

Evaluation of photocatalytic mortars in a real environment

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Introduction



Many cities suffer from air pollution episodes mainly due to two factors, climatic conditions and excessive use of fossil fuels due to road traffic. One way to address this problem and minimize the effects of NO_x pollution is through the use of photocatalysis (De-NO_x process).



The use of photocatalysts into building materials can be an easy way to implement this solution in cities at low cost.



Objective

To evaluate the De-NO_x behaviour of four cement based mortars, without additive (Reference) and with photocatalytic additives (LDH-NiTi, LDH-ZnCr and P25-TiO₂) in a real environment

Materials and methods

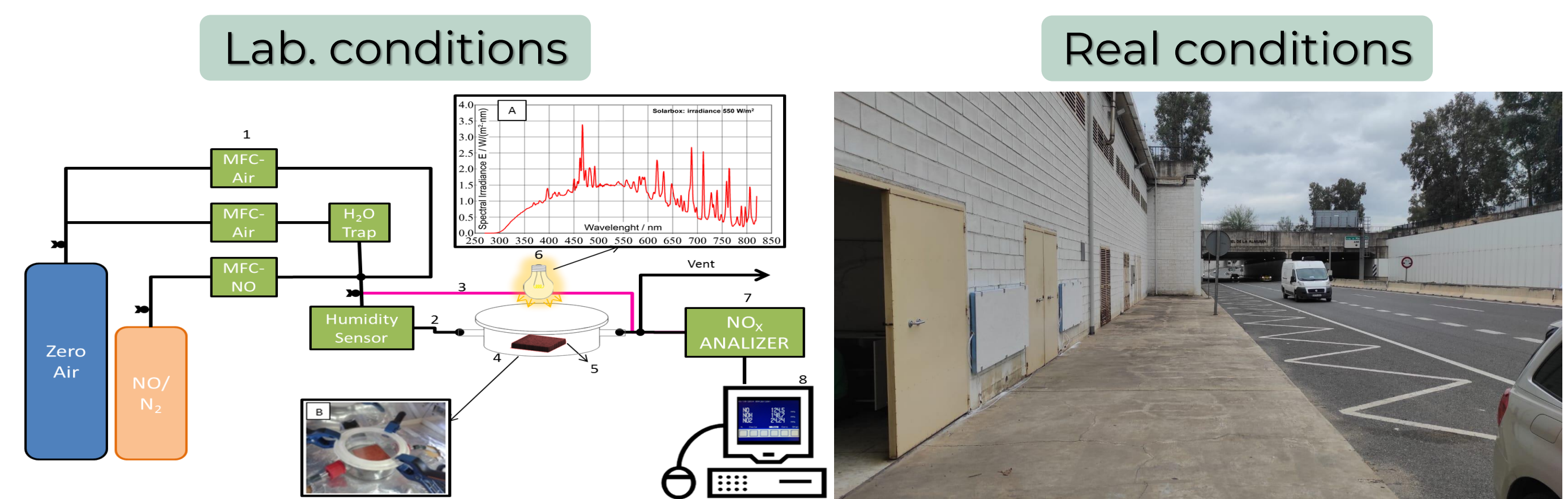
LDH Additive synthesis



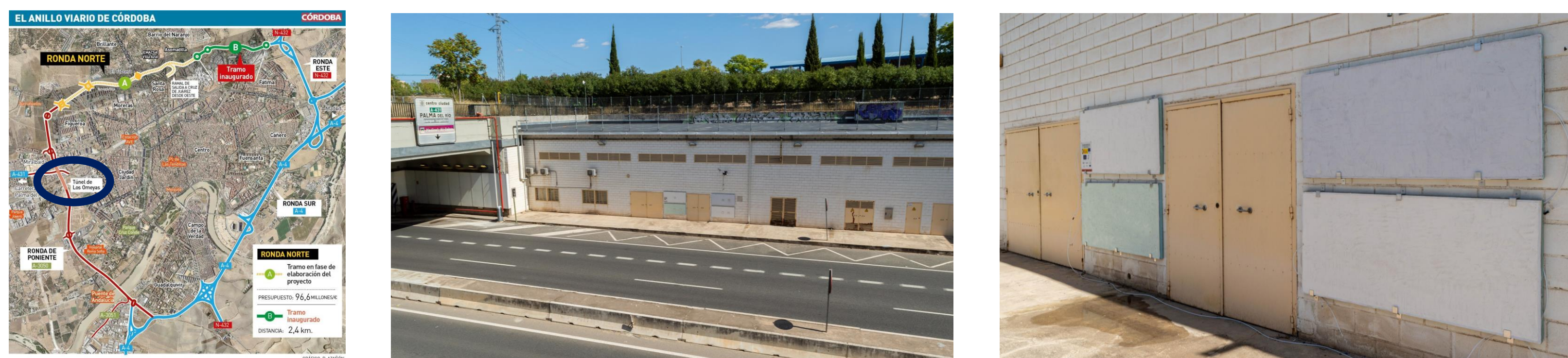
Panels Elaborations



