

Supporting the Tobacco Industry with Machine Enhancements for Reduced-risk Products

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The Requirement

The client was seeking a rotary smoking machine suited for testing a variety of Next Generation Products (NGPs) including Tobacco Heating Products (THPs). Their current rotary smoking machine (sourced from one of our competitors) when used for testing NGPs such as vapour products and THPs, gave significantly lower Total Particulate Matter (TPM) yields due to a dead volume problem with the machine.

An additional key requirement was for a rotary smoking machine that could be seamlessly transformed for a wide variety of sample tests, and that could be efficiently cleaned between smoke runs to prevent any cross contamination between the tests on different samples.

The Solution

The Cerulean engineering team reviewed these challenging requirements and came up with an optimised solution for the client. As the Cerulean SM450 linear smoking machine is synonymous for conventional cigarette tests over many years, this machine was used as the benchmark for comparing the TPM captured by the rotary smoking machine solution.

The Cerulean engineering team specified the Orbit 20 rotary smoking machine, a machine which is already optimised for intense smoking of conventional cigarettes (see figure 1) as the ideal solution to meet these requirements. To prove that the Orbit 20 is the optimised solution for NGPs testing, we worked closely with the client's scientists and conducted tests on a range of samples including monitor test pieces, e-cigarettes and Tobacco Heating Products (i.e. sample I and G) on the SM450 and Orbit 20 smoking machines, using the Health Canada Intense regime.

The TPM results obtained from these tests on both machines (see table 1), showed improvement work was needed for the Orbit 20 to increase the aerosol captured from sample I and G by eliminating a very minimal dead volume.



Figure 1: The newly enhanced Orbit 20 rotary smoking machine

The Modification

As established from the experiments conducted, a significant amount of TPM (>30%) is lost before reaching the capture pad. It was confirmed, by swabbing and weighing swab ends, that this aerosol was lost between the labyrinth seals and the front of the Cambridge Filter Holder (CFH).

Taking these points into consideration, the Cerulean engineering team and the client's scientists worked closely together to design a suitable solution to further reduce the dead volume when testing Tobacco Heating Products (THPs).

The smoke ring and CFH were modified (see figure 2 & 3) to create a conical section, bringing the cigarette butt closer to the CFH. These modifications did not compromise the normal operation of the Orbit 20 with conventional cigarettes but optimised the aerosol captured during THP tests.

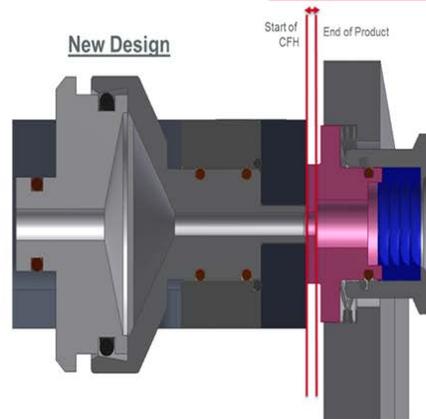


Figure 2: Modified smoke ring

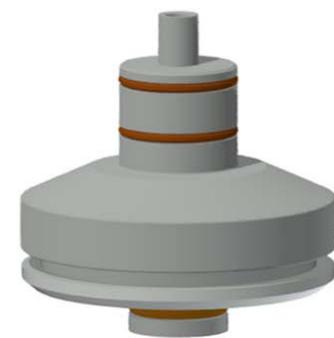


Figure 3: Modified CFH

Smoking Machines	Sample I TPM (mg/cig)	Sample G TPM (mg/cig)	Sample P TPM (mg/cig)	Sample L TPM (mg/cig)	3R4F TPM (mg/cig)	CM8 TPM (mg/cig)
Product type	THP	THP	Hybrid	E-cig	Reference test piece	Reference test piece
SM450	55.5	29.0	47.0	188.5	42.7	42.8
Old Orbit 20	37.9	19.6	48.1	186.7	40.7	42.5
Orbit20/SM450	68%	68%	103%	99%	95%	99%

Table 1: TPM test results

Table 1 depicts the TPM test results from the experiments conducted on the SM450 and Orbit 20 smoking machines on various samples before any modification to the Orbit 20. The experiments were conducted under Health Canada Intense regime (55 ml puff, 2 second duration, 30 second interval).

The Orbit 20 machine produced similar TPM results for sample P, 3R4F and CM8 to the SM450; however, for THP sample I and G, there's a significant amount of TPM (>30%) loss which was due to TPM condensing on the path to the CFH (dead volume).

After modifying the Orbit 20, we conducted further experiments on THP sample I and G to ensure that the aerosol capture during experiments has been optimised; eliminating the dead volume problems (see figure 4).

TPM Comparisons for THP Devices Modified Orbit 20

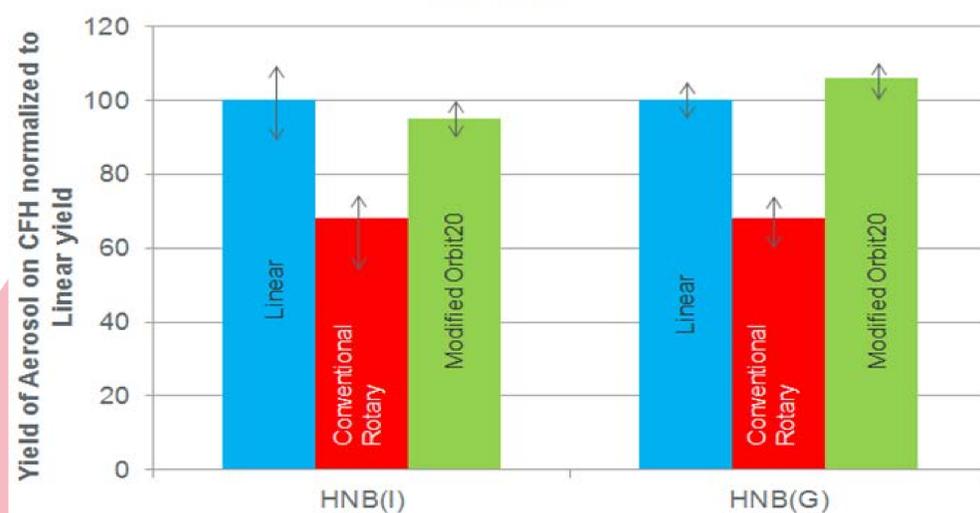


Figure 4: TPM comparisons for THP devices between smoking machines

The Summary

The experiments conducted have enabled Cerulean to provide the tobacco industry with a trusted rotary smoking machine that has been specifically engineered for Tobacco Heating Products (THPs) applications without compromising conventional cigarette testing.

Why Cerulean?

Cerulean has a proven track record in providing the tobacco industry with innovative precision test equipment for a vast range of applications. Our continuing commitment in closely collaborating with our customers was pivotal in developing the ideal machine for these requirements.



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