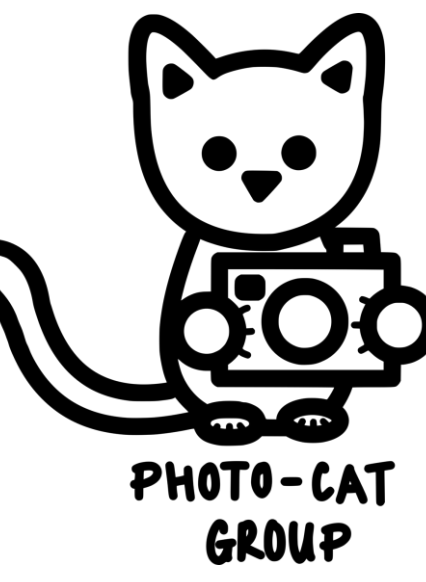


ANbO₃ (A = Na, K, Ag) photocatalysts for the degradation of persistent organic pollutants

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INTRODUCTION

RESEARCH

CONCLUSIONS

Persistent Organic Pollutants

Persistent organic pollutants (POPs) are pollutants that, due to their strong chemical bonds, **do not breakdown in the environment**

They are released from a range of industrial and domestic applications.

Examples include perfluoroalkyl substances (PFAS) and pesticides.

In some cases, contamination from decades ago is **still present today**.¹

Emerging studies show that POPs **can be harmful to human health and the environment**.²

