



## BSA/DNA binding behavior and the photophysicochemical properties of novel water soluble zinc(II)phthalocyanines directly substituted with piperazine groups

Khaoula Khezami<sup>1,2</sup> · Kevser Harmandar<sup>1</sup> · Esra Bağda<sup>3</sup> · Efan Bağda<sup>4</sup> · Gamze Şahin<sup>3</sup> · Nurşen Karakodak<sup>4</sup> · Mahmut Durmuş<sup>1</sup>

Received: 15 February 2021 / Accepted: 15 April 2021 / Published online: 4 May 2021  
© Society for Biological Inorganic Chemistry (SBIC) 2021

### Abstract

In the current research, two novel zinc(II) phthalocyanines (ZnPcs) (**1** and **2**) directly connecting with 4-(4-methylpiperazin-1-yl)phenyl groups have been synthesized through the Suzuki–Miyaura coupling reaction. These ZnPcs **1** and **2** were converted to their water-soluble derivatives (**1Q** and **2Q**) by quaternization. The photochemical and photophysical properties were determined in DMSO for the non-ionic zinc(II) phthalocyanines (**1** and **2**) and in both DMSO and aqueous solutions for the quaternized cationic derivatives (**1Q** and **2Q**) to establish their photosensitizer capabilities in photodynamic therapy (PDT). The spectrofluorometric and spectrophotometric techniques were employed for the determination of interaction between water-soluble ZnPcs (**1Q** and **2Q**) and BSA or ct-DNA. The binding constants of these compounds to BSA were found in the order of  $10^8 \text{ M}^{-1}$ . The binding constant of the ct-DNA interaction with **2Q** ( $1.09 \times 10^5 \text{ M}^{-1}$ ) was found higher than **1Q** ( $6.87 \times 10^4 \text{ M}^{-1}$ ). The thermodynamic constants were determined for both **1Q** and **2Q**. The endothermic and spontaneous nature of interaction was observed with ct-DNA. Besides, the thermal denaturation and viscosity studies proved the non-intercalative mode of binding for both compounds to ct-DNA.