

SOLAR PHOTOCATALYTIC DEGRADATION OF PARABENS IN AQUEOUS SYSTEMS WITH GRAPHITIC CARBON NITRIDES

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INTRODUCTION



Emerging pollutants

- The presence or harmful effects have recently been detected due to the development of new and more sensitive analysis methods.
- Prior to legislation (Administrations have not yet ruled restrictive rules).
- Soluble in water, so they are able to penetrate in all stages of the water cycle.

Types of emerging pollutants:

- Self-care products



- Drugs

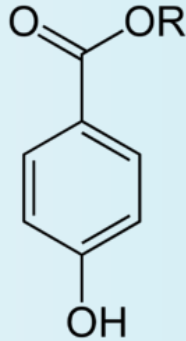


- Surfactants, pesticides, antiseptics.

INTRODUCTION

Parabens

(esters of p-hydroxybenzoic acid)



- High antimicrobial power.
- Stable to pH variations.
- Low manufacture cost.

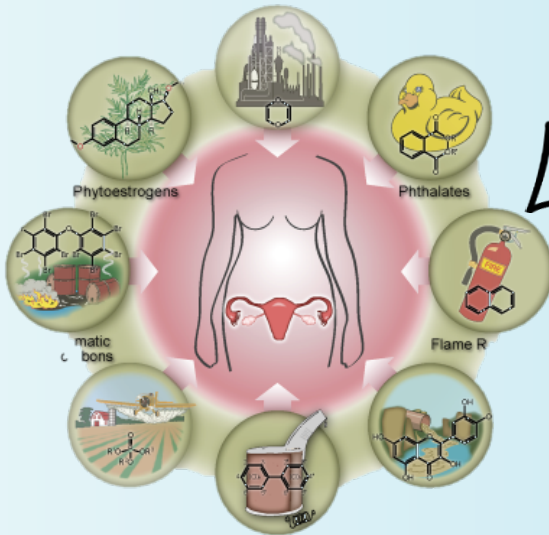
**Ideal
preservative**

**> 80 % cosmetic products, pharmaceutical
and food industry**

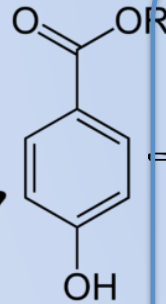
Restrictions :



- Bylaw (UE) N° 1129/2011
- Bylaw (UE) N° 1004/2014
- Colipa n° P82



INTRODUCTION

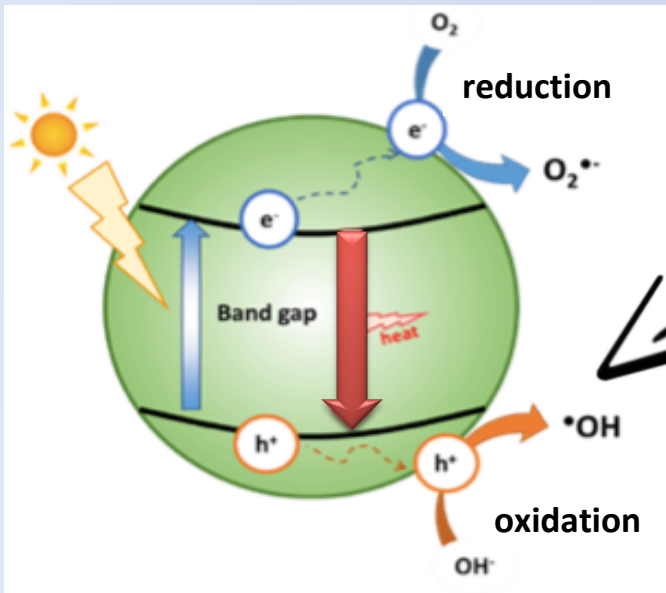


RADIATION

OZONE

AOPs

H₂O₂



HETEROGENEOUS
PHOTOCATALYSIS

INTRODUCTION

Heterogeneous Photocatalysis

Disadvantages of conventional

Photocatalyst TiO_2 (P25)

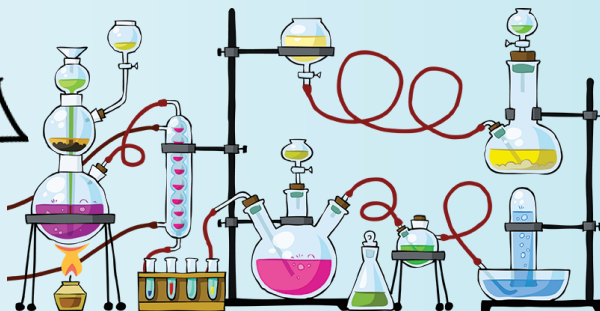
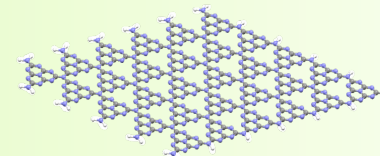
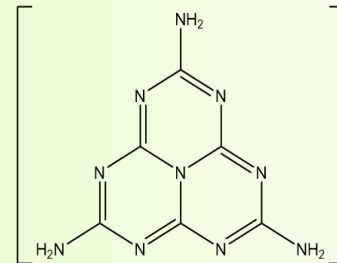


- + Large Band Gap energy.
- + High recombination of e^-/h^+ .

GRAPHITIC CARBON

NITRIDE ($g\text{-C}_3\text{N}_4$)

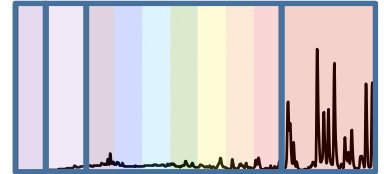
- Carbon nitride most stable allotrope.
- Topology: Poli(tri-s-triazine).
- Obtained from the polycondensation of C and N rings.
- Arranged in layers leading to 3D structures.