Photocatalysis

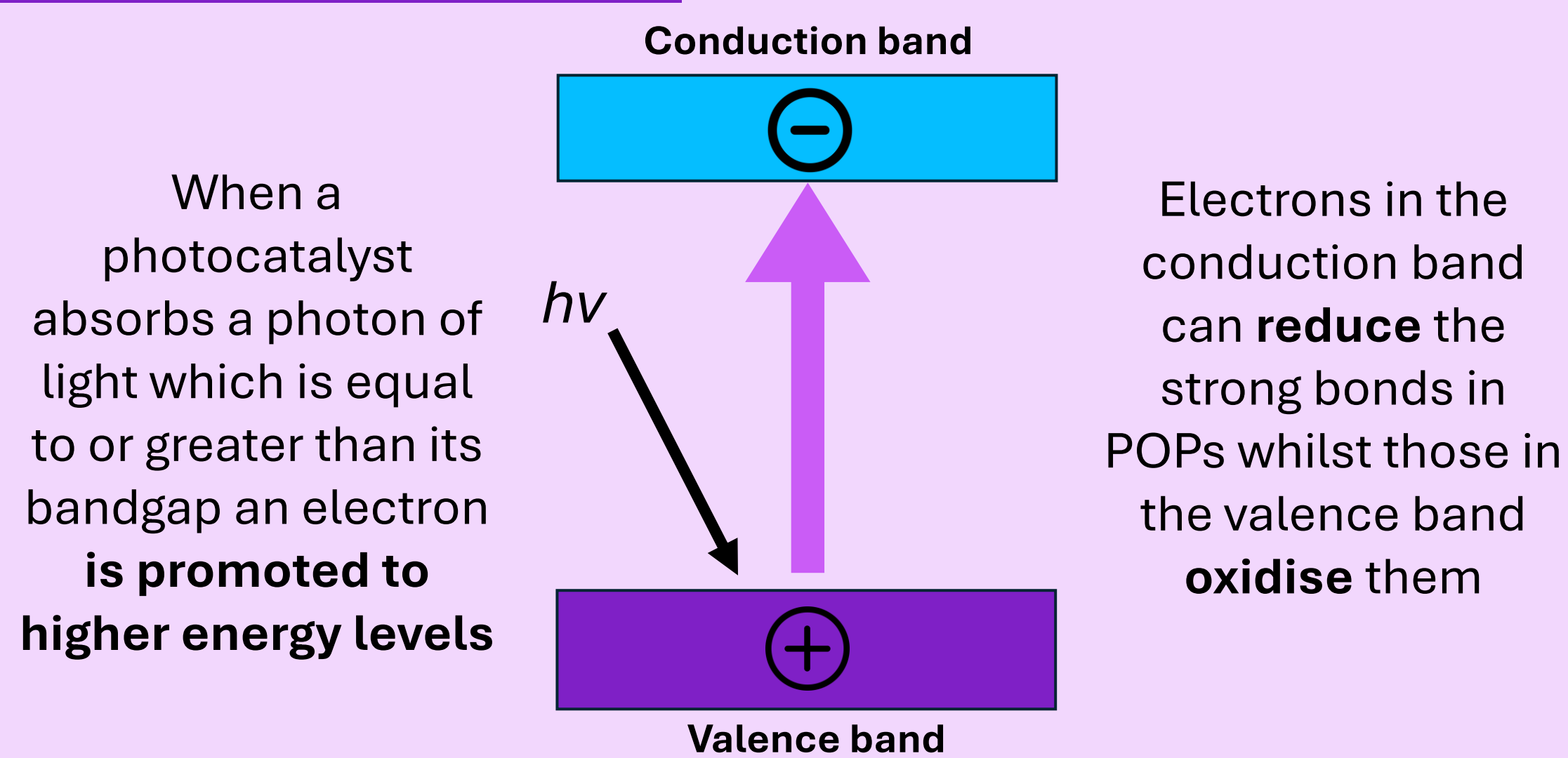


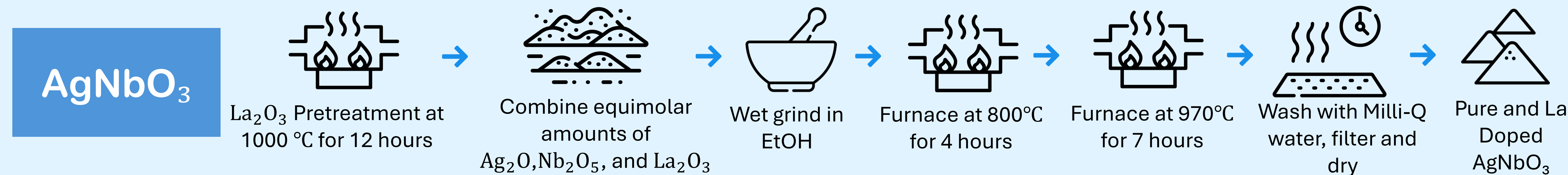
Figure 1: Electronic band diagram of photocatalysis

In pollutant degradation, we aim for **mineralisation** which involves the **complete breakdown of POPs** into non-harmful substances.

Research Aims

- To synthesise Large redox potential photocatalysts with large pollutant mineralisation efficiencies.** Current photocatalysts have insufficient redox potentials to break the strong chemical bonds.
- To enhance the pollutant mineralisation efficiencies of the photocatalysts by lanthanum doping**
- To test the pollutant degradation efficiencies of these photocatalyst**

