

Louise Taylor* and Susan Sims, Eastman Company UK Limited, discuss how to improve indoor air quality to meet the Ecolabel criteria

Are you puzzled by changes to the new Ecolabel criteria¹?

Over the past few years, several voluntary and mandatory labelling schemes have been introduced in Europe to try to improve indoor air quality by limiting the level of VOC and/or emissions from building and construction materials. Achieving compliance with these many different labelling schemes is becoming increasingly difficult. Eastman's enhanced coalescent portfolio provides coating formulators with more options for formulating paints for the future.

Currently the in-can VOC (volatile organic compound) content of paints and varnishes is restricted by EU Directive (2004/42/CE). The Deco Paint Directive defines VOC as "any organic compound having an initial boiling point less than or equal to 250°C measured at a standard pressure of 101.3kPa." The terms 'in-can VOC' and 'emissions' are quite often incorrectly used interchangeably. The 'in-can VOC' can be theoretically calculated and focuses on the wet paint, whereas the 'emission' profile of a coating studies what emits from the dried paint film. The emission profile of a paint film cannot be theoretically calculated as it has to be determined through a series of laboratory tests.

While many paints that meet the highest emission standards can be formulated with traditional coalescents, adding a low emission coalescent from Eastman's portfolio allows formulators the option to transition away from volatile to non-volatile coalescents when required. Rather than wasting resources and time re-formulating paints based on low T_g binders, traditional volatile coalescents can simply be replaced or used in combination with new low- or non-emitting coalescents.

EU ECOLABEL INTRODUCES LIMITS ON IN-CAN SVOC

One of the renowned voluntary labelling schemes in Europe is the Ecolabel. The new criteria for awarding the EU Ecolabel to paints and varnishes was published on May 28, 2014. In addition to the existing in-can VOC restrictions, the new criteria impose restrictions on the Semi-Volatile Organic Compound (SVOC) content of the paint. The SVOC content shall be determined using the appropriate gas chromatography (GC) method given in ISO 11890-2. For water-based paints (ie polar systems), any substance, which elutes between diethyl adipate ($C_{10}H_{18}O_4$) and methyl palmitate

($C_{17}H_{34}O_2$) will be classified as an SVOC and will contribute to the proposed SVOC limits, which are currently set at 30g/lit for white indoor paints and varnishes and 40g/lit for indoor tinted paints/outdoor paints and varnishes.

There are several factors that influence the elution of a compound from a GC column; two of these factors are vapour pressure of the compound(s) of interest and polarity of column and compound(s). To elute from the GC column, a compound must volatilise and move through the column in the gas phase. Once a compound is in the gas phase, it can condense and then volatilise again, repeating this cycle until it elutes. The longer a compound stays in the stationary phase, the longer it takes to elute. Boiling point influences the volatilisation, since the lower the boiling point, the easier it is for a compound to volatilise.

However, boiling point is not the entire story. Polarity of the column and compound also influence the retention time. If a compound has a polarity similar to that of the column, it will be harder for it to volatilise due to molecular interactions between the column and the compound. These interactions must be overcome before the compound can volatilise and move down the column. This applies to the marker compounds as well, making it important that polar markers be used with a polar column and non-polar markers with a non-polar column for VOC and SVOC determination.

Waterborne coatings are polar systems that contain many oxygenated compounds. SVOC content for the Ecolabel standard is to be determined using methyl palmitate as the upper limit SVOC marker for polar systems and n-docosane for non-polar systems. These two marker compounds have very different boiling points, therefore, it is important to note that the boiling point of the marker compound should NOT be used to determine whether a product will be classified as an SVOC or not. The definition of an SVOC in accordance with the Ecolabel clearly states that the upper SVOC limit is based on the elution of the compound relative to n-docosane on a non-polar column or methyl palmitate on a polar column. Using the boiling point as guidance for SVOC status can be very misleading for some compounds. A case in point is Eastman Optifilm enhancer 400. It has a boiling point of 344°C, which is above the boiling point of methyl palmitate (322.4°C)² and, as one would expect, it elutes after the polar marker compound (**figure 1**). However, Optifilm

1. Official Journal of the European Union (2014/312/EU) – Commission Decision of 28 May 2014 – Establishing the ecological criteria for awarding the EU Ecolabel for indoor and outdoor paints and varnishes.

2. The boiling point evaluation was conducted using the photocell detection method according to the OECD Guidelines for the Testing of Chemicals, Section 1, Test 103: Boiling Point.