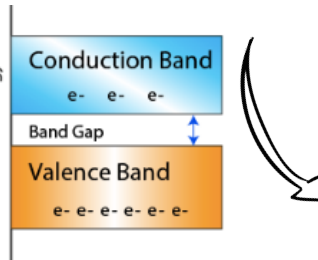
INTRODUCTION

PROPERTIES OF $g\text{-C}_3\text{N}_4$

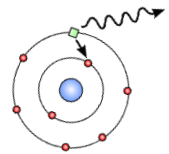
✓ Better absorption in the visible light interval.



✓ Lower Band Gap.



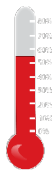
✓ Multiple excitations for the absorption of a photon.



✓ Chemical stability.

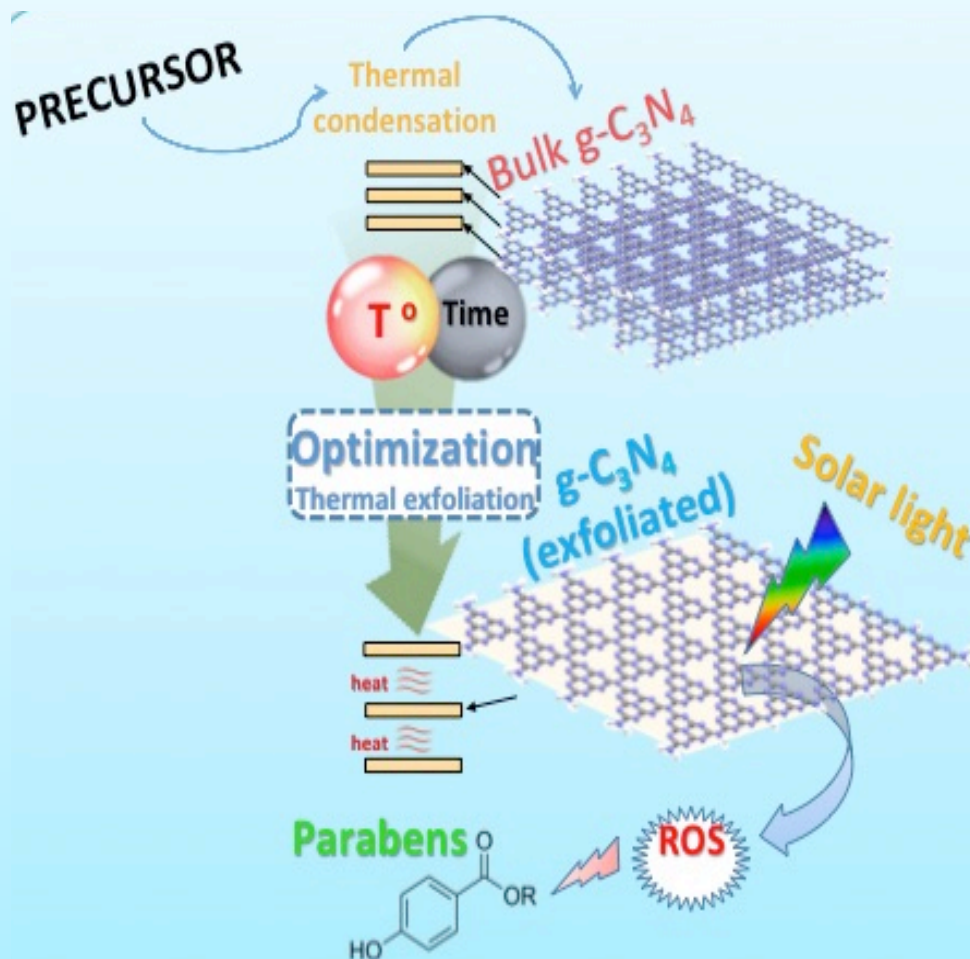


✓ Thermal stability.