Solid State Synthesis



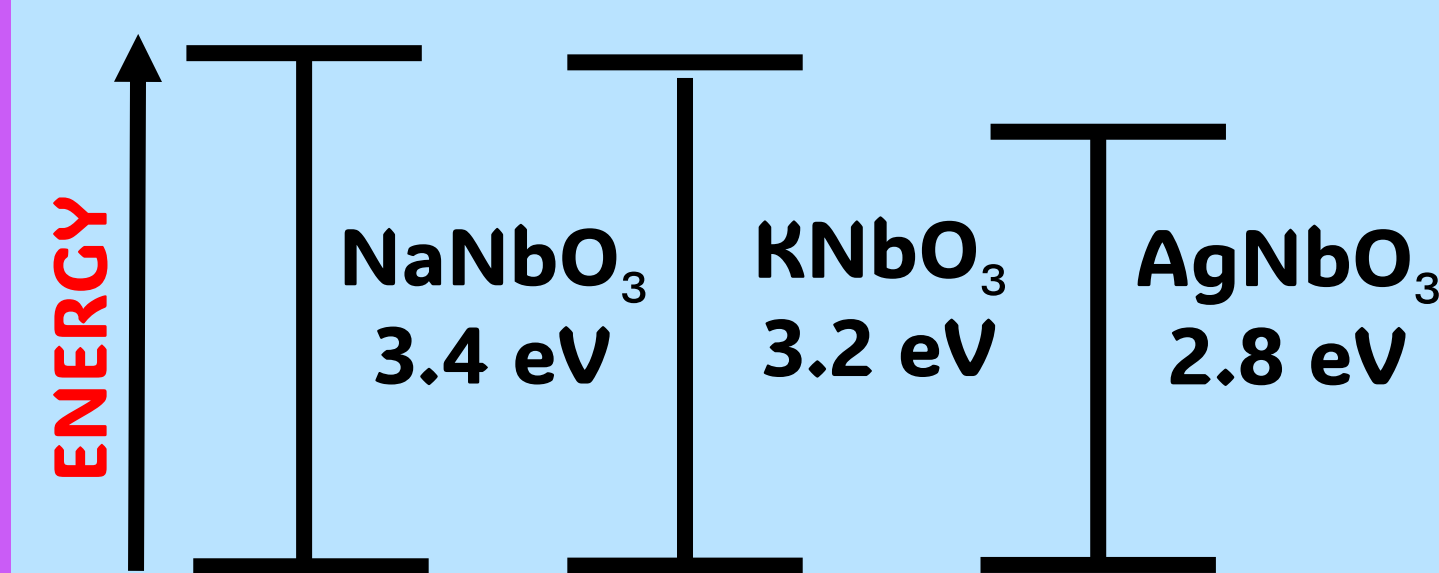
Characterisation

Powder X-ray Diffraction

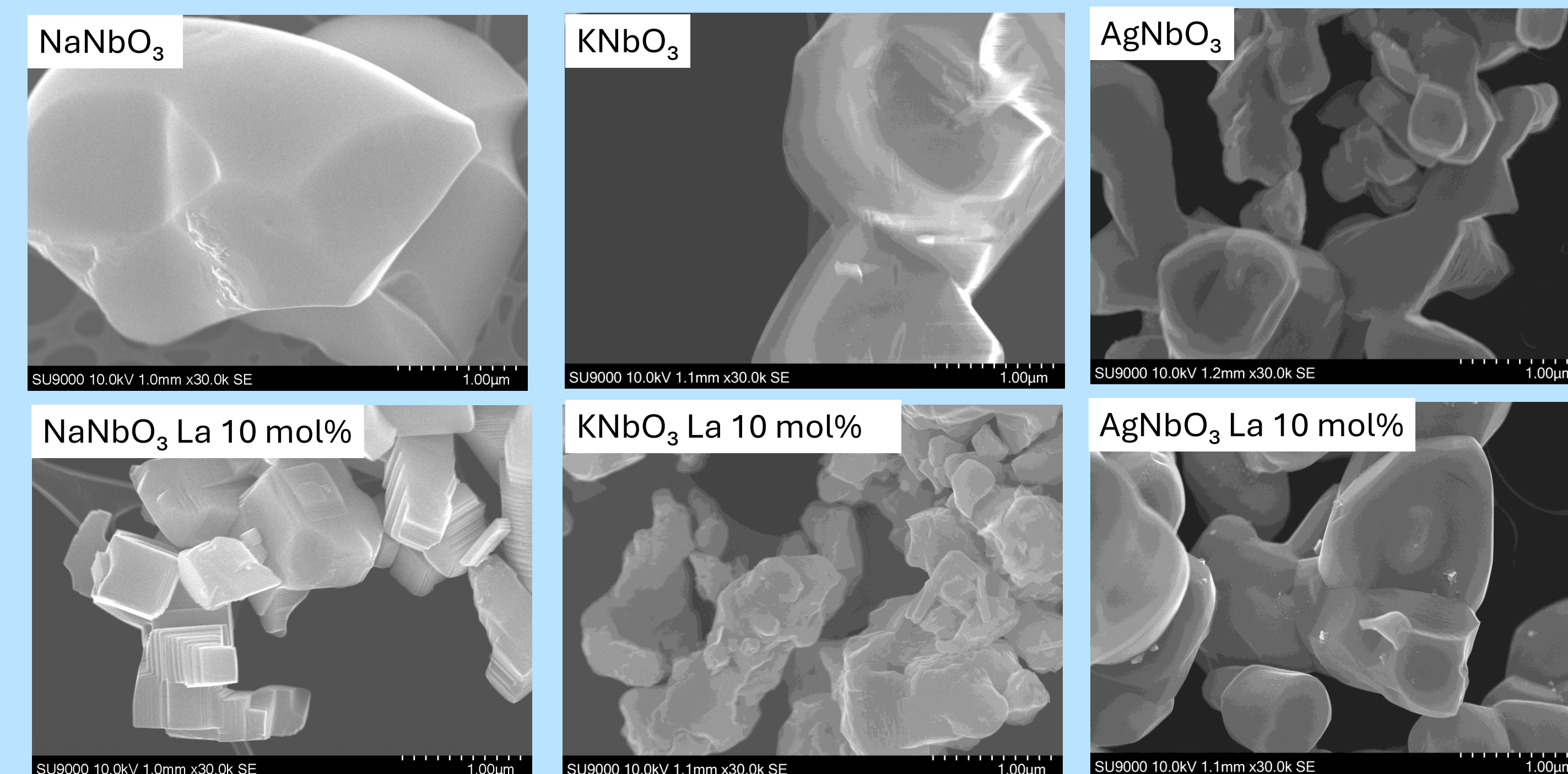
NaNbO₃, KNbO₃ and AgNbO₃ have an **orthorhombic crystal structure and matched reference spectra**.

