

Validity of the 44mm Cambridge Filter Pad for trapping total particulate matter in excess of 150mg

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INTRODUCTION

Current ISO smoking standards (ISO 3308, ISO 4387) limit the maximum quantity of Total Particulate Matter (TPM) that should be trapped on a 44mm Cambridge Filter Pad (CFP) to 150mg.

When smoke methods were first developed in the 1950s, cigarettes had machine smoke yields much higher than those commonly available today. A consequence of this was that to produce a TPM yield of 150mg on a CFP, at a rate of about 8 puffs per cigarette, required approximately 40 puffs using only five cigarettes.

Nowadays products have much lower yields and for 150mg of TPM to be collected using, e.g. a 1mg/cig ISO yield product, approximately 1000 puffs may have to be taken.

In addition, new more intense smoking regimes, e.g. Health Canada Intense (HCl), have been adopted and these are known to generate significantly more water which may also affect pad integrity and the suitability of the CFP for smoke trapping under HCl has yet to be demonstrated.

To characterise the trapping efficiency of the CFP with contemporary cigarettes, an investigation has been conducted to examine the capability of 44mm CFPs to trap quantities of smoke up to and beyond the current ISO standard limit under both ISO and HCl smoke regimes.

EXPERIMENTAL PLAN

Incremental numbers of a 1mg (ISO) commercial product and two University of Kentucky reference cigarettes - 1R5F (2mg ISO) and 3R4F (8mg ISO) - were smoked onto separate 44mm CFPs to obtain a range of TPM from approximately 50 to 400 mg/pad. Both ISO and HCl regimes were used.

Nicotine, water, TPM, nicotine free dry particulate matter (NFDPM) and carbon monoxide (CO) machine yields were measured. A comparison of the results was made between TPM up to the ISO limit of 150 mg/pad and those up to approximately 400 mg/pad under both regimes.

RESULTS

Figure 1 shows that under ISO smoking the ratio of TPM yield to number of cigarettes smoked reduces for the 1 and 2mg ISO yield products as the number of cigarettes smoked increases. This implies that the trapping efficiency of the CFP is compromised under these conditions. However, TPM from the 8mg ISO yield product is trapped with equal efficiency from 50 to ~350mg TPM yield.

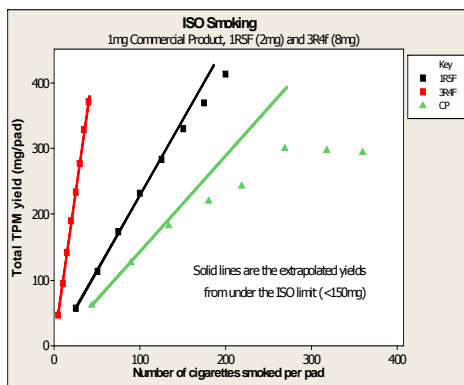


Figure 1

Under the HCl regime, Figure 2 suggests that the CFP may be an efficient trap for TPM at yields considerably in excess of 150 mg per pad.

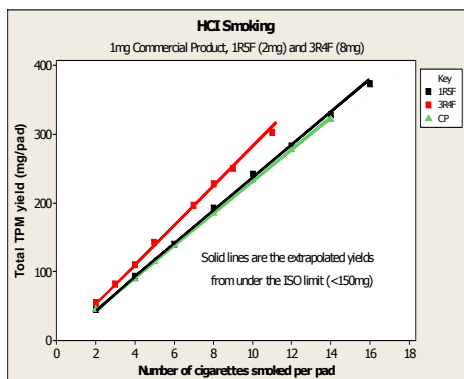


Figure 2

A second investigation was then carried out to see whether the 44mm CFP effectively traps NFDPM, CO, water and nicotine at yields above the 150mg/pad ISO limit under both ISO and HCl regimes.

Figure 3 shows that the CFP is effective at trapping NFDPM at TPM yields up to 400mg/pad under the ISO smoke regime and up to 200mg/pad under HCl. Likewise, the increased TPM on the CFP does not influence the CO yields up to 300mg/pad as shown in Figure 4.

