NO_x REMOVAL BY VACUUM ULTRA-VIOLET LIGHT IRRADIATION IN FLOW REACTORS

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The emission in atmosphere of massive amounts of nitrogen oxides (NO_X = NO + NO_2) from combustion processes represents a pivotal point from both the environment and the human health.[1] The main aspects related to the NO_X emission are not only their intrinsic toxicity, but also their active role in the ozone tropospheric production. Ozone itself represents a serious threat for the human health, but also a severe problem for plants because reduce significantly the photosynthesis. Secondly, the production of NO_X caused the formation in atmosphere of nitrogen acidic species (primarily HNO_3 and HNO_2) which can *i*) create serious damage to buildings and to the cultural heritage and *ii*) have a central role in the production of Particulate Matter (PM) especially in urban context.[2] The actual technologies proposed or in use for the NO_X abatement are not completely satisfying because *i*) not able to reach the total abatements of the pollutants; *ii*) expensive; *iii*) based on the use of precious and/or rare elements/metals; *iv*) employing additional reactants and *v*) characterized by high energy request.[3] In this light, a breakthrough in the field of the technologies for the NO_X abatement pollutants is mandatory.

In this work, the photolysis of NO by irradiation with a 172 nm Xe_2 excimer lamp was investigated in a perfectly mixed flow-through reactor (Continuous Stirred Tank Reactor, CSTR). This lamp shows a high efficiency for power energy to light conversion. The influence on the reaction rate of parameters such as the inlet flow, the substrate concentration, the photon flux entering into the reactor and the presence of oxygen was investigated. The experimental kinetic data were interpreted applying a general first-order kinetic model valid for CSTR, properly modified to take into account the changes in the experimental parameters. The pseudo first-order kinetic constant for the direct photolysis of NO under conditions of maximum irradiation was evaluated and the related reaction rate at different concentration computed. VUV photolysis of NO is a first-order process with respect to NO. The NO direct photolysis rate is linearly depended from the photon flux entering into the photo-reactor.

In the presence of oxygen two different reaction pathways are operative suggesting the presence of indirect mechanisms of transformation in which O_3 plays a key role. In the presence of O_2 an almost complete abatement of NO_X was observed.

The exploitation of this technology in real-world contexts seems to be feasible even if the presence of a successive step for the O_3 abatement is mandatory.

References

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