

# Large scale air decontamination system using dielectric barrier discharge combined with UV-activated TiO<sub>2</sub>

## INTRODUCTION

### AIR QUALITY

1 out of 10 deaths related to pollution diseases

90% of the time spent indoors in Europe



5.5 million people die prematurely due to indoor air pollution (2013)  
49% of the cities do not meet WHO pollution guidelines

1.43\$ trillion – Costs associated to air pollution in Europe (2010)

42.9\$ billion – Corresponded to Spain



15% reduction of employee's productivity by low indoor air quality

J. G. Martín *et al*, Chemosphere, 2020

#### VOCs

Paint, cleaning chemicals, furniture outgassing, cigarette smoke, *etc.*

#### Biological

Animals, food spills, standing water, humans, outdoor environment, *etc.*

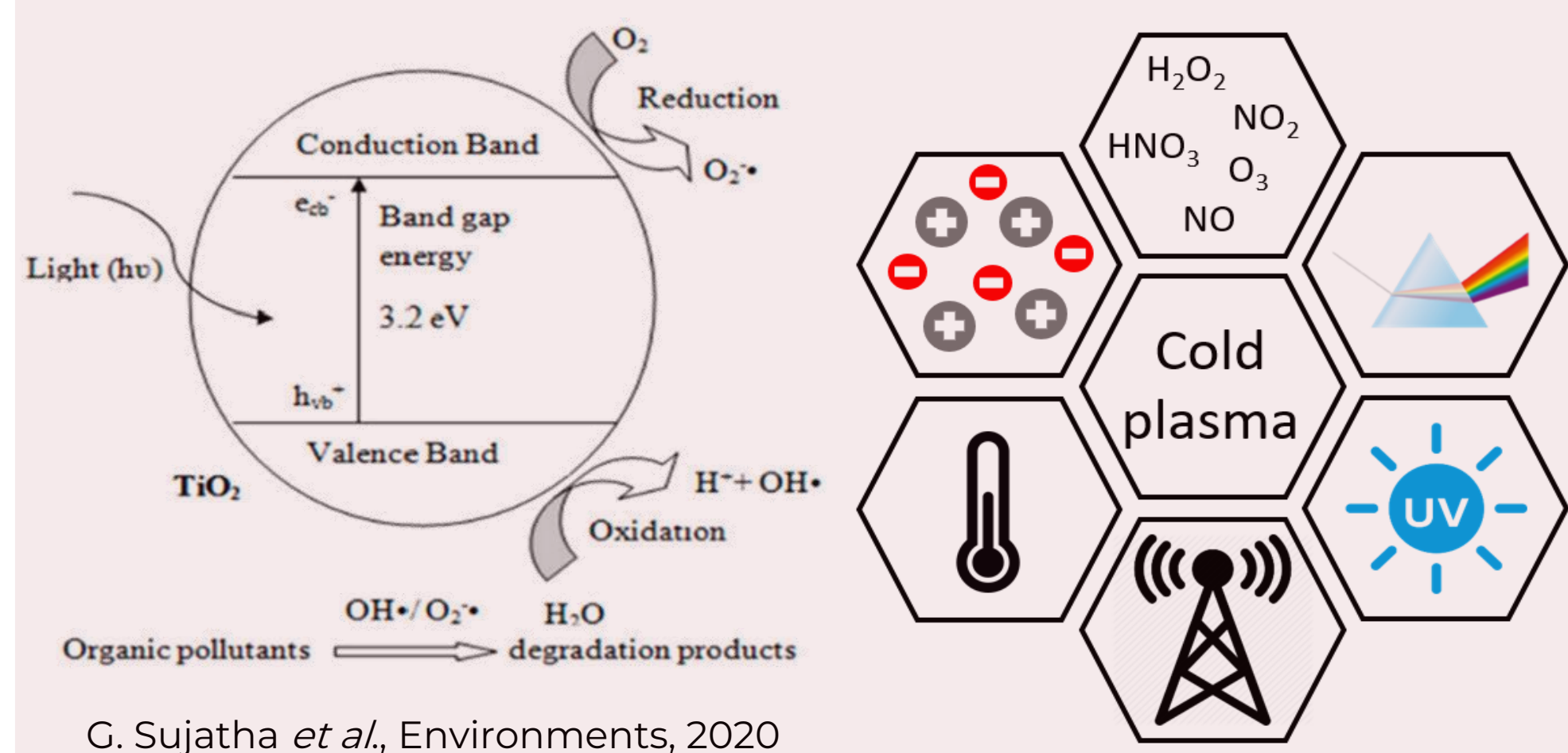
#### PM

Cooking, outdoor air, combustion, tobacco smoke, *etc.*