Generally, an **increase in lanthanum doping resulted in smaller crystallite sizes**.

UV-Vis Diffuse Reflectance spectroscopy



Scanning electron microscopy and energy dispersive X-ray spectroscopy



Lanthanum doping resulted in a decrease in nanoparticle size.

Lanthanum doping introduced **terrace features in NaNbO₃**.

Elemental analysis confirmed composition

Pollutant Degradation

Methyl orange (MO) is a textile dye and was chosen as a model pollutant to **investigate the photocatalytic activity of the niobates**.

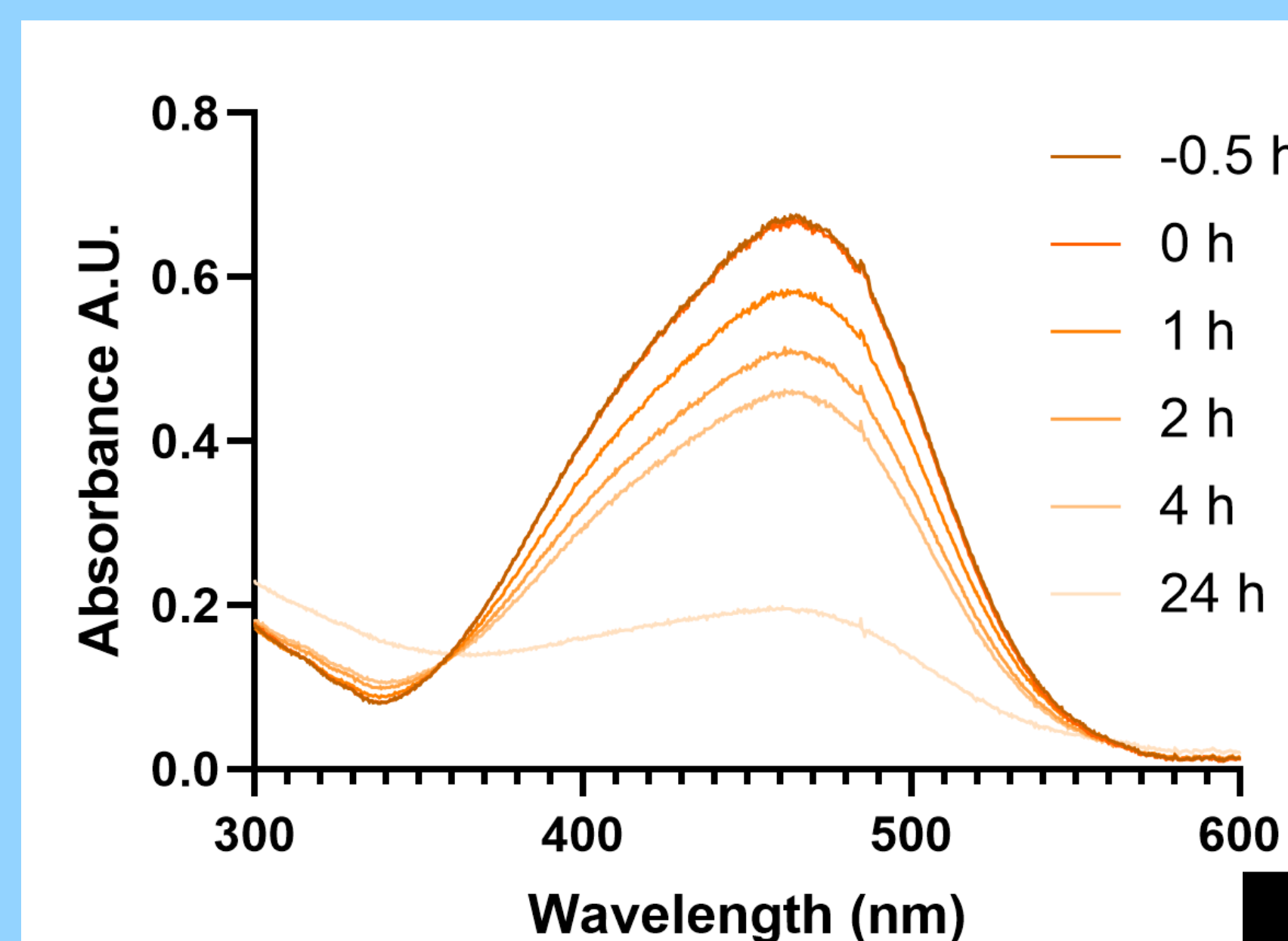
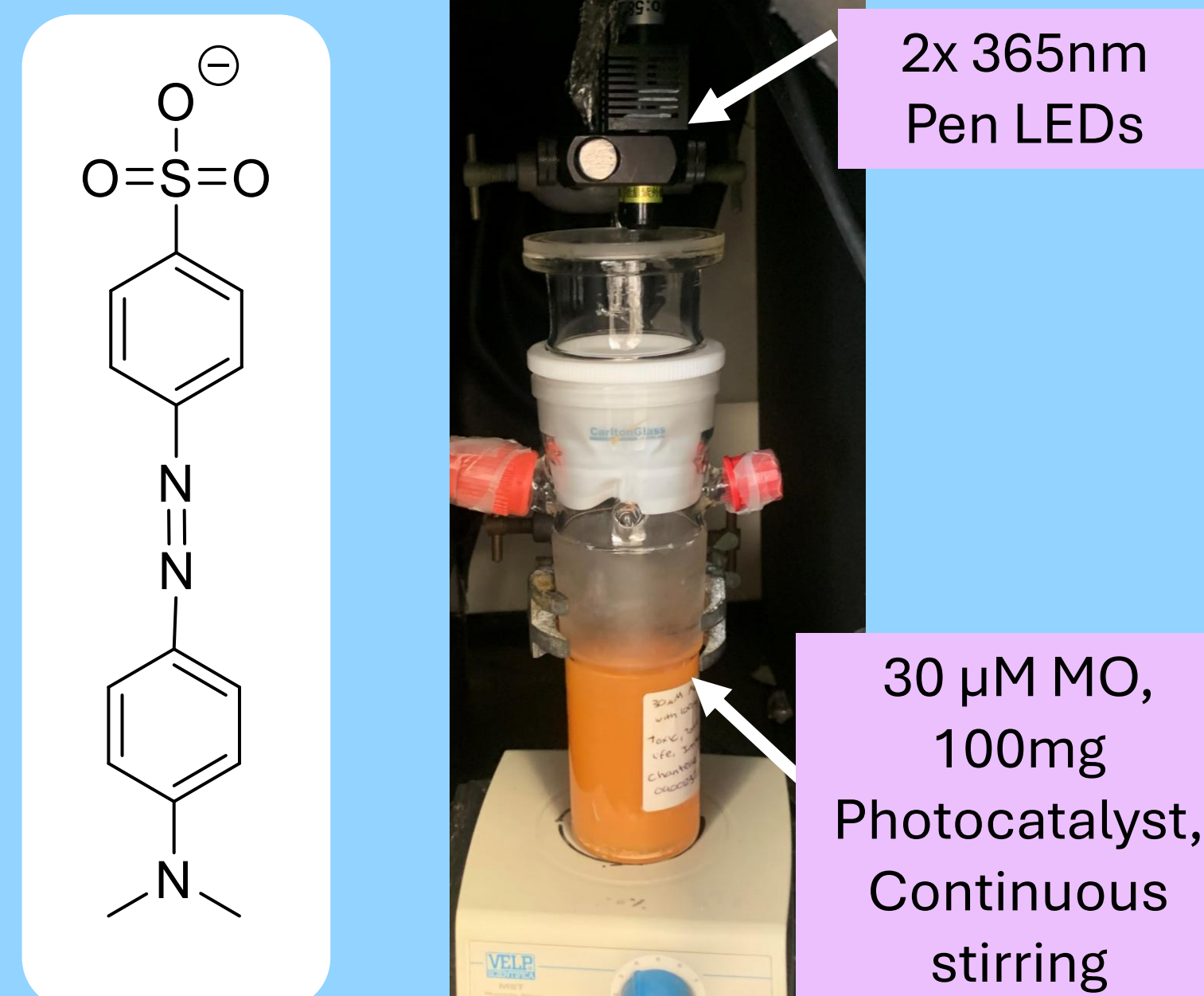


