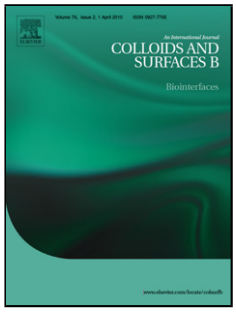

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<AT>DNA Aptamer Functionalized Gold Nanostructures for Molecular Recognition and Photothermal Inactivation of Methicillin-Resistant *Staphylococcus aureus*

<AU>Ismail Ocsoy[a,†], Sadi Yusufbeyoglu[a], Vedat Yılmaz[a], Eric S. McLamore[b], Nilay Ildız[c], Ahmet Ülgen[d]
<AFF>[a]Department of Analytical Chemistry, Faculty of Pharmacy, Erciyes University, 38039 Kayseri, Turkey
<AFF>[b]Department of Agricultural and Biological Engineering, Institute of Food and Agricultural Sciences, University of Florida, 1741 Museum Road, Gainesville, FL, USA
<AFF>[c]Department of Pharmaceutical Microbiology, Faculty of Pharmacy, Erciyes University, 38039 Kayseri, Turkey
<AFF>[d]Department of Chemistry, Faculty of Science, Erciyes University, 38039 Kayseri, Turkey

<ABS-Head><ABS-HEAD>Graphical abstract

<ABS-P>► Interraction of aptamer conjugated Au NR and Au NP and MRSA bacterial cell and their PTT performance.

<ABS-HEAD>Abstract

<ABS-P>In this work, we report the development of DNA aptamer-functionalized gold nanoparticles (Apt@Au NPs) and gold nanorods (Apt@Au NRs) for inactivation of Methicillin-resistant *Staphylococcus aureus* (MRSA) with targeted photothermal therapy (PTT). Although both Apt@Au NPs and Apt@Au NRs specifically bind to MRSA cells, Apt@Au NPs and Apt@Au NRs inactivated ~5% and over 95% of the cells,respectively through PTT. This difference in inactivation was based on the relatively high longitudinal absorption of near-infrared (NIR) radiation and strong photothermal conversion capability for Apt@Au NRs compared to the Apt@Au NPs. The Au NRs served as a nanoplatform for the loading of thiolated aptamer and also provided multivalent effects for increasing binding strength and affinity to MRSA. Our results indicate that the type of aptamer and the degree of multivalent effect(s) are important factors for MRSA inactivation efficiency in PTT. We show that the Apt@Au NRs are a very effective and promising nanosystem for specific cell recognition and *in vitro* PTT.
<KWD>Keywords: DNA aptamer; Nanostructures; Photothermal Inactivation; Methicillin-Resistant Staphylococcus aureus

<H1>1. Introduction
The detection and inactivation of pathogenic bacteria is important for human and animal health, as well as industrial needs and crop security. *Staphylococcus aureus* (SA) is the one of the most dangerous disease-causing bacteria and exhibits resistance to various antibiotics [1-4]. Although 33% of the population carry the SA without any potential risk [4, 5], SA can rapidly reach health-threathing levels. SA can survive on many types of food, or in/on humans and animals, which makes the task of detecting SA challenging. Many life-threathing infectious diseases, such as meningitis, septicaemia and myocarditis (inflammation of the heart), as well as suppurating wounds and skin infections are caused by SA [4, 5]. Various antibiotics have been developed to treat SA infections, but antibiotic-resistant SA strains have become a major problem, particularly those that are resistant against antibiotics containing β-lactam [6-8].