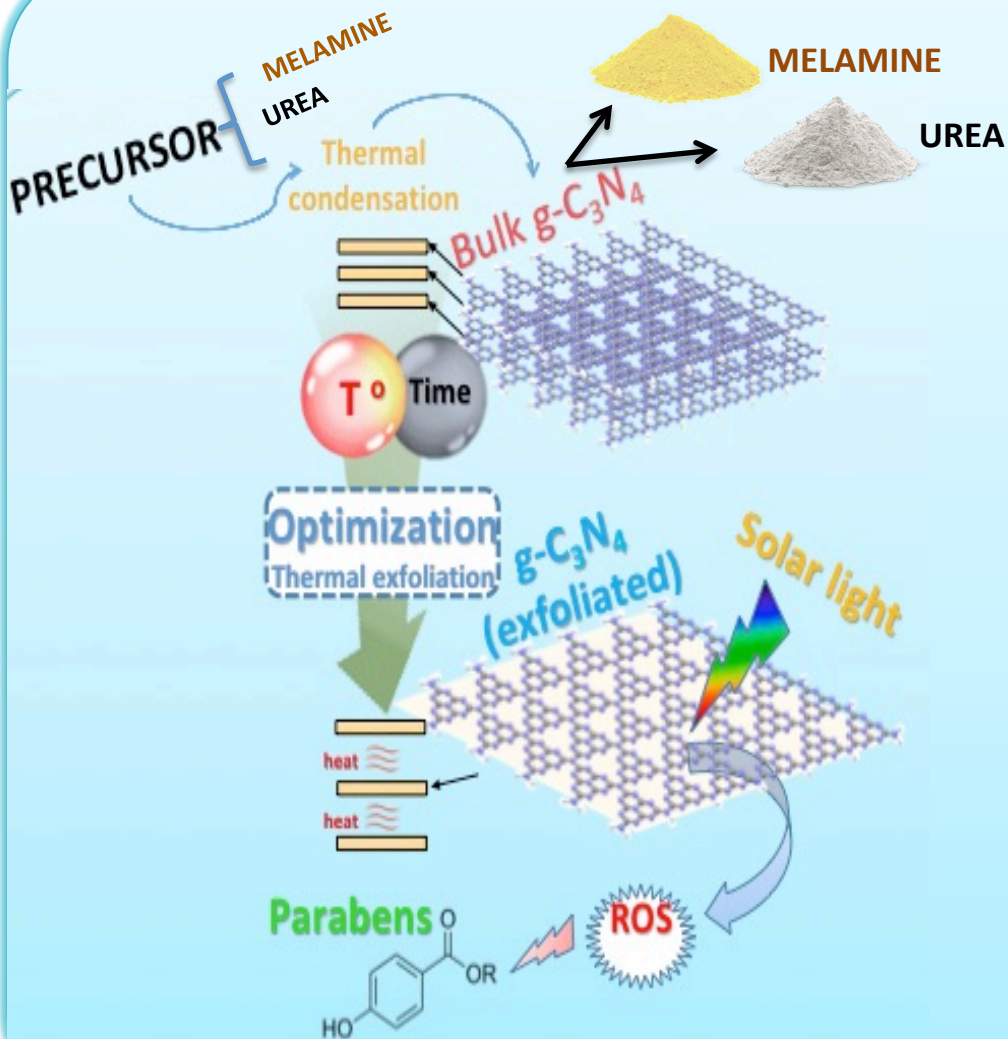


OBJECTIVE

- ✓ Synthesis of $g\text{-C}_3\text{N}_4$ from different precursors.
- ✓ Study of the influence of synthesis parameters on the physicochemical properties and photocatalytic activity.
- ✓ Target components: Methylparaben and Benzylparaben.



EXPERIMENTAL PROCEDURE



Characterization Techniques

- DRX
- Adsorption-desorption isotherms of N_2 at 77K
- Diffuse reflectance spectroscopy UV-VIS
- Elemental analysis (C/N)
- IR absorption spectroscopy

Photocatalytic Reactions

- Simulated solar radiation.
- Initial concentration of parabens in aqueous solution of 5 ppm.

