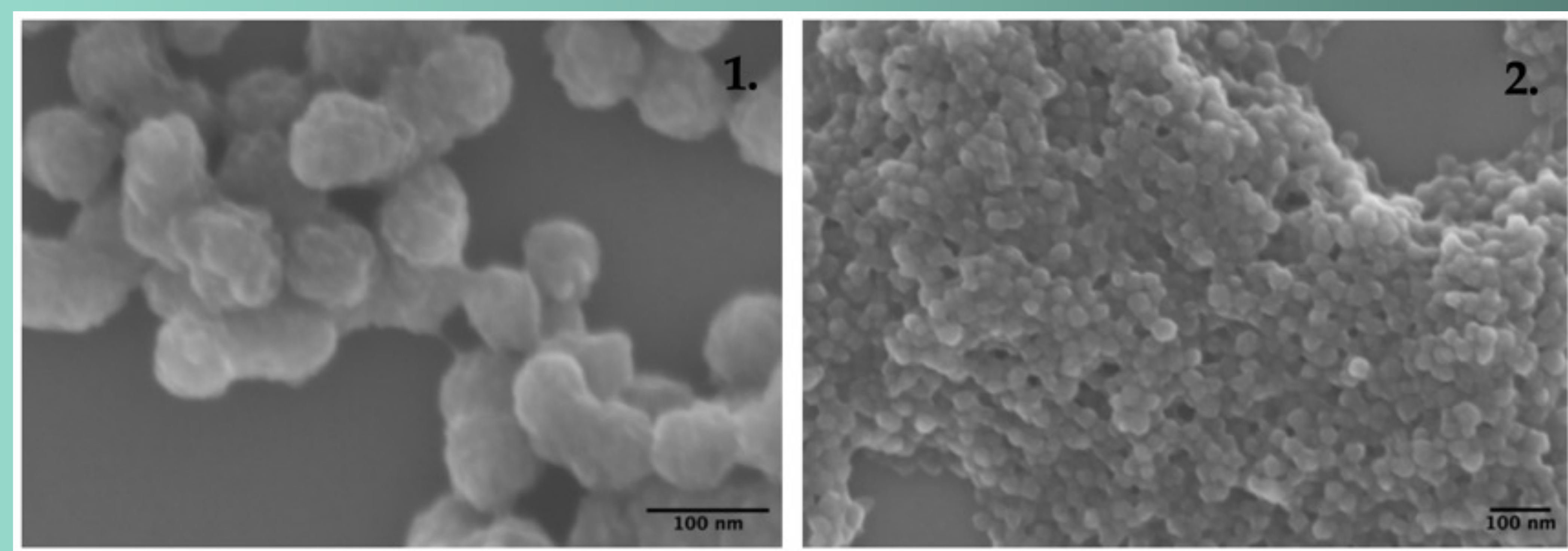

Figure 1. SEM imagines of **(1)** PANI and **(2)** Ppy nanoparticles.