De-NO_x test



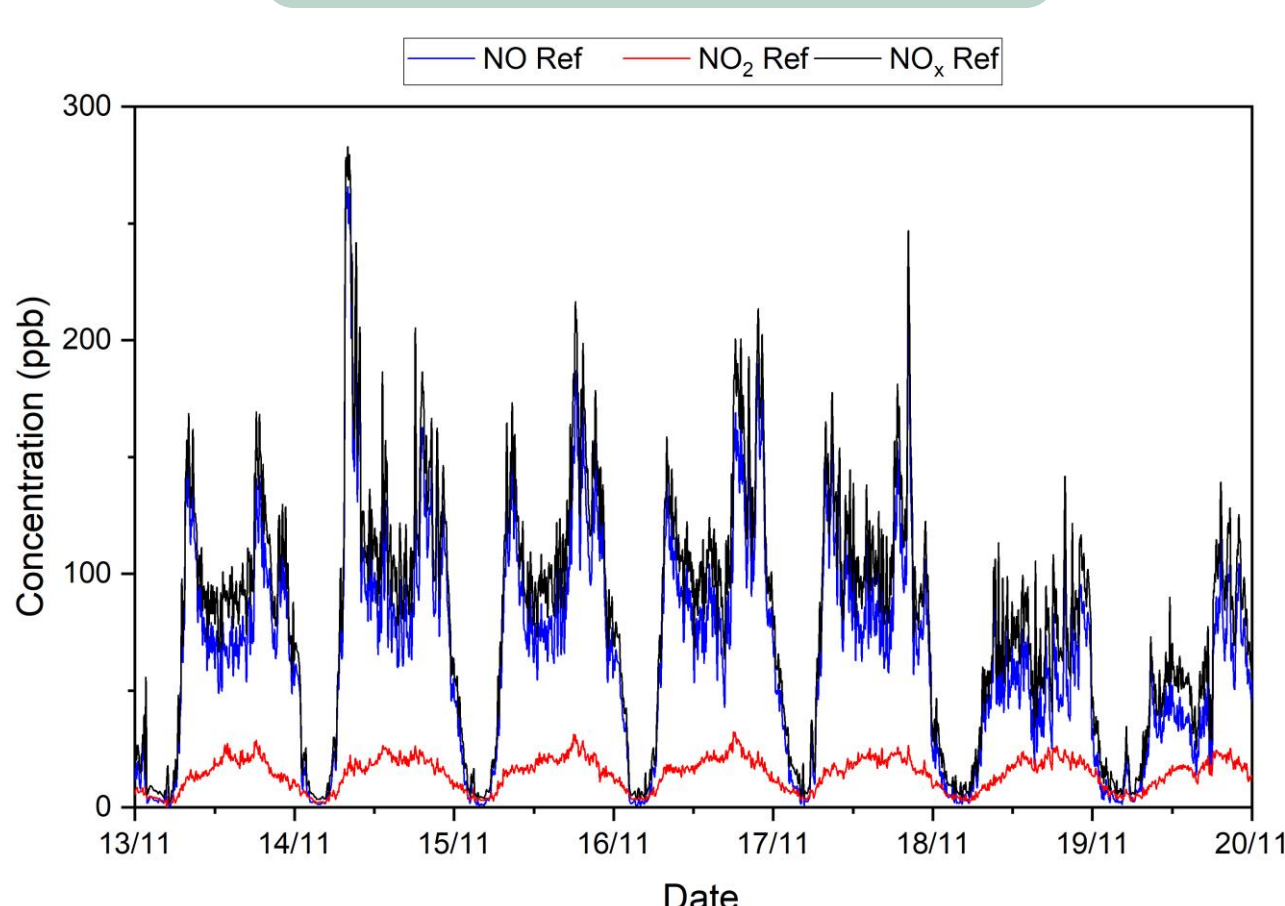
Panels location



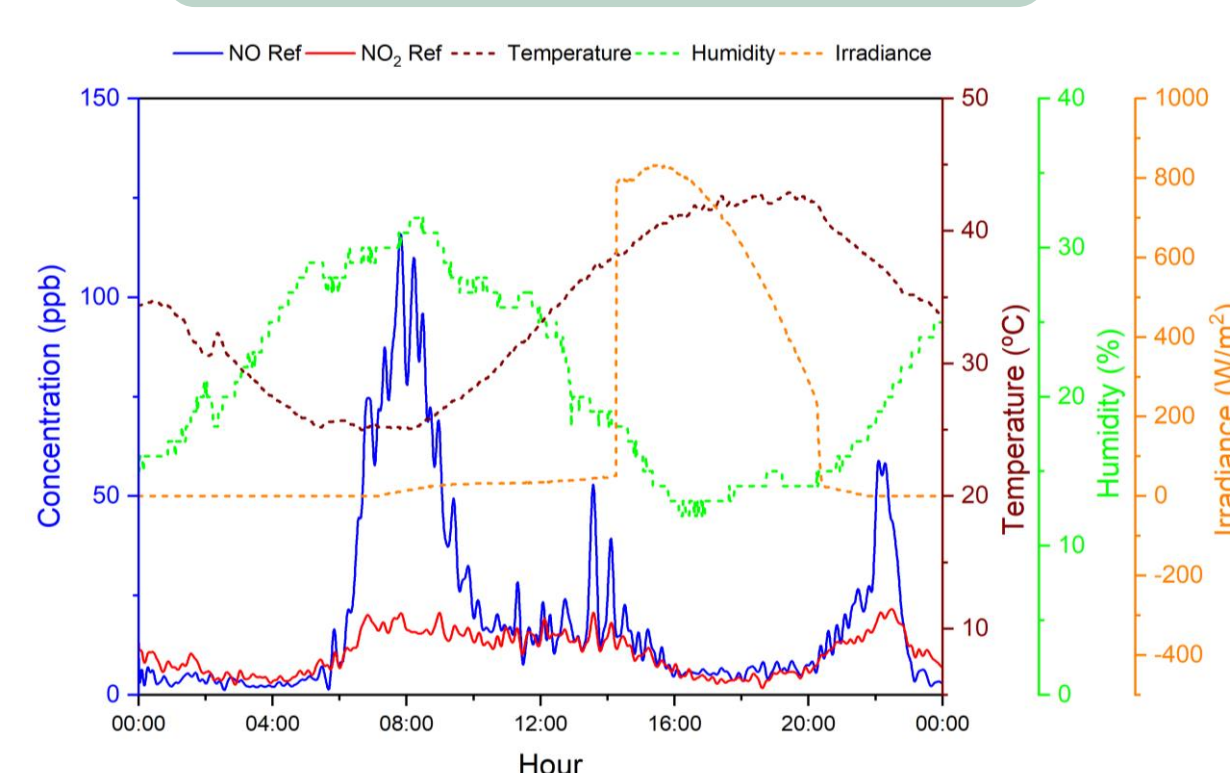
The experiment was conducted by continuous measurement using two simultaneous NO_x gases analyser instruments. One of them remained operational throughout the experiment, monitoring the reference mortar, while the other alternated on a weekly basis to assess the photocatalytic activity of each of the other 3 studied mortars.

