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DETERMINATION OF GASEOUS SPECIES TRANSFORMATION RATE IN FLOW REACTORS: SOME CASE-STUDIES OF ENVIRONMENTAL CONCERN

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The accurate determination of gaseous species has a widespread importance in both technological and pure scientific contexts. These measurements are routinely carried out for emissions in atmosphere, the control of the catalytic converters of vehicles, for testing the depollution ability of the filters at the end of the chimneys, or for the determination of the rate of gaseous reactants transformation. The accurate determination of the transformation rate in the gas phase finds a direct application in the study of reactions of atmospheric concern, and for the determination of the working mechanism of catalysts for solid-gas transformations.
Usually analysts are primarily focused on the detector and on its performances, while less attention is placed on the type of the reactors. Contrariwise, this is a peculiar point because it affects directly the way data are interpreted.[1] The determination of the rate of transformation can be carried out both in *bulk reactors*, in which the concentration of the desired species is monitored as a function of time, and in *flow reactors*, in which the analyte is detected at the exit of the reactor continuously fed with reactants. The evaluation of $[A_i]$ needs proper analytical techniques and it is well known standard (static) analytical problem. The standard (dynamic) analytical problem involved in the evaluation of a fast $d[A_i]/dt$ in batch reactors needs only short integration time of the detector. The evaluation of a dynamic property is a challenging (dynamic) analytical problem, that requires the correct choice of the proper fast technique and possibly of defined molecular probes, but often can be bypassed by the proper configuration of the reactor (any probe molecules with standard technique). This could be a basic contribution of analytical chemistry as multisciplinary science to industrial, environmental and standardization issues.
Three case studies of environmental concern in which flow reactors have been tested will be shown: *i*) the measure of the NO/NOx abatement rate on irradiated photocatalytic specimens; *ii*) the determination of the O_3 abatement rate on innovative catalysts and *iii*) the study of the NO photolysis under Vacuum UV irradiation. A comparison between the bulk and the in-flow measurements of gaseous species will be presented with the aim to underline the merits (many) and the defects (few) of the use of flow reactors vs. bulk systems.

[1] C. Minero, A. Bedini, M. Minella, Int. J. Chem. React. Eng. 11 (2013) 1-16.