

# **Synthesis of Titania Photocatalysts for Organic Compounds**

## **Abatement**

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In the last years to reduce the impact of environmental pollution many efforts have been made to the development of purification technologies for the reduction of the undesirable compounds. In fact, the exhausts from automobiles and stationary sources contain CO, NO<sub>x</sub> and hydrocarbon and the conversion of these pollutants to CO<sub>2</sub>, N<sub>2</sub> and H<sub>2</sub>O using photocatalytic processes is a challenge<sup>1</sup>. In particular there is an increasing interest in the mineralization of aromatic hydrocarbons due to their high harmfulness. Titanium dioxide is a promising candidate for the optimization of efficient photocatalytic processes and in the most recent literature several examples of studies on the photocatalytic degradation of aromatic compounds can be found<sup>2-5</sup>. In the present work we have investigated TiO<sub>2</sub> based catalyst for the degradation of ethylbenzene (EB) chosen as representative aromatic molecule.

In particular we have prepared TiO<sub>2</sub> powders by precipitation of TiOSO<sub>4</sub>, as previously reported<sup>6</sup>. For all the synthesized TiO<sub>2</sub> we have evaluated the influence of some preparative parameters (type of base, pH of aging, calcination temperature) on their chemical-physical properties (surface area, pore size distribution, crystalline phase,..) and consequently on their catalytic performance.

To perform the reaction, all the TiO<sub>2</sub> samples were formed into pellets, ground and sieved to 0.2-0.3 mm size: the granules were introduced into a 2 mm internal diameter microreactor irradiated with a 125 W UV lamp. The EB concentration was 1000 ppm and the sample mass 150 mg. The analysis was performed by on-line gas-chromatography.

During the reaction, the aromatic molecules adsorb on the catalysts and, only in the presence of UV irradiation, are partially converted to CO<sub>2</sub>. It has been observed that the white anatase powder gradually darkens until becoming completely brown. A subsequent TPO test showed a CO<sub>2</sub> evolution peak around 400°C typical of the combustion of carbonaceous deposits

Fig. 1 shows the volume of EB adsorbed (a) and the conversion (b) in function of BET surface area for the samples prepared with different bases and a pH 5.5. In general it is evident a correlation between the BET surface area and the catalytic data (EB adsorption, EB conversion); it is possible, however, to observe some interesting differences in the behaviour of the two series of samples. The conversion rises with the increase of surface area for all the investigated catalysts. Also the EB adsorption volume shows an increase, but the NaOH derived catalysts seem to have a higher power of adsorption than the  $\text{NH}_4\text{OH}$  samples. In fact they adsorb the same amount of gas despite the lower surface area. Therefore, an optimal abatement efficiency depend not only from the surface area but also from other parameters used for the synthesis of the  $\text{TiO}_2$  catalysts.

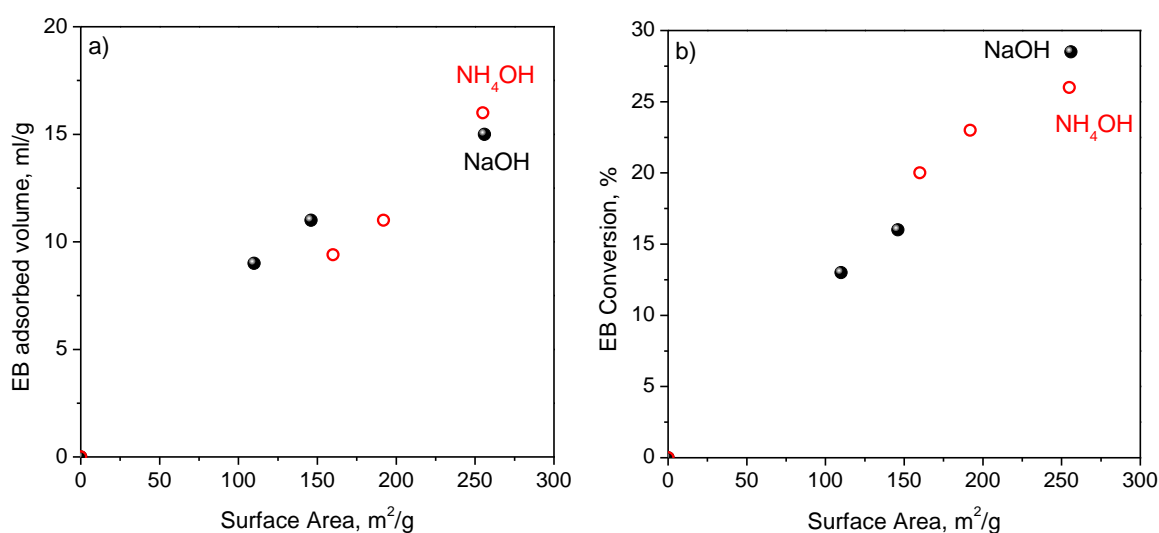


Fig. 1: a) Correlation between surface area of  $\text{TiO}_2$  and a) EB adsorbed volume; b) EB conversion

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