**ΠΑΝΕΠΙΣΤΗΜΙΟ ΚΡΗΤΗΣ**
**ΤΜΗΜΑ ΕΠΙΣΤΗΜΗΣ ΚΑΙ ΤΕΧΝΟΛΟΓΙΑΣ ΥΛΙΚΩΝ**

**ΠΑΡΟΥΣΙΑΣΗ ΜΕΤΑΠΤΥΧΙΑΚΗΣ ΔΙΠΛΩΜΑΤΙΚΗΣ ΕΡΓΑΣΙΑΣ**

## Τίτλος

# Solar Light Induced Photocatalytic Removal of Parabens from Water Using Metal/CNN/$CeO_2$ Photocatalysts

της **Μαρίας Ζωγραφάκη,** μεταπτυχιακής φοιτήτριας του

Τμήματος Επιστήμης και Τεχνολογίας Υλικών του Πανεπιστημίου Κρήτης

**Επιβλέπων Καθηγητής: Γεράσιμος Αρματάς**

## Παρασκευή 24/2/2023

## 10:00

Η παρουσίαση θα πραγματοποιηθεί στην **αίθουσα Φ2 του Τμήματος Φυσικής,** του Πανεπιστημίου Κρήτης.

ABSTRACT

Current trends in water and wastewater treatment are focused on the development of cost-effective, environmental-friendly and sustainable treatment technologies, which are consistent with the “zero” waste concept. Parabens are commonly used as antimicrobial preservatives in pharmaceutical products, cosmetics, and foodstuff. Both parabens and their halogenated products are toxic and negatively affect the anatomy and physiology of animals and humans. Solar photocatalysis, which is an advanced oxidation process, has been considered as a viable alternative for the removal of parabens and their metabolites from water due to high degradation efficiency and no demand energy. Graphitic carbon nitride (g-$C_3N_4$), a typical metal-free photocatalyst, is particularly attractive thanks to its cheapness, non-toxicity and exceptional chemical stability. Despite all the above advantages, its photocatalytic performance is still insufficient due to low visible light response and high recombination rate of the photogenerated electrons and holes. A great number of semiconductors have been coupled with g-$C_3N_4$ to construct heterojunctions. Among them, cerium oxide ($CeO_2$), an essential and inexpensive rare earth metal oxide, has been attracting intense attention in photocatalysis, owing to the great oxygen storage capacity (OSC) and multi-valence states of $Ce^{4+}/Ce^{3+}$, which could be beneficial to reduce the recombination rate of photoinduced charge carriers. Herein, we report for the first time

an efficient photocatalytic system for methyl paraben (MP) removal, using solar ($\lambda > 360$ nm) and visible ($\lambda > 420$ nm) light-driven $CeO_2$/g-$C_3N_4$ heterojunctions. The physicochemical properties of pure $CeO_2$, g-$C_3N_4$, and $CeO_2$/g-$C_3N_4$ composites were investigated using a combination of characterization techniques, such as XRD, SEM-EDS, TEM, UV-Vis, XPS and electrochemical spectroscopy. Among the catalysts with different mass ratio of $CeO_2$, 10%$CeO_2$/g-$C_3N_4$ showed the best photocatalytic performance. This is attributed to the enhanced charge carrier's separation as a result of the proper band edges alignment between g-$C_3N_4$ and $CeO_2$ components and strong visible light absorbance. The photocatalytic degradation of MP followed the first-order kinetics, and the 10%$CeO_2$/g-$C_3N_4$ catalyst exhibited a 2.5- and 11.2-times higher reaction rate ($k$) constant than that of pure g-$C_3N_4$, investigated under solar and visible light illumination, respectively. Further, from scavenger trapping experiments it is confirmed that hydroxyl radicals ($OH^{\cdot}$) and dissolved oxygen are the predominant active species involved in MP oxidation over 10%$CeO_2$/g-$C_3N_4$ composite catalyst.