DETERMINATION OF LEAKAGE IN E-VAPING PRODUCTS

GOKSEL, Hasan & JACQUES Thomas
PMD R&D, Philip Morris Product S.A. (part of Philip Morris International group of companies)

Introduction and Discussion

An important quality aspect of e-vaping products is the absence of liquid leakage from the cartridge. Therefore it is highly important to verify the cartridge integrity using a reliable method.

Methods in test for occurrence of leakage under exaggerated conditions of stress can be used, e.g., during the development of new products to ensure that leakage does not occur when new products are introduced in the market. Various external conditions can influence product leakage and should be considered from the design phase, to the manufacturing and use of the product.

In total, 588 samples tested with PMI Method in Buchi Syncore, 84 samples with AFNOR method

PMI Proposed Methods

The e-vaping consumable leakage testing method proposed by PMI R&D addresses product leakage robustness in a sequence of dynamic conditions: temperature, movement and pressure are considered as variables that can influence leakage.

Conclusions

It is important to verify the cartridge integrity using a reliable method. Methods to test for occurrence of leakage under exaggerated conditions of stress can be used, e.g., during the development of new products to ensure that leakage does not occur when new products are introduced in the market. Various external conditions can influence product leakage and should be considered from the design phase, to the manufacturing and use of the product.

AFNOR

Leakage (mg) PMI Method

<table>
<thead>
<tr>
<th>Leakage</th>
<th>PMI Method</th>
<th>AFNOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>No leakage</td>
<td>588 replica</td>
<td>0</td>
</tr>
<tr>
<td>0.15&lt; x&lt; 1</td>
<td>21%</td>
<td>0</td>
</tr>
<tr>
<td>0.15&lt; x&lt; 1</td>
<td>0%</td>
<td>0</td>
</tr>
<tr>
<td>0.15&lt; x&lt; 1</td>
<td>5%</td>
<td>0</td>
</tr>
<tr>
<td>0.15&lt; x&lt; 1</td>
<td>4%</td>
<td>0</td>
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</table>

We propose a method that can look at the influence of these factors on leakage in different e-cigarette models.

AFNOR standard (AFNOR XPD 90-300-1): is the best known standard for leakage testing of e-vaping consumables. According to this standard, the absence of leakage of an e-vaping product is verified by placing two vials (leaking and non-leaking) to represent products which have leakage or no leakage. If leaking vials give >200 mg and other no leakage, test can be initiated.

Currently, AFNOR standard (AFNOR XPD 90-300-1) is the best known standard for leakage testing of e-vaping consumables. According to this standard, the absence of leakage of an e-vaping product is verified by placing the consumable on an absorbent paper, upright, vertically or horizontally, for a minimum of 6 hours per position. The verification must be conducted at a controlled temperature of 20°C ± 5°C.

Different products tested with AFNOR test (AFNOR XPD Art. 20 §3 (g)) and results as follow;

No leakage observed in disposable products (96)
49% of screened products showed no leakage. 41% of screened products show low levels of leakage, (less than 5 mg). 10% of screened product is leaking between 5 mg and 50 mg.

PMI Method: Pressure, Temperature, Movement

Product is exposed to mechanical stress during its use. Transferring from manufacturing center to point of sale, transportation, and storage can add to the product’s contact with different environmental conditions.

Objective: Develop best quantitative/visual method to determine product leakage robustness in a sequence of dynamic conditions.

Study Design & Evaluation Criteria

1. Design of method

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Table 1: AFNOR results with different products

2. Visual inspection during Aerosol collection

- Select extreme conditions (A-4) and AFNOR (A-1) conditions and run aerosol collection method.
- Observe leakage on pH paper visually for 70 samples

Results

In total, 84 samples with PMI Method in Buchi Syncore, 84 samples with AFNOR method

No leakage observed with AFNOR method. Table 3 shows leakage with PMI method.

Table 2: PMI Method’ leakage results

<table>
<thead>
<tr>
<th>Leakage</th>
<th>No Sample</th>
<th>0.15&lt; x&lt; 1</th>
<th>0.15&lt; x&lt; 1</th>
<th>0.15&lt; x&lt; 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>No leakage</td>
<td>84 replica</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>0.15&lt; x&lt; 1</td>
<td>5%</td>
<td>0%</td>
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Table 3: PMI Method Leakage Results

Summary of Results & Conclusions

PMI Method (Pressure, Temperature, Movement)

Use PMI method (Pressure, Temperature, Movement) during product development stage and batch control.

Competing Financial Interest

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