PRECURSOR

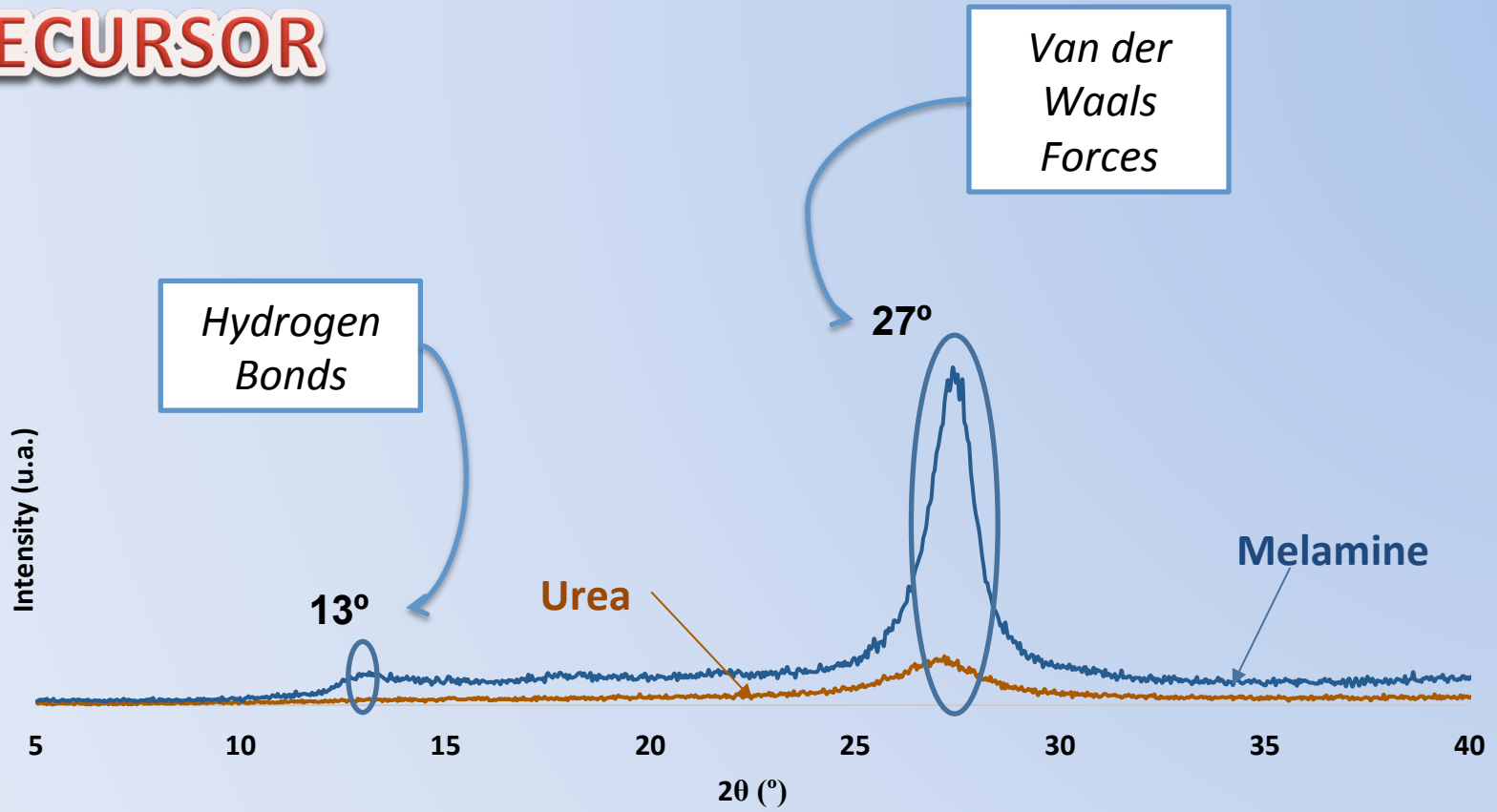
THERMAL
EXFOLIATION
TREATMENT

TIME OF THE
EXFOLIATION
TREATMENT

TEMPERATURE OF
THE EXFOLIATION
TREATMENT

COMPARISON
WITH TiO₂

PRECURSOR



PRECURSOR

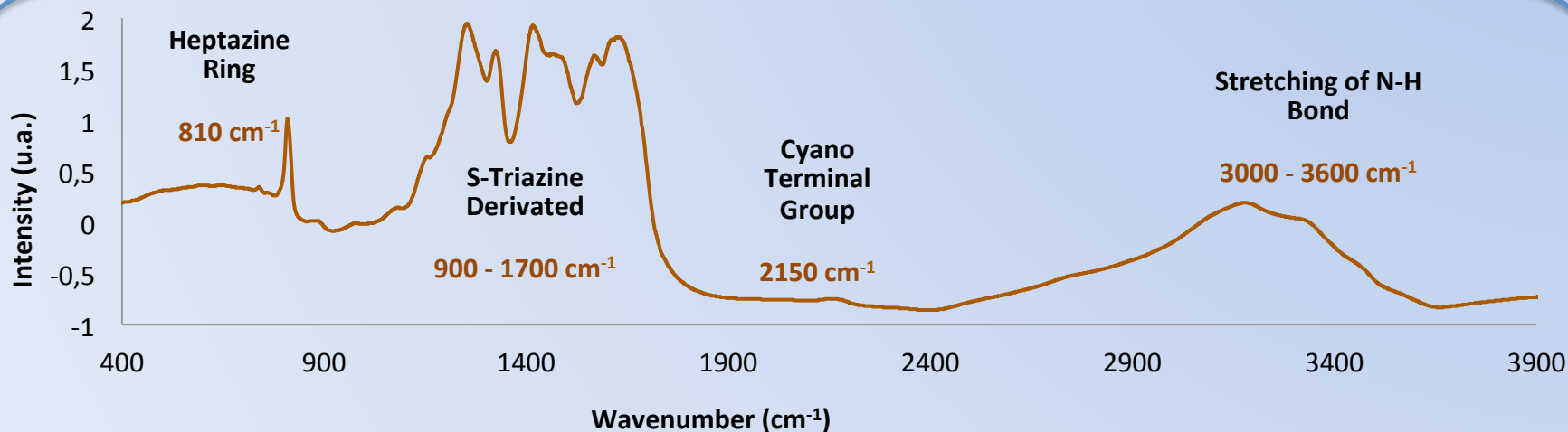
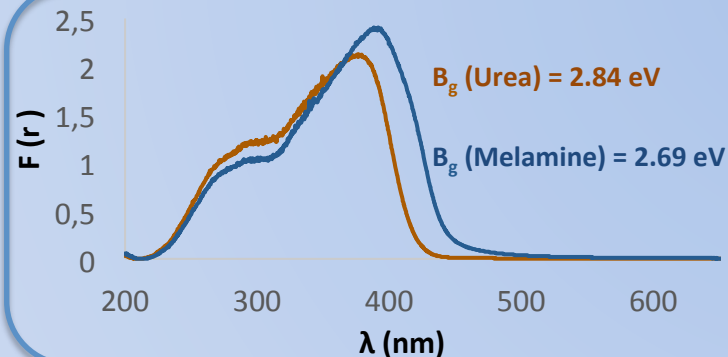
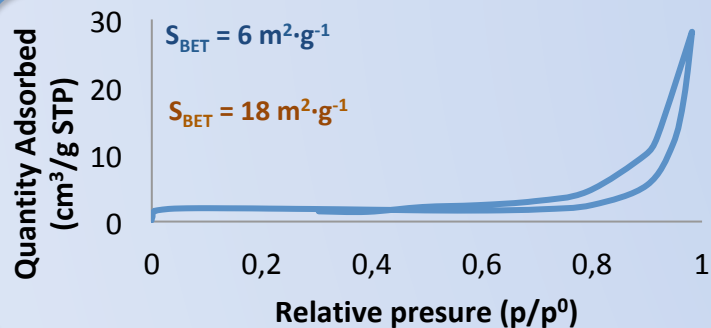
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PRECURSOR



C/N (Urea) = 54.70%

C/N (Melamine) = 55.26%

PRECURSOR

THERMAL
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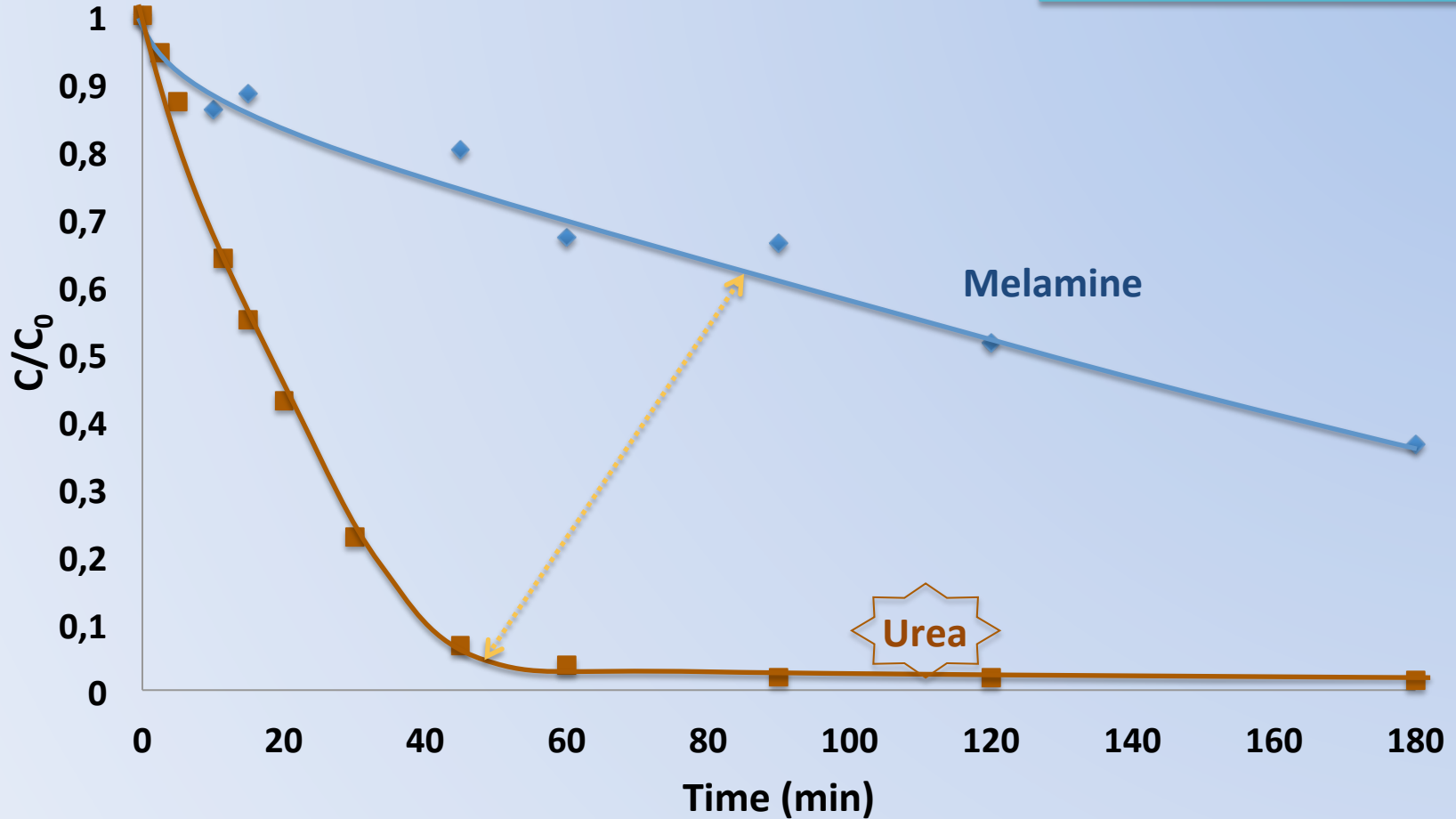
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PRECURSOR