### How to deal with those pollutants ?

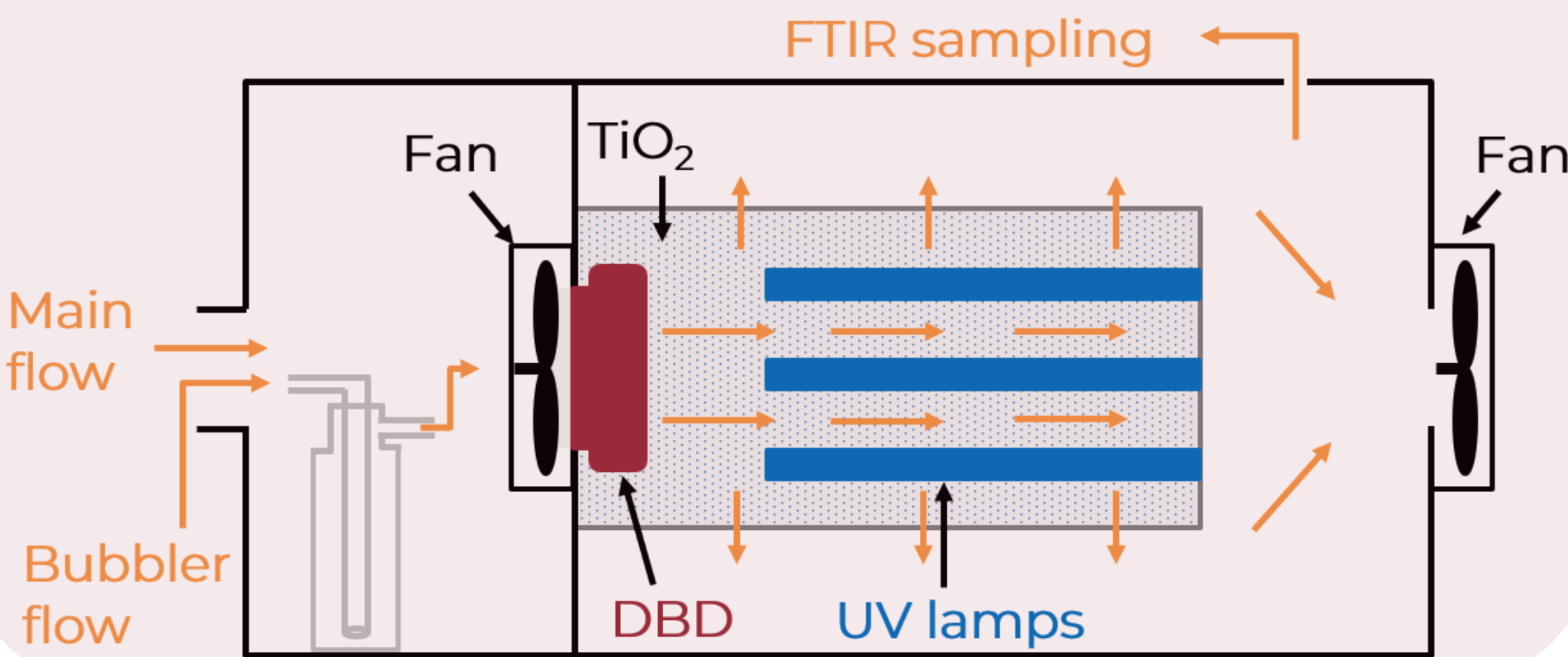
UV activated TiO<sub>2</sub>

Nonthermal plasma



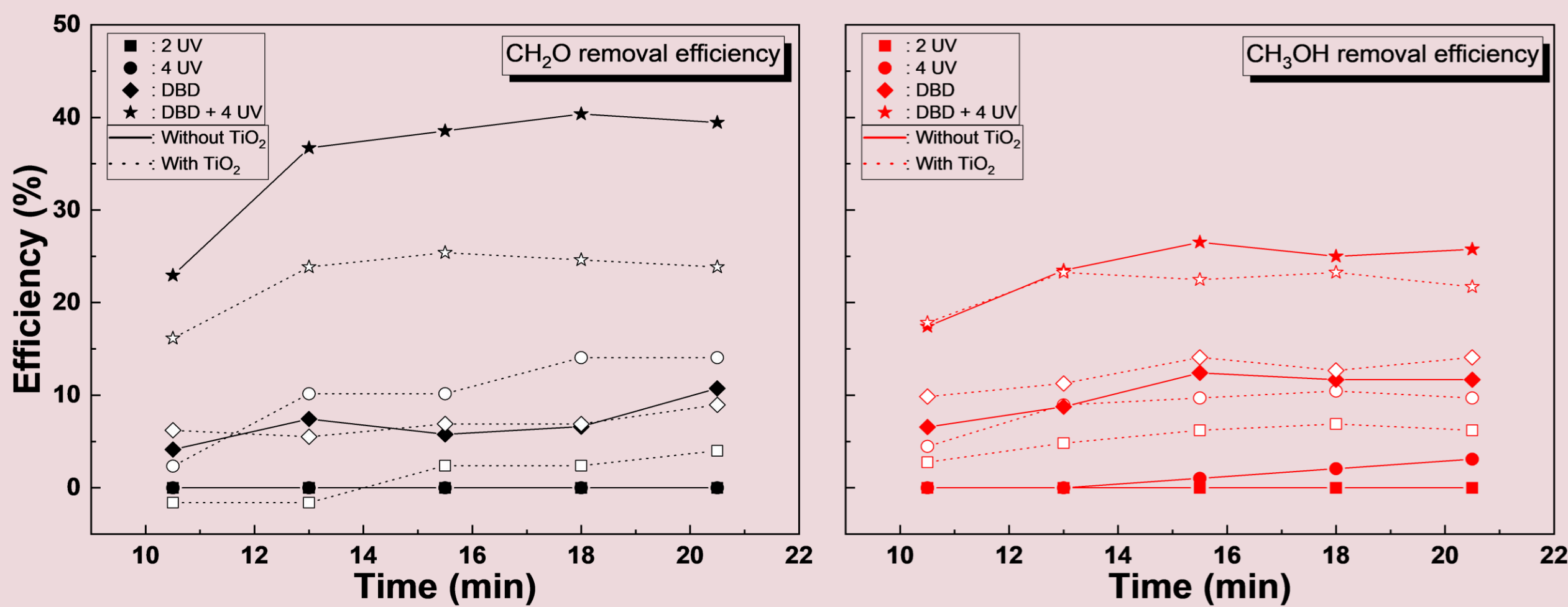
G. Sujatha *et al*, Environments, 2020

## EXPERIMENTAL SETUP



## RESULTS

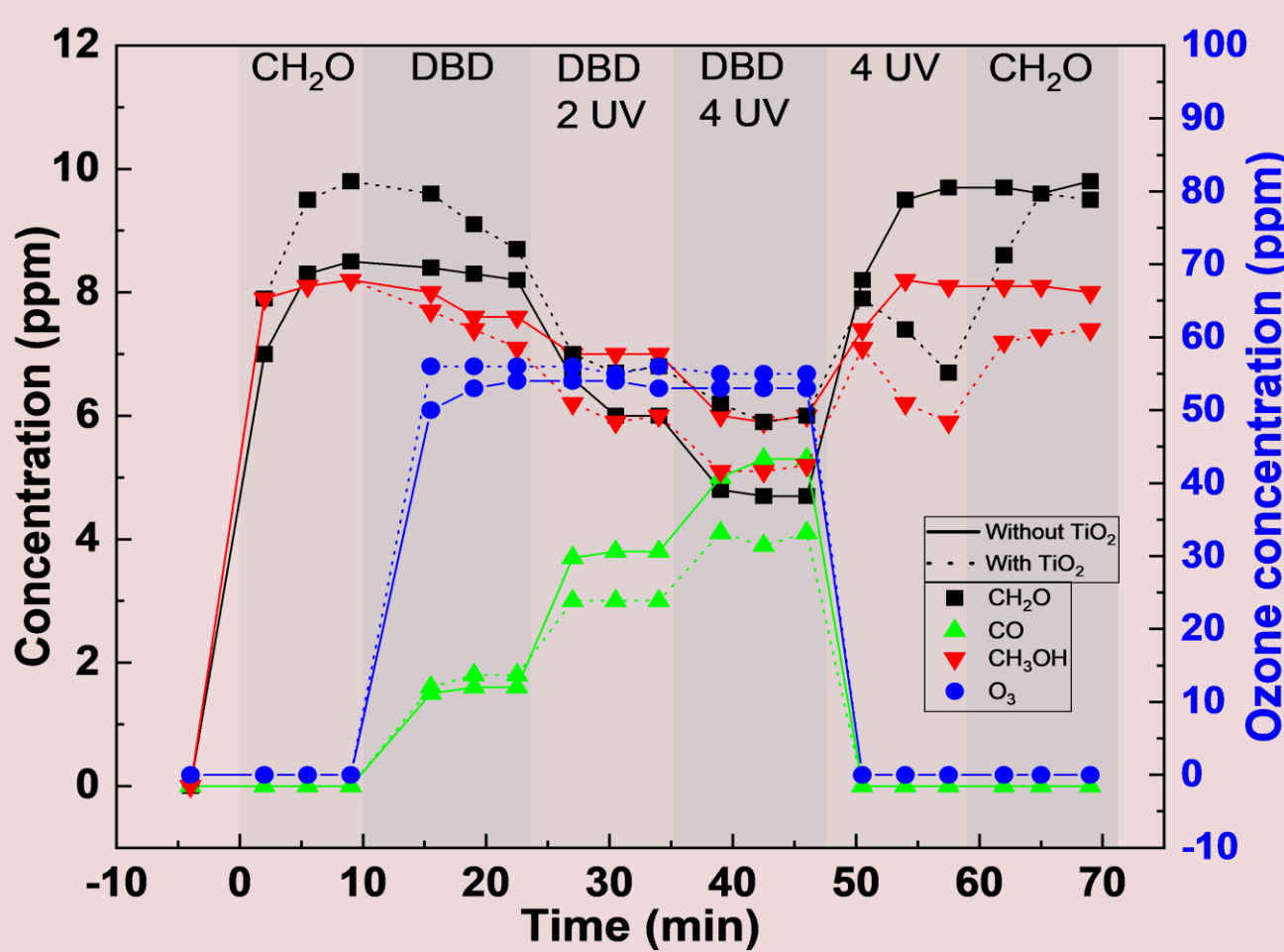
### Effect of the components: DBD, UV, DBD + UV



