Tokai J Exp Clin Med., Vol. 10, No. 4, pp.347–348, 1985

Stability of Tobacco Smoke Odor in Enclosed Spaces

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During each of five experiments, four sedentary subjects smoked a total of 8 cigarettes during one hour while occupying an odor test chamber. The air temperature was 20–22°C and the relative humidity was 35–50%. During the entire test period (6 h) the odor intensity in the chamber was evaluated by judges. After smoking ceased, the odor intensity continued to rise for one or two hours and then remained constant in a way that is characteristic of unreactive contaminants.

(Key Words: Ventilation, body odor, stability)

INTRODUCTION

In 1937, Yaglou (1) found that after cessation of smoking in an unventilated chamber, tobacco smoke odor first increased for an hour ot two, then remained stable for about another hour, and finally decayed slowly. This observation has important implications for ventilation requirements in spaces where smoking occurs, and further attention to the quantitative features of the time-course of tobacco smoke odor seemed worthwhile.

During each of five experiments, four subjects smoked a total of 8 cigarettes during one hour while occupying an odor test chamber (2). The air temperture was 20–22°C and the relative humidity was 35–50%. During smoking, the air change was 1.36 h^{-1}, and in a 240-minute long postsmoking period, the air change in the then empty chamber was reduced to 0.46 h^{-1}. Background odor level in the chamber was determined in a 60-minute presmoking period.

During the entire test period, the odor intensity in the chamber was evaluated by 4 male and 26 female judges. Each judge evaluated the intensity of the odor by two means: 1) choosing, from a Dravnieks olfactometer, a concentration of butanol that matched the intensity of tobacco smoke odor, and 2) a position on the Yaglou six-point scale (no odor, slight odor, moderate odor, strong odor, very strong odor, overpowering odor). Each judge assessed also whether the odor was acceptable or not. The assessments took approximately 1 minute for each judge.

There was an excellent correlation between odor intensity assessed by Yaglou's scale and by butanol intensity matching. The level of butanol chosen from the olfactometer served as the primary psychophysical judgement, and the results from this evaluation are shown in Figure 1.

After smoking ceased, odor intensity stayed at approximately the same level for one hour and then decayed. Once the decay had begun, it corresponded to the infiltration rate of 0.46 h^{-1}. The results imply that even after smoking has ended there is still generation of odor in the space. Thereafter, the odorous contaminants exhibit a kind of stability characteristic of unreactive contaminants. Our observations agree with those of Yaglou (1). Further studies will be necessary to quantify the growth of odor during the first hour or two after cessation of smoking.

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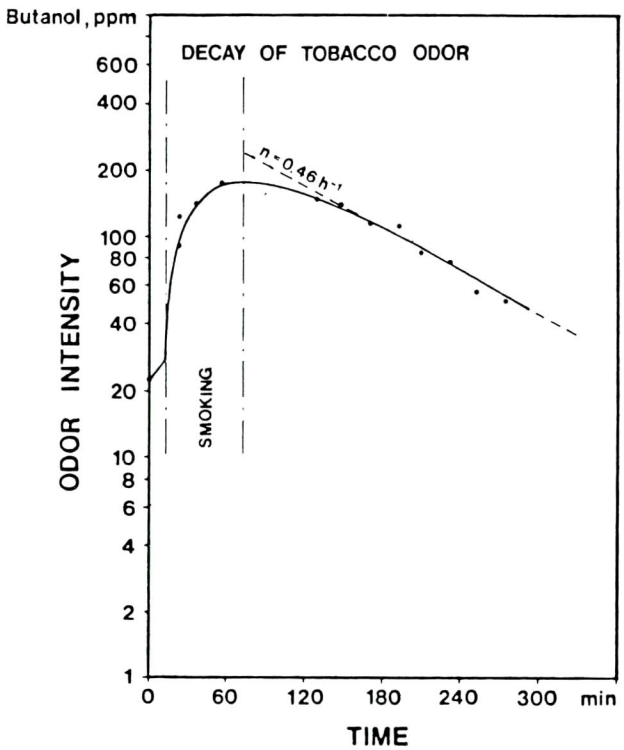

Fig. 1 Odor intensity, expressed by butanol concentration, as a function of time. The background odor level of 20 ppm butanol has been subtracted. Each point on the graph is the geometric mean of 115 evaluations.