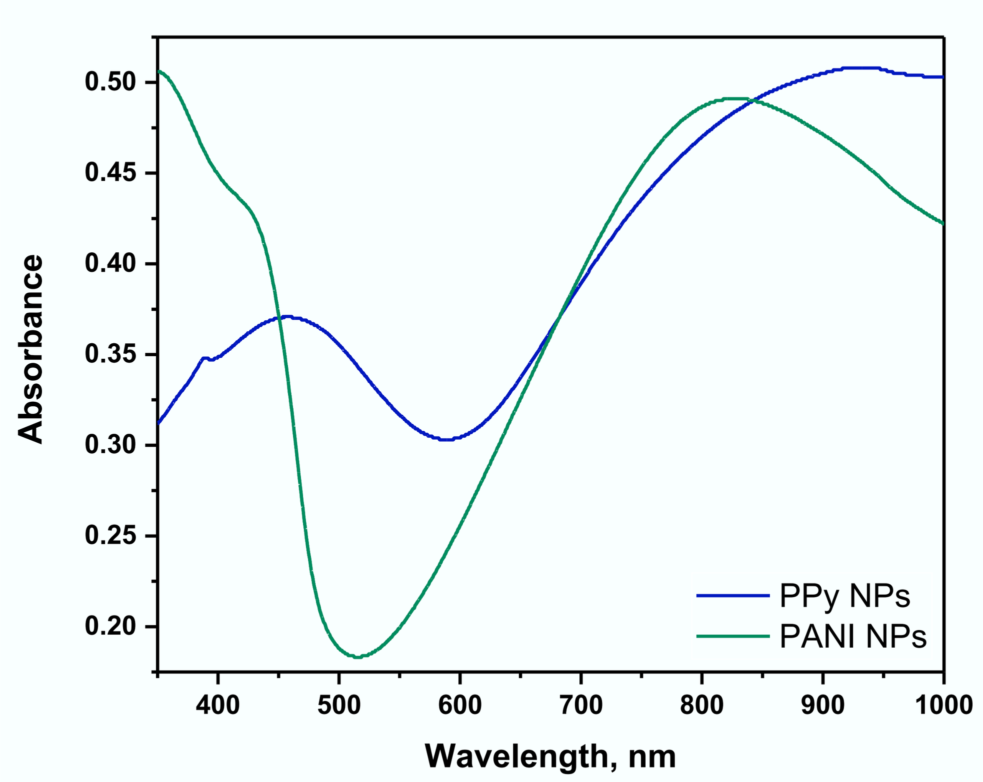

Figure 2. Absorbance spectra of (-) PANI and (-) PPy NPs solutions.

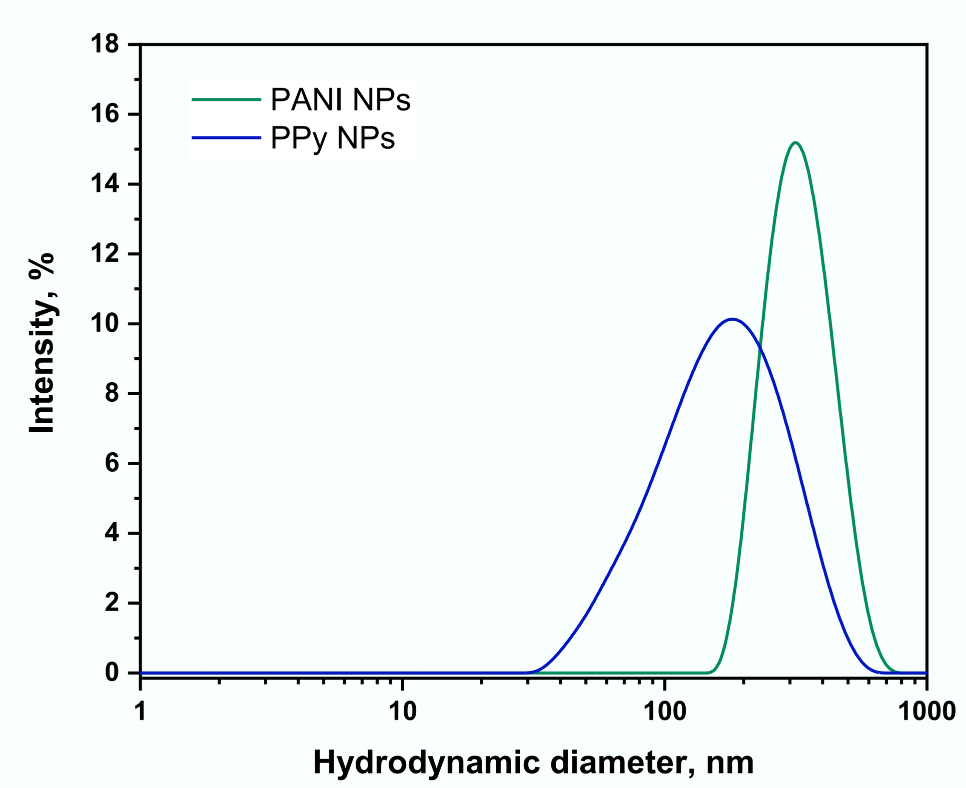

Figure 3. PANI and Ppy NPs size distribution by dynamic light scattering (DLS).

	PANI	PPy
Nanoparticles size, nm	40.33 ± 2.95	17.83 ± 1.64
Hydrodynamic size, nm	295.3	190,1

1 table. Nanoparticles sizes.

SUMMARY

- PPy and PANI nanoparticles were synthesized using stabilizer - poly(vinyl alcohol);
- The size of PANI nanoparticles was 40.33 ± 2.95 nm, while PPy nanoparticles were 17.83 ± 1.64 nm in size;
- These research findings indicate that the particles we obtained are capable of forming consistently stable colloidal solutions, making them suitable for further investigations.

References

[1] Sunilkumar, A., et al. AC electrical properties of transition metal dichalcogenide based polypyrrole composites. *Chemical Papers*, 2023, 1-9.
[2] Folorunso, O., et al. Conductive polymers' electronic structure modification for multifunctional applications. *Materials Today Communications*, 2023, 106308.
[3] Elumalai, P., et al. Investigation of structural and optical properties of ternary polyaniline–polypyrrole–nickel oxide (PANI-PPy-NiO) nanocomposite for optoelectronic devices. *Polymer International*, 2023, 72.2: 176-188.