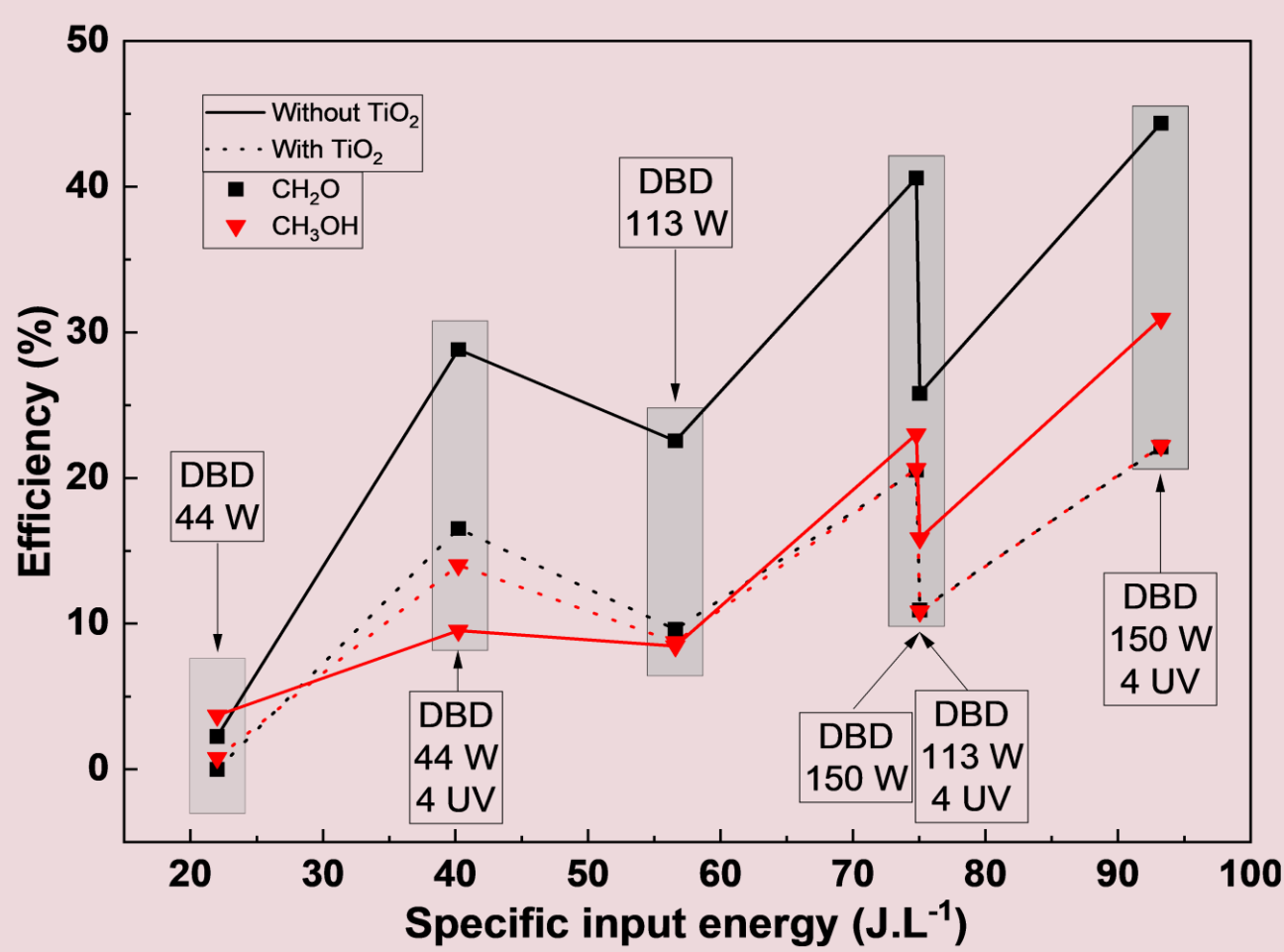
Better efficiency without TiO<sub>2</sub>. Low effect of the single elements alone.