Pollutant: Benzylparaben



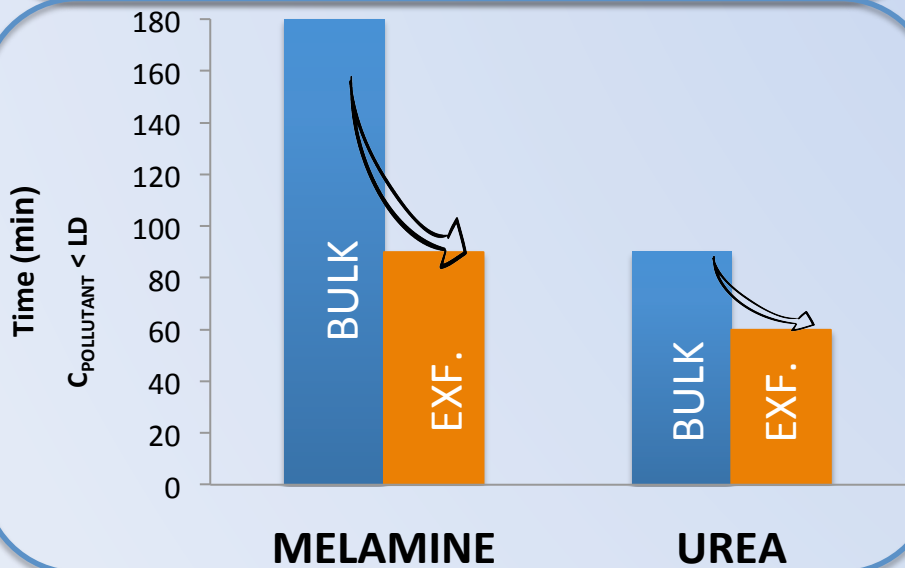
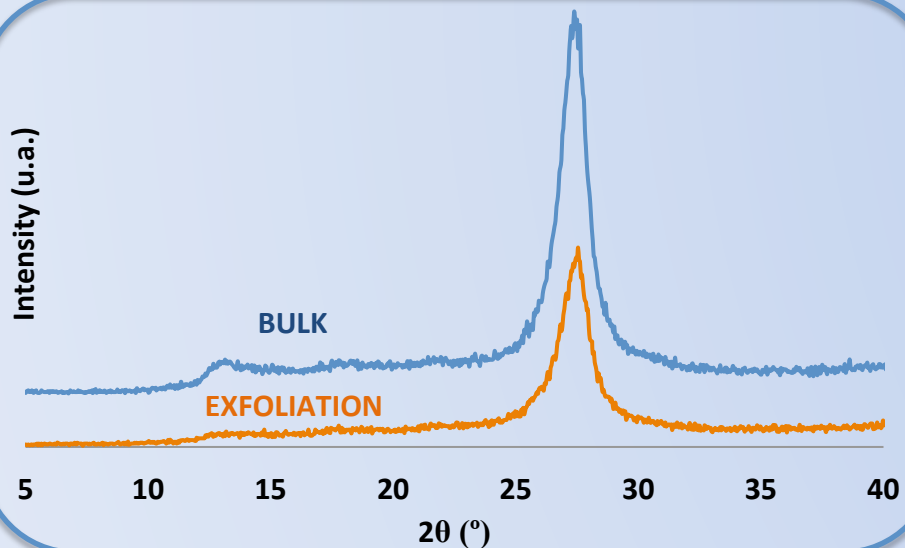
PRECURSOR