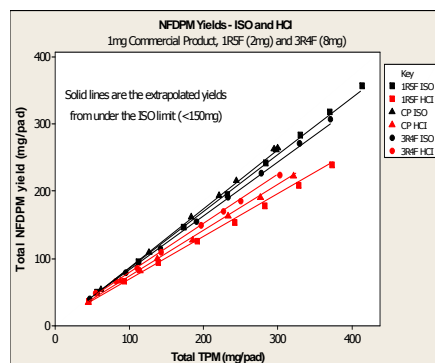


Figure 3

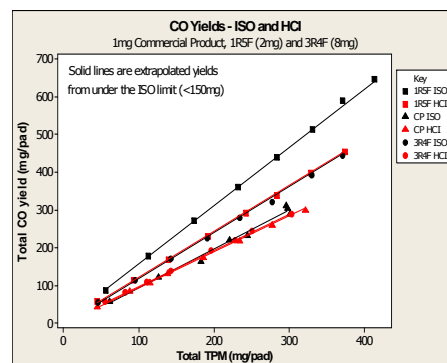


Figure 4

Conversely, Figure 5 shows that, when smoked under HCl regime, the CFP may be efficient at trapping nicotine at yields up to 300 mg/pad but under the ISO smoke regime it stops being an effective trap above 150 TPM mg/pad. When the ISO TPM limit of 150mg/pad is exceeded, the use of the 44mm CFP cannot be supported as a satisfactory trap for water under the ISO regime as found in Figure 6. In addition, the losses are greater when the lower ISO yielding products are smoked which concurs with Figure 1. However, under the HCl regime the CFP appears to be a consistent trap for water at yields up to 300mg/pad TPM.

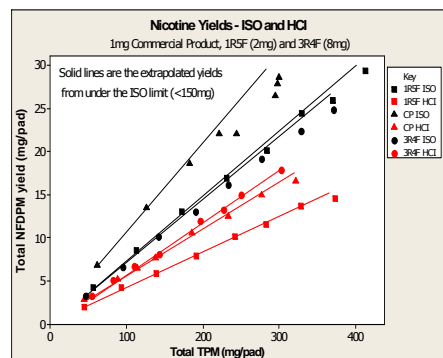


Figure 5

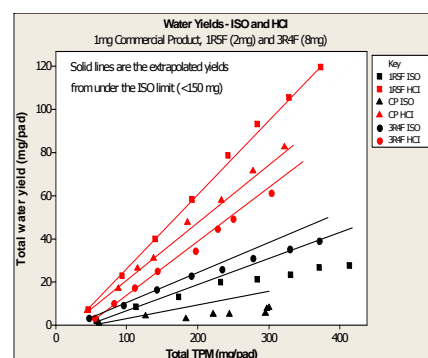


Figure 6

The different behaviours exhibited by the 44mm CFP towards the four components discussed here are illustrated in Figure 7. It demonstrates the order of failure potential of the CFP and confirms it to be water>nicotine>HCl NFDPM above 150 mg/pad TPM under ISO smoking. It also confirms that the effectiveness of the CFP towards measurement of CO under both regimes and NFDPM under ISO is not compromised when measured above the current limit of 150 mg TPM per pad.

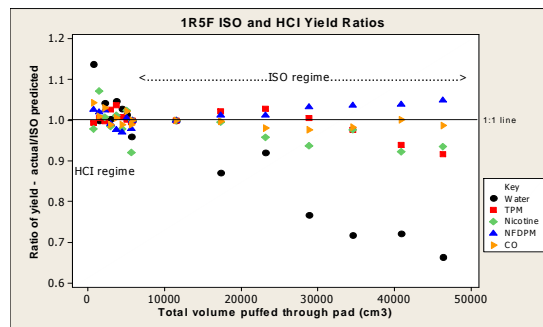


Figure 7

CONCLUSION

This work has shown that, with contemporary cigarettes, the capacity of the CFP is different when products are smoked under ISO and HCl smoke regimes. The losses, in particular water, that occur at the higher pad loadings under ISO smoking may be correlated to the total number of puffs, and the puff volume, taken during the smoking process.