4. CONCLUSIONS

In present study the TiO_2 thin films synthesized by ultrasonic spray pyrolysis on different support materials, window and borosilicate glass surfaces, were used as photocatalyst with their surface area varied from 120 to 600 cm^2. The influence of operation conditions, such as specific residence time, air humidity, initial content of pollutants and irradiation source, on photocatalytic oxidation (PCO) of methyl-tert-butyl (MTBE) was estimated. The gas-phase intermediate product of MTBE PCO detected by means of infrared spectroscopy was tert-butyl formate (TBF).

The photocatalytic activity of TiO_2 catalyst on the surfaces of borosilicate glass sufficed to decompose MTBE totally without formation of intermediate product TBF (to CO_2 and H_2O). This was achieved with catalyst surface of 360 and 480 cm^2, at specific residence time of 0.13 and 0.065 s cm^{-2} respectively, under UV-A irradiation, at initial content of MTBE 5 ppm and relative humidity (RH) 6%. At higher MTBE content of 10 ppm its total degradation with no gaseous by-products formed was observed with thin films surface area of 480 cm^2 at specific residence time of 0.13 s cm^{-2} (UV-A, RH 6%). Also, this coating demonstrated high photocatalytic activity in humid atmosphere and under visible light.

Unfortunately, TiO_2 thin films on soda lime glass could not achieve complete degradation of MTBE without formation of intermediate product TBF. The highest MTBE conversion of 94% was achieved with coating`s surface area of 600 cm^2, at specific residence time of 0.13 s cm^{-2}, UV-A irradiation, at initial content of MTBE 5 ppm and RH 6%, where concentration of TBF was 0.4 ppm. The deterioration of the performance of this thin film if compared to thin film on borosilicate glass could be attributed to the catalyst poisoning by sodium ions diffusing from soda lime glass.

Based on the present study the following conclusions can be made:

- The increase in the air humidity from 6 to 40% resulted in the decrease in MTBE photocatalytic conversion, especially, it affected the performance of TiO_2 thin films on soda lime glass: conversion reduced ca. 4 times and an accumulation of by-product was observed. In the case of thin film on borosilicate glass, humid air contributed to slower intermediate product TBF degradation.
- TiO_2 catalyst on both support material was able to oxidize MTBE under visible light.
- Changing of initial content has a low influence on photocatalytic activity of TiO_2 catalyst on both surfaces. Increase in initial concentration of MTBE resulted in a certain decrease in its photocatalytic conversion.
- Influence of residence time is substantial in PCO process with TiO_2 thin films on both supports. Conversion of MTBE is higher at longer residence time.