Figure 2: UV Vis Absorbance spectrum of MO over 24 hours using pure AgNbO₃

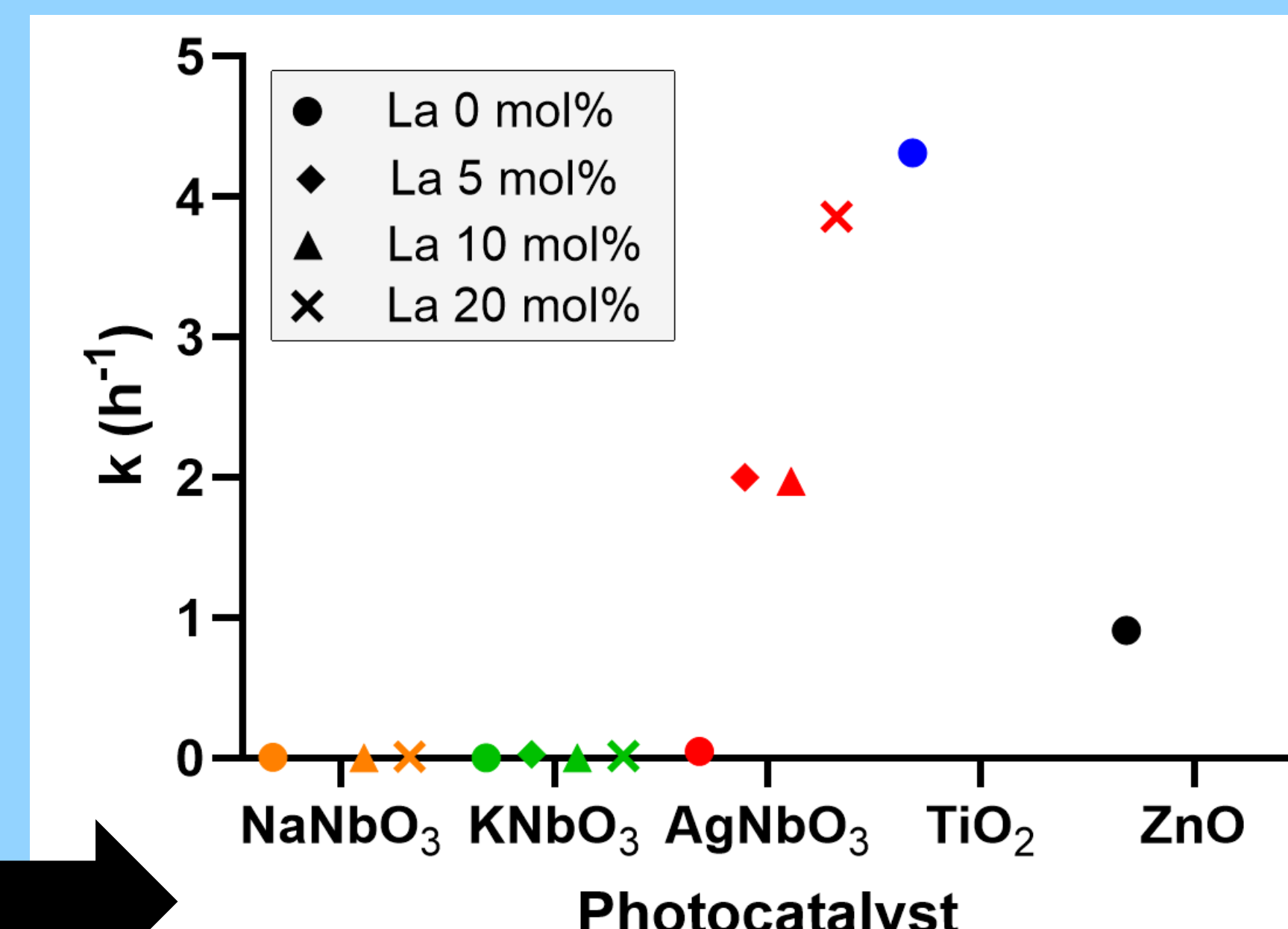


Figure 3: Rate constants of niobates as compared to TiO₂ and ZnO. Change in MO concentration over time was fitted to first-order kinetics.