Results

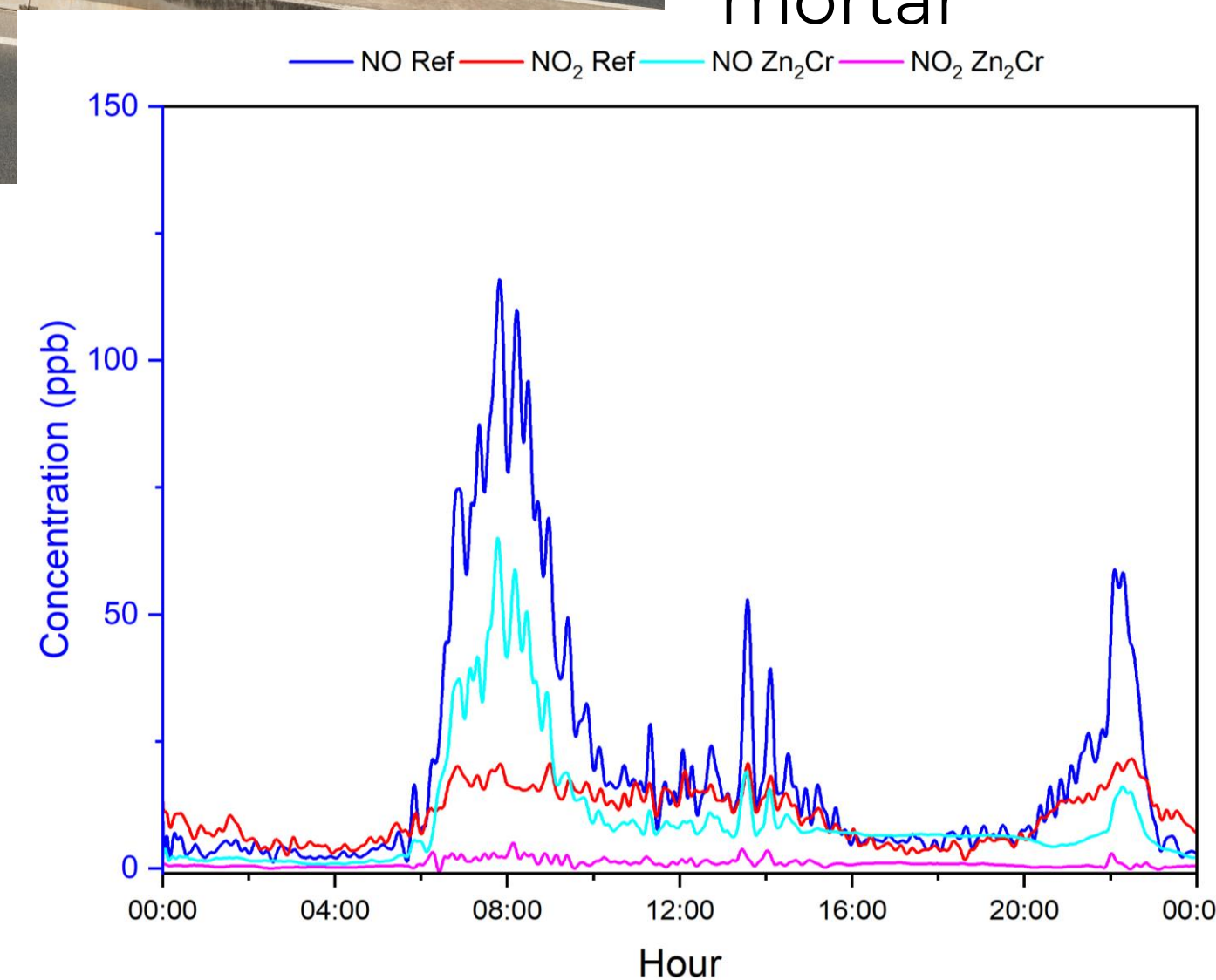
NO_x Week Profile



Parameter Profile



NO_x 24 hours Profile



Both panels replicate the same NO_x contamination profile, although the concentration values are significantly lower in the photocatalytic mortar

		Removal gases (%)		
		T1 07:00-14:00	T2 14:00-19:00	T3 19:00-22:00
P25	NO	74	60	61
	NO ₂	59	70	71
	NO _x	65	69	71
Ni ₃ Ti	NO	21	50	53
	NO ₂	85	76	94
	NO _x	40	65	71
Zn ₂ Cr	NO	36	31	54
	NO ₂	91	85	91
	NO _x	50	51	76

The P25-mortar has the best NO removal efficiency, while the LDH-mortars have a higher selectivity, i.e. they remove more NO₂. For low and high irradiance values (T1, T2), the P25-mortar shows the best performance, although when the irradiance is maximum, the LDH-mortars improve their performance. When irradiance is diffuse (T3), LDH-mortars equal or even surpass the efficiency of P25-mortar.

Acknowledgement

Proyecto PID2021-121865-100



Conclusions

- It is demonstrated that the pollution of NO_x gases in a real urban environment can be mitigated by using photocatalysis.
- The De-NO_x efficiency of mortar with LDH additives is similar to that of TiO₂ with relation to NO abatement and even improves the removal of the highly toxic NO₂.

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