VOC Testing of Paints - Test methods and Requirements

1. INTRODUCTION

This article explains the different test methods and VOC definitions. Different regulations, voluntary ecolabels and systems for sustainable buildings, that are defining VOC requirements for paints, are presented. Eurofins has been focussing on VOC testing for more than 30 years and has developed a widely recognised combined testing and evaluation solution named Indoor Air Comfort. This has proven to be a valuable tool for manufacturers looking to evidence and promote low VOC emissions.

2. TESTING METHODS

Different test methods are used to determine VOC content and emissions from paints and this section is discussing details and differences of these methods.

VOC Content can be measured according to ISO 11890-2 by extraction of VOCs from the product followed by gas chromatographic analysis. Test results are typically expressed in g/l. Single compounds can be identified and quantified. For this type of test, VOC is defined as a compound with a boiling point less than or equal to 250°C. Another way of testing VOC content is a gravimetrical test method according to ISO 11890-1 or ASTM D 2369, where for example a defined wet amount is weighed onto a substrate and dried for one hour at 110°C and weighed again. The difference in weight is considered to be VOC. Water content can be determined separately and can be subtracted. Single compounds cannot be identified or quantified. The test results are expressed as total VOC in g/l.

VOC emission testing is performed by simulating a model room in test chambers. This is defined in EN 16516 and EN 16402. The test chambers are made of stainless steel or glass and are operated with an air exchange rate of purified air of 0.5 per hour, a temperature of 23°C and 50% rel. humidity. Different scenarios for use of the tested products are defined, like the wall scenario, the floor and ceiling scenario and a scenario for small surfaces like for doors and windows. A so-called loading factor is defining the area of the test specimen for each scenario. For the test specimen preparation, paints are wet applied onto an inert substrate like glass in a pre-defined amount in g/m^2. The test specimen is transferred into the test chamber and stays there for the whole testing period of 28 days. Optionally a pre-conditioning can be performed under the same climatic conditions in a separate chamber. The chamber air is tested after 3 and 28 days by sampling onto Tenax TA tubes followed by thermal desorption and GC/MS analyses. Volatile aldehydes can be determined by sampling onto DNPH tubes followed by HPLC analyses. The test results are expressed as model room concentrations in mg/m^3 or $\mu g/m^3$. Evaluation of the results is done by comparing this model room concentration with the limit values of the requirements.The emission test method defines a VOC as an organic compound eluting between and including n-hexane and n-hexadecane on a specific gas chromatographic column.

3. REQUIREMENTS, LABELS AND REGULATIONS

There are regulations and labels, that define VOC content requirements based on testing according to ISO 11890-2. This are the EU Decopaint Directive (2004/42/EC), the EU Ecolabel, the Nordic Swan Ecolabel and the Blue Angel DE-UZ 102 from Germany. These requirements are using different limit values, but the same test chamber method.

There are regulations and labels, that define VOC emission requirements based on testing according to EN 16516 and EN 16402. This are the French VOC Label (Décret n° 2011-321), the Italian CAM decree (CAM Edilizia), the German AgBB scheme, the EU Taxonomy regulation, the voluntary label M1 label from Finland, the Danish Indoor Climate Label, ECOproduct Norway [6], Byggvarubedömningen from Sweden or Cradle to Cradle. These requirements are using different limit values, but the same test chamber method.

There are certification systems for green or sustainable buildings. These certifications are among others defining VOC requirements for the construction products used in the certified building. This can be either VOC content criteria or VOC emission criteria or both. Prominent providers of certification systems for sustainable buildings are LEED, BREEAM, Well Building, the French HQE Certification and Miljöbyggnad.

All these different requirements make it complicated for manufacturer of paints and coatings to keep an overview and to show proof of compliance as well as for their customers. Multiple testing, evaluations and documentation uses a lot of resources.

4. POSSIBILITIES WITH INDOOR AIR COMFORT GOLD

Eurofins developed a product certification called Indoor Air Comfort Gold combining these VOC content and emission requirements in one test setup for content and one for emission. The lowest limit values from the combined requirements are applied and used as limit values for Indoor Air Comfort Gold. A product that complies with Indoor Air Comfort Gold automatically complies with all combined testing requirements. This certification simplifies the proof of compliance for various requirements because it reduces testing costs, documentation, and paperwork.

Certified paints undergo rigorous testing for VOC content and VOC emissions, and annual audits of production sites. This audit is performed every year and includes for example evaluation of the factory production control, handling of raw materials, in house testing of finished products and traceability. Products are retested annually to ensure ongoing compliance with evolving standards. The certification is accredited under ISO 17065, which means that DANAK, as an independent body, reviews the quality of the certification processes in annually accreditation audits.
The Indoor Air Comfort Gold certification offers manufacturers a competitive edge by proving their products are best-in-class for low emissions. It also provides assurance to retailers and private label owners, who can require certification for brand protection. Certified products are listed on Eurofins' website and can display the Indoor Air Comfort Gold label on product packaging and for marketing purposes.

5. SUMMARY AND OUTLOOK

The regulatory landscape in Europe dealing with VOC content and VOC emission requirements with many different mandatory requirements, voluntary labels and certification systems for sustainable buildings is very complex and inextricable.
Eurofins' Indoor Air Comfort Gold certification helps manufacturers demonstrate commitment to indoor air quality, regulatory compliance, and sustainability, while simplifying these complex requirements into a single, trusted certification.