THERMAL EXFOLIATION TREATMENT

TIME OF THE EXFOLIATION TREATMENT

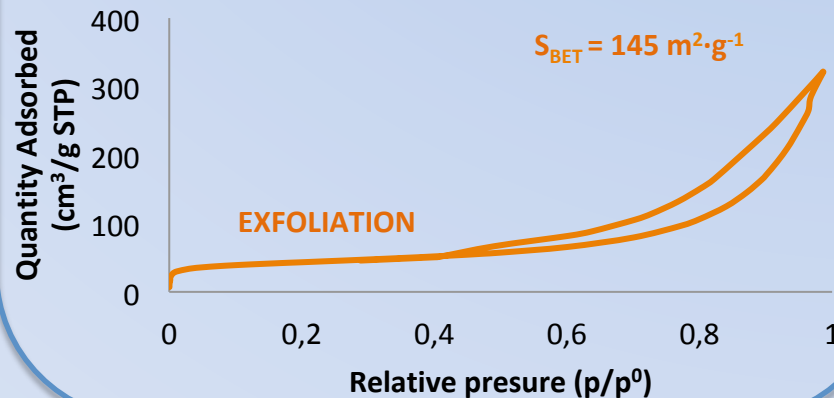
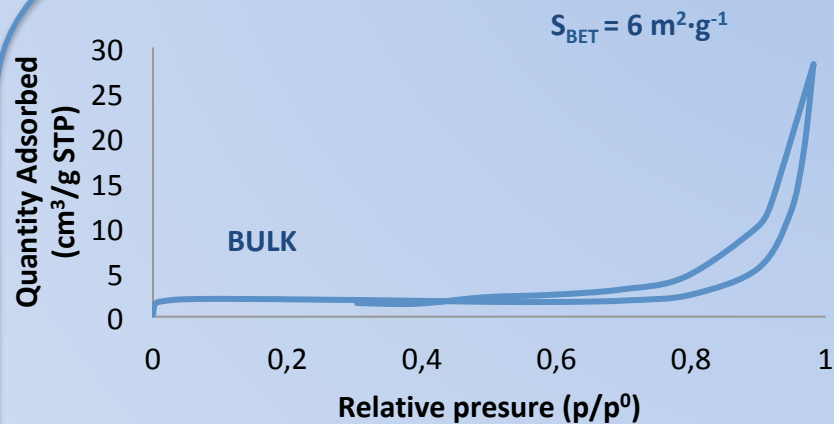
TEMPERATURE OF THE EXFOLIATION TREATMENT

COMPARISON WITH TiO₂



Pollutant: Benzylparaben

THERMAL EXFOLIATION TREATMENT



PRECURSOR

THERMAL
EXFOLIATION
TREATMENT

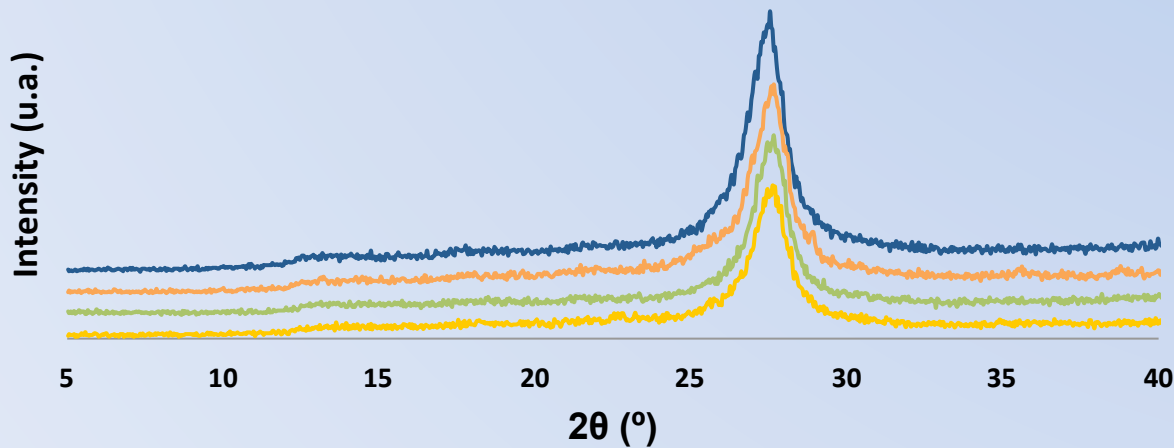
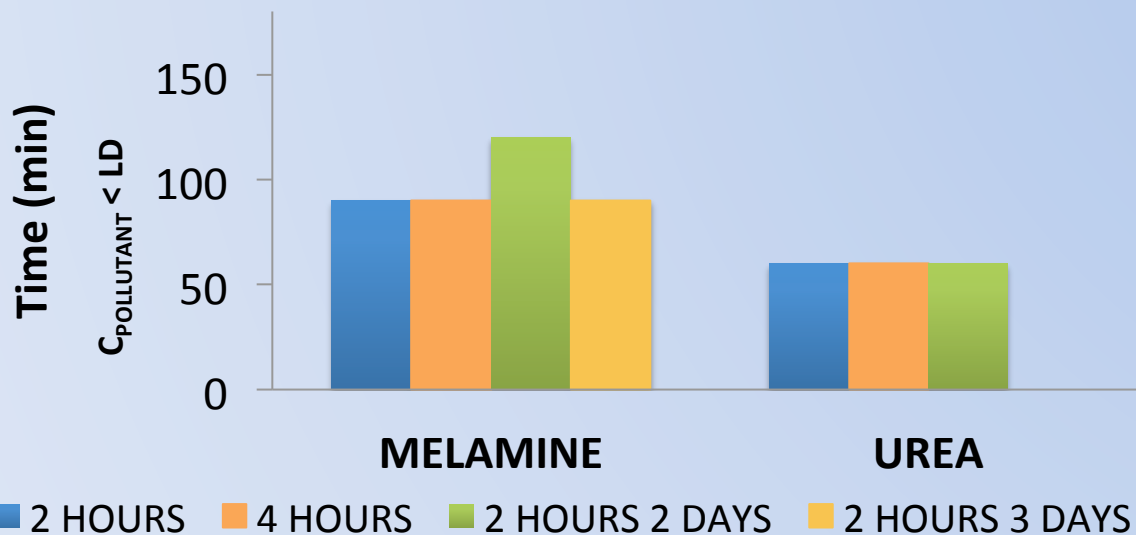
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Pollutant: Benzylparaben



