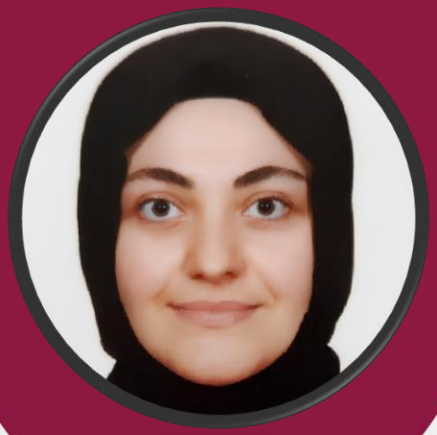
INVESTIGATION OF THE EFFECTIVENESS OF GLYCOPOLYMER BASED THERANOSTIC NANOSYSTEM IN BREAST CANCER

Gulsah YIGIT ERDEM

ORCID: 0000-0003-3908-6692
BEZMIALEM VAKIF UNIVERSITY
INSTITUTE OF HEALTH SCIENCES
DEPARTMENT OF BIOTECHNOLOGY
PhD PROGRAM

GRADUATION DATE: 03.03.2025



KEYWORDS

- *Glycopeptide Polymer*
- *Theranostic Nanoprobes*
  - *Chemotherapy*
  - *Gene Therapy*
- *Photothermal Therapy*
  - *Breast Cancer*

SUPERVISOR

Prof. Dr. Aydan DAG
ORCID: 0000-0002-1552-8030
BEZMIALEM VAKIF UNIVERSITY
INSTITUTE OF HEALTH SCIENCES
DEPARTMENT OF BIOTECHNOLOGY
ISTANBUL – TÜRKİYE
adag@bezmialem.edu.tr

THESIS ABSTRACT

Theranostic nanoparticles (TNPs) have significant potential in personalized medicine. In this study, two nanoprobes targeting breast cancer and enabling a synergistic triple therapy approach were developed. $NaYF_4$:Yb^{3+},Er^{3+}-based upconversion nanoparticles were coated with a Dox-loaded biodegradable glycopolymer to form UCNP@P-Dox, and Fe_3O_4 was incorporated to create UCNP@MP-Dox, imparting photothermal and magnetic properties. The nanoprobes were loaded with anti-Bcl-2 siRNA to enable controlled drug release in the tumor microenvironment. In vivo studies demonstrated that the combination therapy more effectively inhibited tumor growth compared to monotherapies. These findings highlight the potential of theranostic nanoprobes as a powerful antitumor strategy.

APPLICATION AREAS OF THE THESIS RESULTS

The development of biocompatible and smart nanocarrier systems creates an important model for effective drug development processes in cancer diagnosis and treatment, contributes to the design of broad-spectrum bionanoprobes, and promotes the emergence of patented products.

ACADEMIC ACTIVITIES

1- *Publications, seminars and patents related to the thesis subject:*

Yigit Erdem, G., Goncu, B., Atasoy, S., Yıldız Uysal, A., Dag, S., & Dag, A. (2025). Multifunctional Theranostic Glyconanoprobes for Synergistic Eradication of Breast Cancer. *Journal of Materials Chemistry B*.

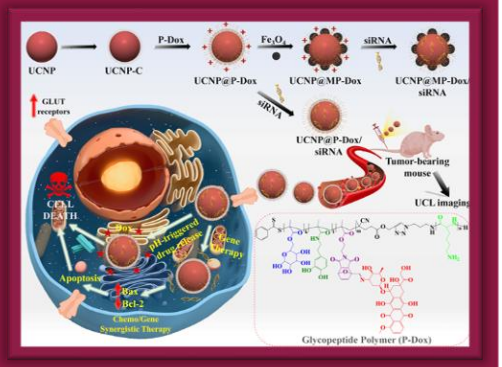
Dag, A., Yigit Erdem, G., Goncu, B., Atasoy, S., Yıldız Uysal, A., & Dag, S. "Bionanoprobes". *PCT Patent No: PCT/TR2025/050090 (Application Submitted).*

Yiğit Erdem, G., Omurtag Ozgen, P. S., & Dag, A. (2021). Investigation of The Effectiveness Of Glycopolymer Based Theranostic Nanosistems In Breast Cancer. *The 13th International Symposium on Pharmaceutical Sciences, June 22-25, Ankara, Turkey.*

Dağ, A., Yigit, G., Omurtag Ozgen, P. S., Atasoy, S., & Gurek, A. G. (2019). Preparation of Targeted Upconversion Luminescent Bionanoprobes and Their Theranostic Applications. *6th Biomaterials Days, December 9-10, Istanbul, Turkey.*

BEZMIALEM VAKIF UNIVERSITY
1845

CONTACT
gulsahyigiterdem@gmail.com



2- *Other publications, presentations and patents:*

Dag, A., Cakilkaya, E., Omurtag Ozgen, P. S., Atasoy, S., Yigit Erdem, G., Cetin, B., ... & Gurek, A. G. (2021). Phthalocyanine-conjugated glyconanoparticles for chemo-photodynamic combination therapy. *Biomacromolecules*, *22*(4), 1555-1567.

Atasoy, S., Goncu, B., Yigit Erdem, G., Omurtag Ozgen, P. S., & Dag, A. (2021). Development of targeted drug/gene bio-nanoprobes and investigation of their therapeutic potential. *XVII. Congress of Medical Biology and Genetics, October 28-31, Turkey.*

Gencoglu Katmerlikaya, T., Cetin Ersen, B., Yigit Erdem, G., Omurtag Ozgen, P.S & Dag, A. (2021). Synthesis of Cisplatin and/or Gemcitabine Containing Polymeric Nanodrug Formulations for Breast Cancer Treatment. *The 13th International Symposium on Pharmaceutical Sciences, June 22-25, Ankara, Turkey.*

Ozgen, P. S. O., Atasoy, S., Kurt, B. Z., Durmus, Z., Yigit, G., & Dag, A. (2020). Glycopolymer decorated multiwalled carbon nanotubes for dual targeted breast cancer therapy. *Journal of Materials Chemistry B*, *8*(15), 3123-3137.

Dag, A., Omurtag Ozgen, P. S., Atasoy, S., Zengin Kurt, B., Durmuş, Z., & Yigit Erdem, G. (2020). "Synthesis of Glycopolymer-Containing Carbon Nanotubes for Cancer Treatment", *T.C. Patent No: 2020/22203 (Registered)*.

Omurtag Ozgen, P. S. , Atasoy, S., Zengin Kurt, B., Durmus, Z., Yigit, G., & Dag, A. (2019). Doxorubicin-Conjugated Glycopolymer-Coated Carbon Nanotubes (CNT) for Breast Cancer Therapy. *6th Biomaterials Days, December 9-10, Istanbul, Turkey.*

Dag, A., Cakılkaya, E., Yigit, G., Atasoy, S., & Gurek, A. G. (2019). Phtalocyanine Conjugated Glyconanoparticles for Combination Therapies. *The 16th Pasific Polymer Conference, December 8 - 12, Singapore.*