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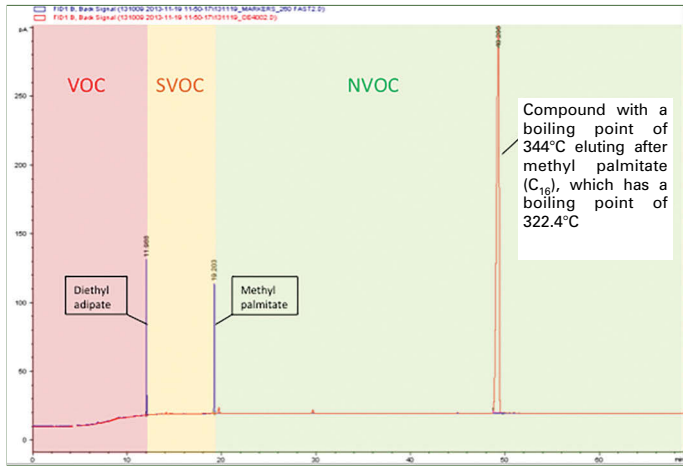


Fig 1. SVOC Analysis using polar Ecolabel GC conditions in accordance with ISO 11890-2 method

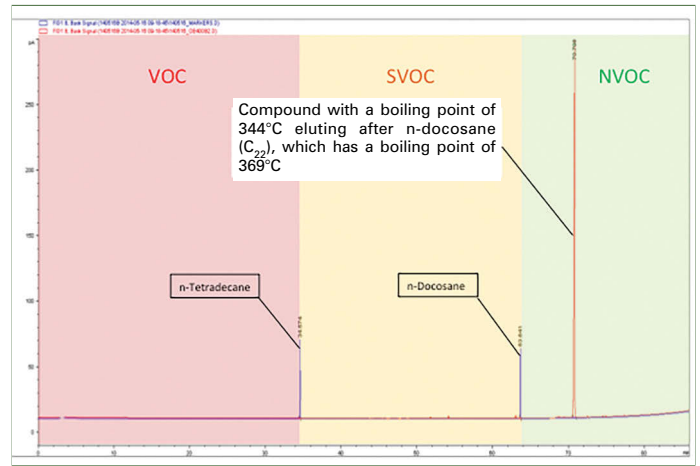


Fig 2. SVOC Analysis using non-polar Ecolabel GC conditions in accordance with ISO 11890-2 method

enhancer 400 has a much lower boiling point than n-docosane (369°C) yet it still elutes after the non-polar marker compound. Based on boiling point alone, one could incorrectly assume that Optifilm enhancer 400 is an SVOC. However, GC testing clearly shows that it elutes well after n-docosane and is, therefore, a non-SVOC. The chromatograph (figure 2) shows the elution of Optifilm enhancer 400 relative to n-tetradecane (C₁₄H₃₀) and n-docosane (C₂₂H₄₆) markers using conditions in ISO 11890-2 method for non-polar systems.

FORMULATING PAINT FOR THE FUTURE

The new SVOC restrictions will not affect all paints currently available on the market, however, should you find that your formulation is above the newly imposed limits for SVOC or if you simply want to formulate paints for the future, view Eastman’s newly extended portfolio of coalescing aids, which has been designed to help formulators achieve an optimum balance between great performance and low emissions.

With Eastman Optifilm enhancer 400, formulations may achieve a low- to zero-VOC paint with great performance in any market.

Products perform with:

- Near-zero emission
- Zero VOC
- Is not classified as an SVOC in accordance with the new Ecolabel criteria
- Excellent film integrity, good touch-up properties, and wet scrub resistance
- Ultralow odour
- Formulation flexibility
- Non-yellowing films
- Safe and easy to use

CONCLUSION

The definition of an SVOC in accordance with the Ecolabel clearly states that the upper SVOC limit is based on the elution of the compound relative to n-docosane on a non-polar column or methyl palmitate on a polar column. Using the boiling point as guidance can be very misleading for some compounds. Although there is a relationship between boiling point, volatility and elution on a GC column, there is not

necessarily a direct correlation. If a coatings manufacturer is unfamiliar with VOC/SVOC/non-VOC classification based on elution on a GC column, they should seek guidance from the supplier to obtain confirmation on the status of the compound rather than relying on boiling point guidance.

Formulating with Eastman Optifilm enhancer 400 will help to eliminate the need for extensive re-formulation and will offer the formulator a simple, cost competitive way to create a low-odour, near-zero emission coating that can meet the requirements of many of the mandatory and voluntary labelling schemes present in Europe at this time.

Optifilm™ enhancer 400 is the trademark of the Eastman Company

A bright future

Producer of goldbronze and silver-aluminium pigments in powders, pastes and granules for the printing inks, paints and plastics industries.

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