### Byproducts formation

Relative humidity 60%, 120 L/min, 115 W

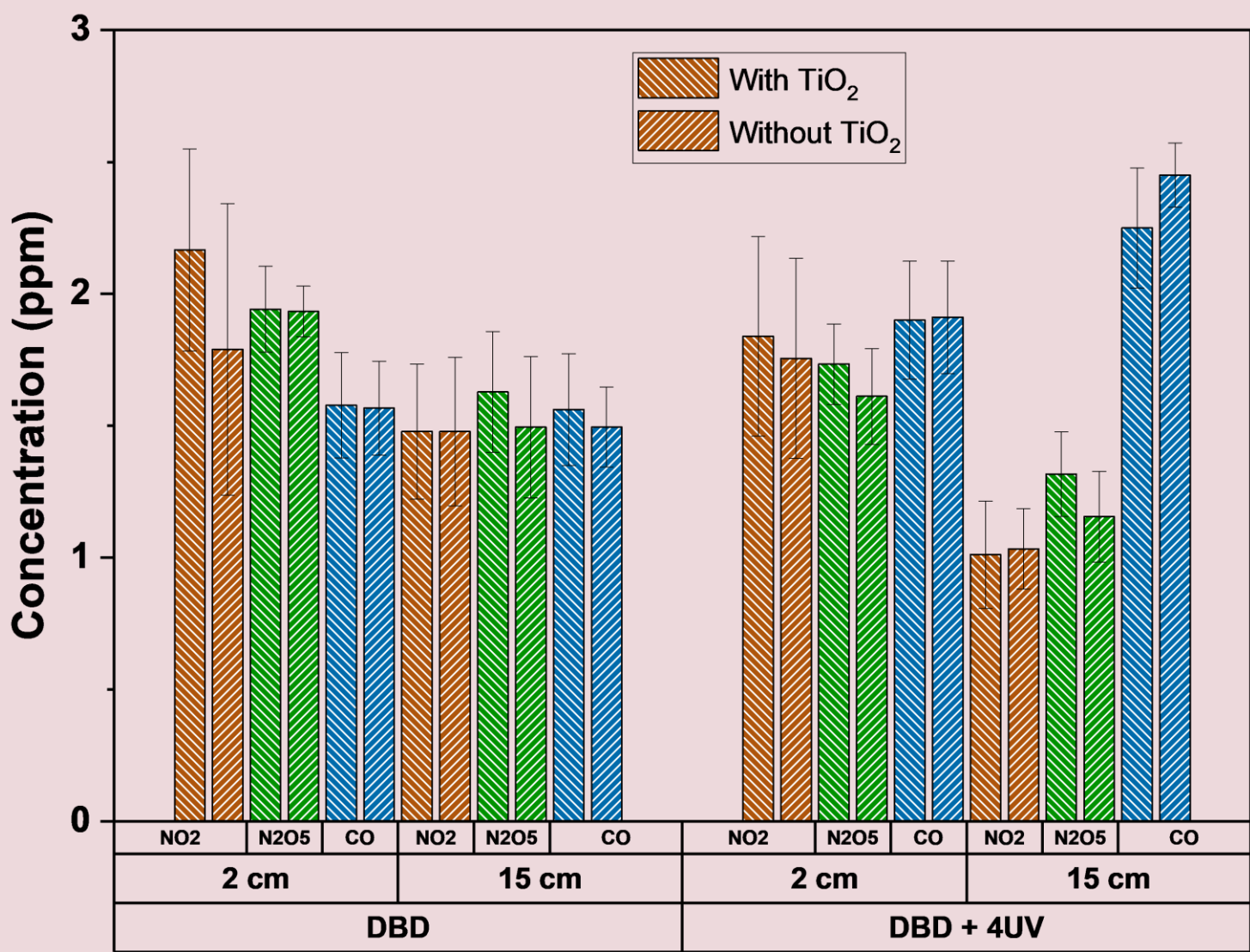


Impact of the specific input energy



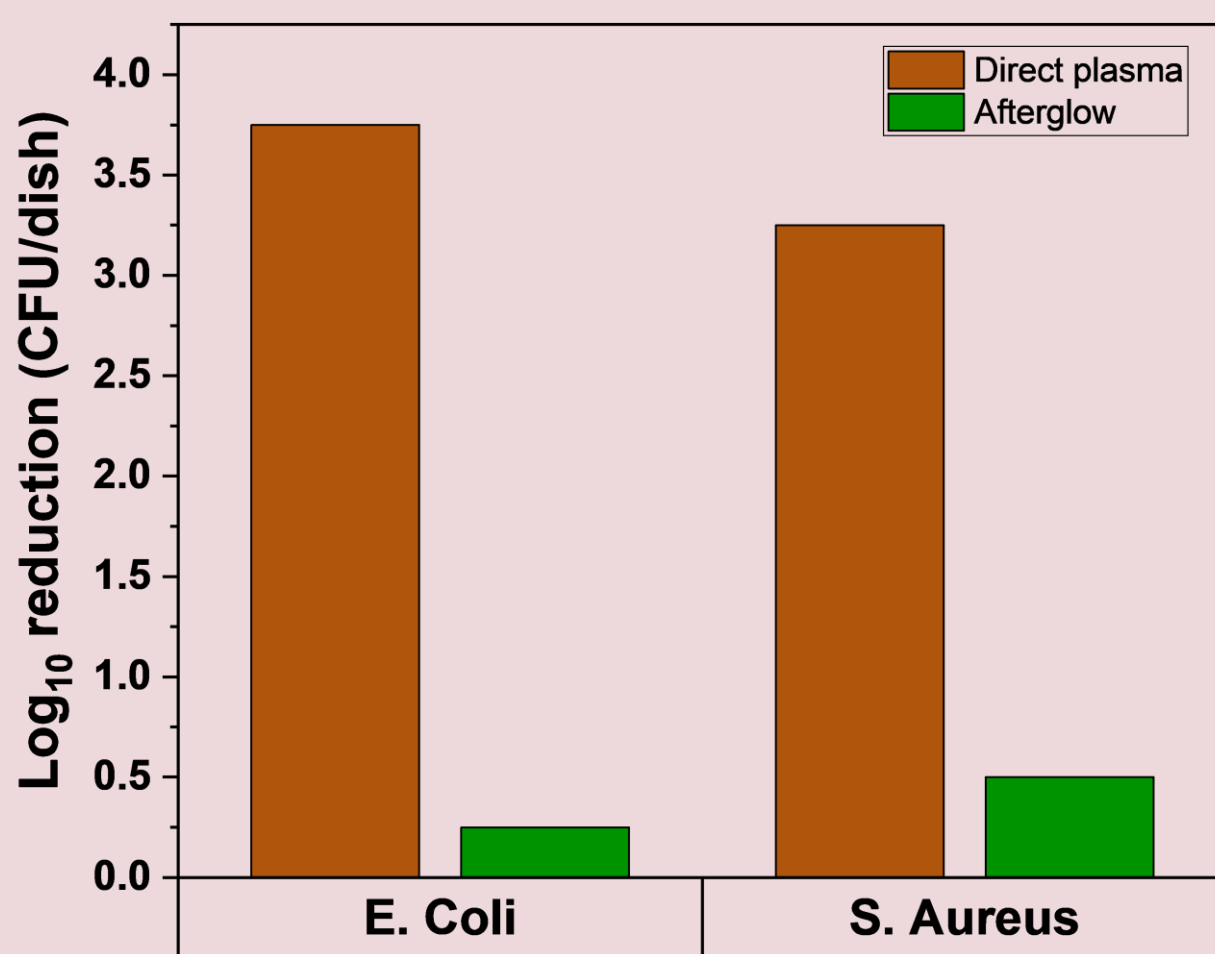
The main formed byproduct are CO, CO<sub>2</sub>, and O<sub>3</sub>.  
For the same specific input energy, the synergy between plasma and UV is more interesting in terms of efficiency.

### Influence of FTIR sampling distance



Change of chemistry depending on the distance → Several steps fragmentation ?

### Preliminary results on bio-decontamination



Complete inactivation of bacteria with single pass in the discharge

T. Vazquez *et al*, J. Elstat. 2025

## CONCLUSION

Promising results for indoor air cleaning using a combination of plasma and UV lamps  
Efficiency up to 50% at removing formaldehyde in a single pass  
The synergy of the discharge and UV lamps gives the best results  
The fragmentation processes seem to vary at different distances from the plasma  
Complete inactivation of E. Coli and S. Aureus using the plasma only



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EU NextGenerationEU: Recovery and Resilience Plan of Slovak Republic - 09I03-03-V03-00033 EnvAdwice

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