PRECURSOR

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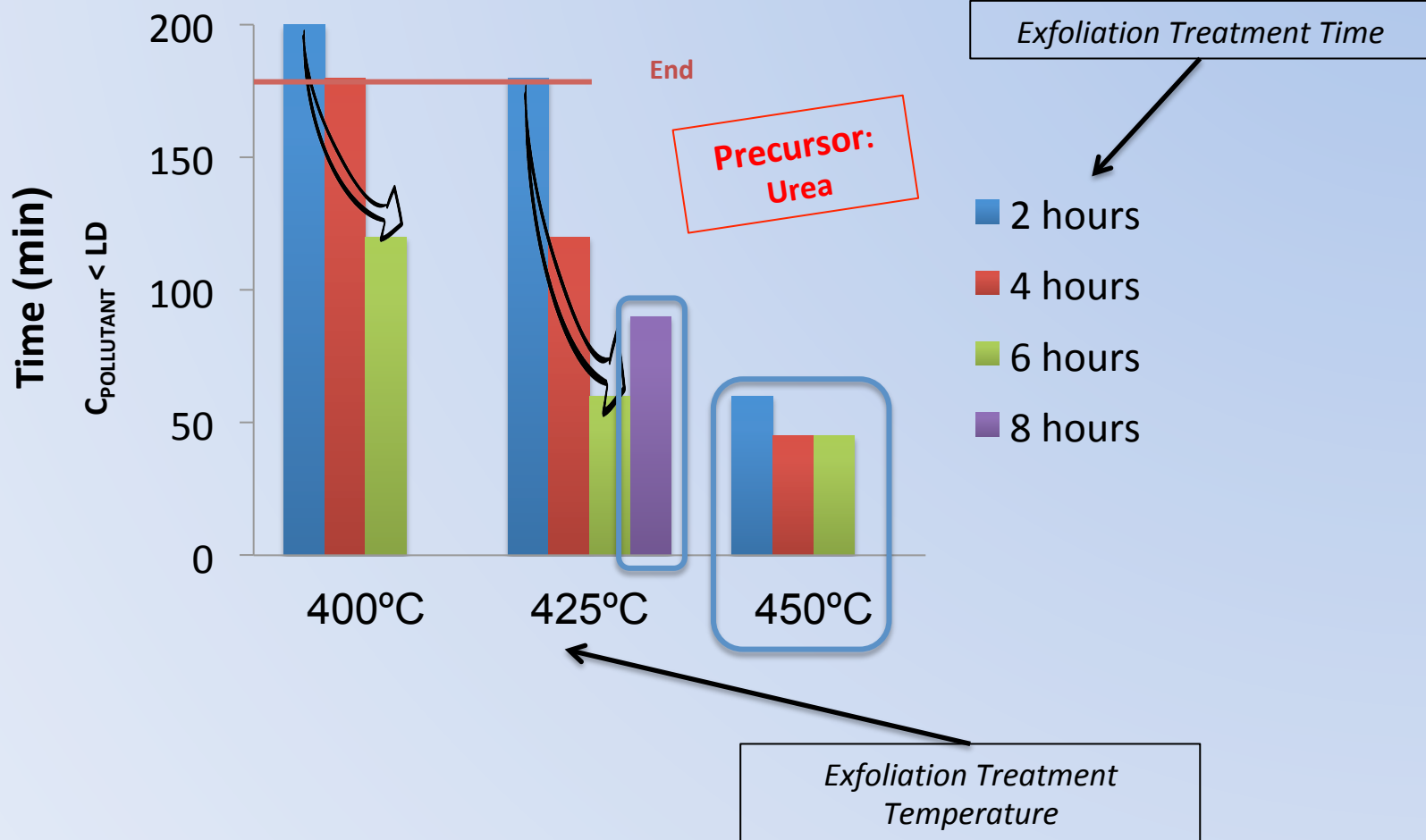
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COMPARISON
WITH TiO₂

TIME OF THE EXFOLIATION TREATMENT

Pollutant: Methylparaben



PRECURSOR

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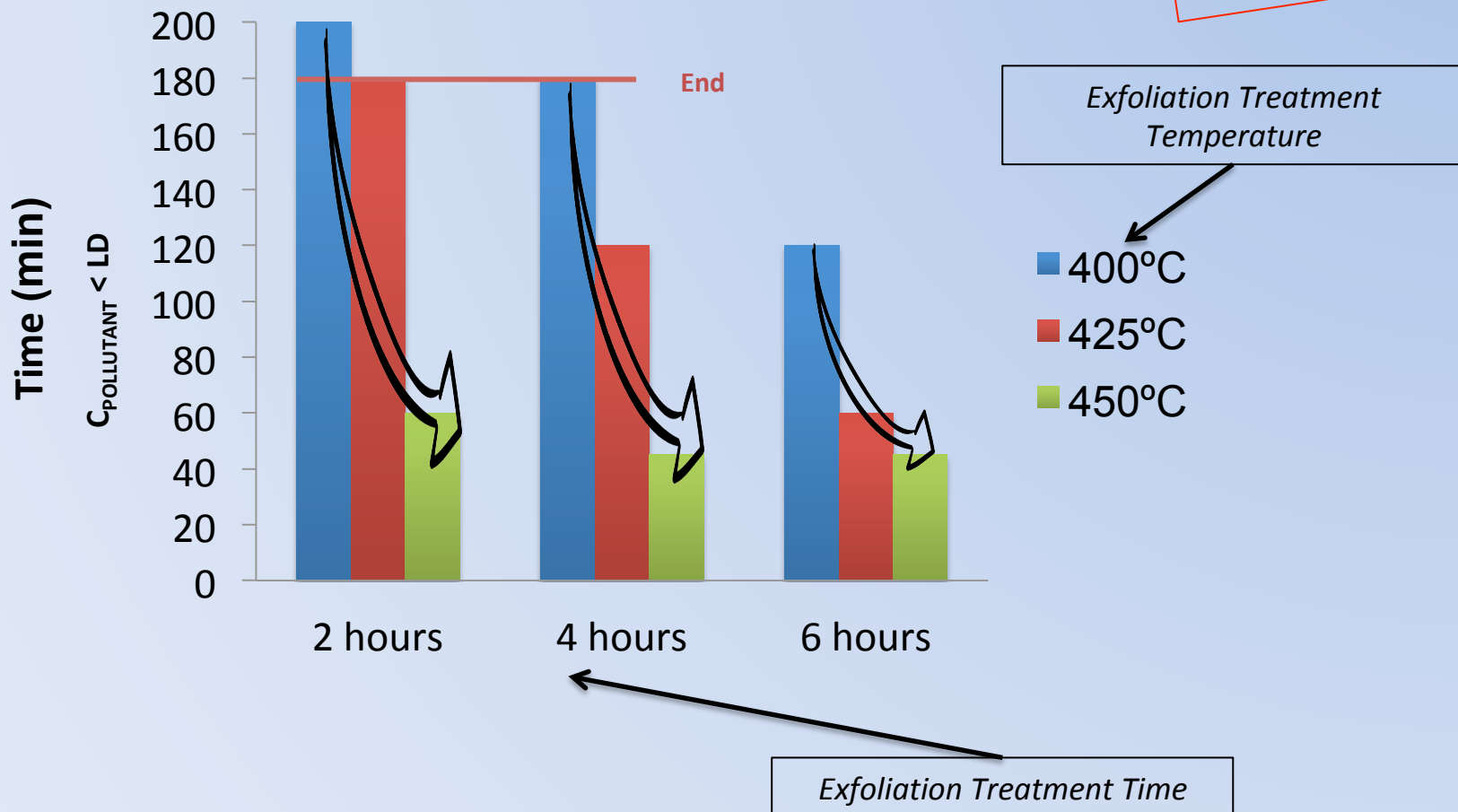
TEMPERATURE OF
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WITH TiO₂