The AgNbO₃ La 20 mol% sample showed the **highest photocatalytic activity**.

Lanthanum doping **increased** the photocatalytic activity of AgNbO₃

In future work, this highly active photocatalyst can be tested on POPs, for example, Perfluorooctanoic acid (PFOA)

Research can be conducted on lanthanum doping in this material to increase photocatalytic activity and determine **whether larger degradation efficiencies can be achieved in AgNbO₃**

Scavenger experiments can also be undertaken to determine the **mechanism of AgNbO₃ pollutant breakdown**.

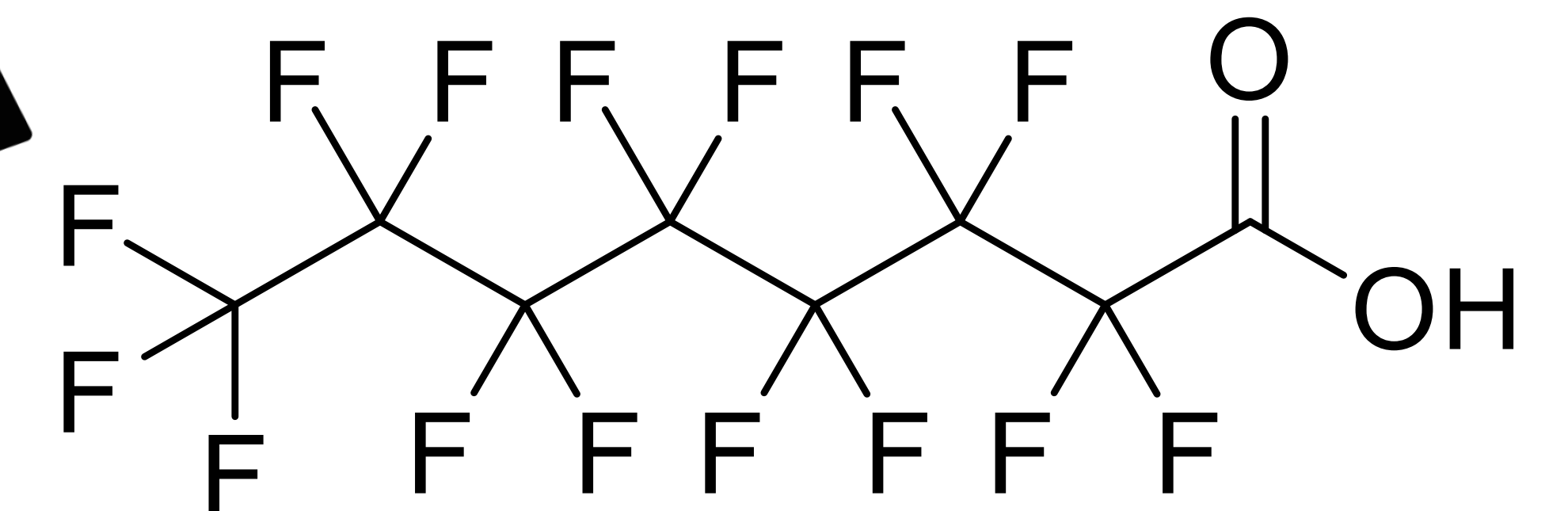


Figure 4: Chemical structure of perfluorooctanoic acid (PFOA).

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- (3)Al-Qaradawi, S.; Salman, S. R. Photocatalytic Degradation of Methyl Orange as a Model Compound. *Journal of Photochemistry and Photobiology A: Chemistry* **2002**, 148 (1-3), 161–168. [https://doi.org/10.1016/s1010-6030\(02\)00086-2](https://doi.org/10.1016/s1010-6030(02)00086-2).