TEMPERATURE OF THE EXFOLIATION TREATMENT

Pollutant: Methylparaben

Precursor:
Urea



PRECURSOR

THERMAL
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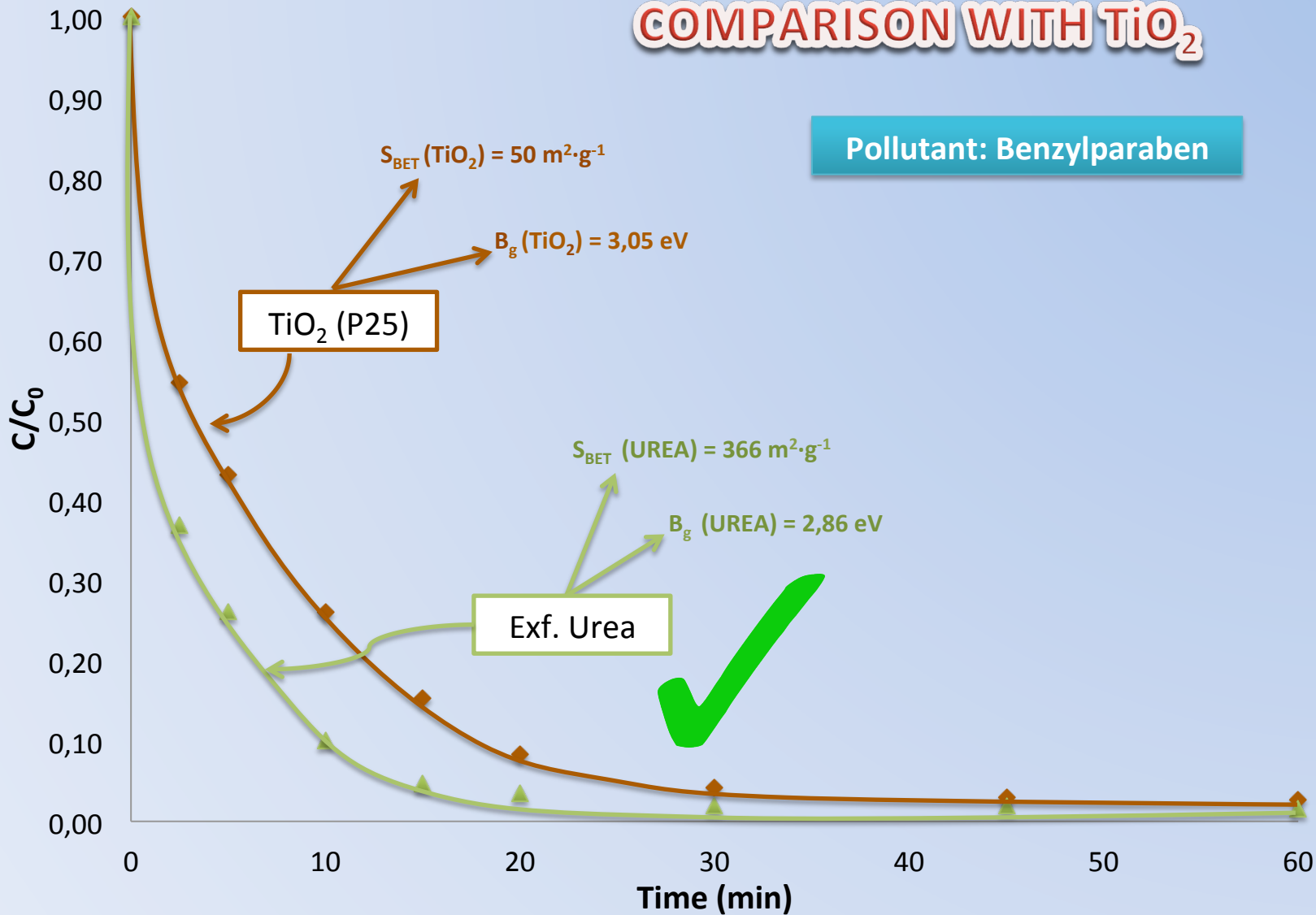
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COMPARISON WITH TiO₂

Pollutant: Benzylparaben



CONCLUSIONS

For an improvement in the photocatalytic activity:

1. The choice of the precursor in the synthesis of g-C₃N₄ is crucial.
2. Thermal exfoliation treatment of g-C₃N₄ materials is a good tailoring strategy. There is a correlation between the breaking of hydrogen bonds and the increase of the photocatalytic activity in the g-C₃N₄ materials.

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*thank
you*

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