HARDWOOD FLOOR PROTECTION INFORMATION

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Solvent-free, water-based finishes – does “solvent-free” mean free of solvents?

Unlike solvent-based finishes, which use solvents for dissolving polymers (binders) and adjusting the viscosity of the finish, water-based finishes only use solvents in small concentrations to promote the temporary swelling and softening of the binder particles dispersed in the water so that the polymer particles can coalesce to form a film. This process is called film formation, and the solvents used for this purpose are known accordingly as film-forming agents.

After the film has formed, the solvents, or “film-forming agents”, must evaporate to enable the binder to achieve its original hardness and give the resulting finish its desired mechanical properties, such as scratch and abrasion resistance. These solvents are also known as volatile organic compounds, or VOCs, because they evaporate and are released into the air of the room after the film has formed through the coalescence of the binder particles.

In order to understand the term “solvent-free” in the context of water-based finishes, it is first necessary to consider what is covered by the term “solvent” according to its definition. Unfortunately, the issue becomes

somewhat complicated at this point because there are various definitions for what can and cannot be classified as a solvent.

When considering emissions into indoor air – and, accordingly, indoor-air hygiene – all volatile organic compounds are relevant. Therefore, the World Health Organization (WHO) has developed the following general classification system for these compounds, based on their boiling points:
Very volatile organic compound (VVOC) < 50 – 100°C
Volatile organic compound (VOC) > 50 – 100°C < 240 – 260°C
Semi-volatile organic compound (SVOC) > 240 – 260°C < 380 – 400°C

Similarly, these compounds can also be classified on the basis of their retention times in the gas chromatograph. According to DIN ISO 16000, the following definition applies to emissions to be measured in the test chamber:
VOC: all individual substances within a retention time range of C_6 (hexane) – C_{16} (hexadecane)
SVOC: all individual substances within a retention time range of C_{16} (hexadecane) – C_{22} (docosane)

A number of classification systems, such as the GEV classification criteria for the Emicode label and the evaluation scheme of the German Committee for Health-related Evaluation of Building Products (AgBB) for the building inspectorate approval of the Deutsches Institut für Bautechnik (German Institute for Civil Engineering – DIBt), are based on this definition. A narrower definition can be found, for example, in the European "Decopaint" Directive 2004/42/EC and in Rule 617 of Germany's Technical Rules for Hazardous Substances (TRGS 617) "Substitutes and substitution of working methods for solvent-based surface treatment agents for parquet

and other wood floorings". In these cases, only VOCs with a boiling point of ≤ 250°C are classified as solvents. Rule 610 of the Technical Rules for Hazardous Substances (TRGS 610) "Substitutes, substitution of working methods for solvent-based primer and adhesives for floorings" differs from Rule 617 in that it defines a solvent as a VOC with a boiling point of ≤ 200°C. However, this rule does not apply to finishes, only to primers and adhesives.

Regardless of which definition is used, all VOCs are always relevant when considering the level of emissions – and this is the decisive factor when it comes to indoor air hygiene. The various boiling points simply mean that the solvents will evaporate, or "off-gas", from the finish into the indoor air at different rates. While the VOCs with low boiling points will be associated with high emission levels in the beginning, their emission rates will decrease quickly. SVOCs, on the other hand, have higher boiling points, meaning that they will off-gas more slowly, contaminating indoor air for a longer period of time. Using SVOCs in place of VOCs with the aim of making finish formulations appear to be solvent-free is therefore counterproductive for indoor-air hygiene. Furthermore, when finishes with SVOCs are used on new or refurbished floors, the waiting period before the rooms can be used is longer because the finish needs more time to cure.

Descriptions like "solvent-free" or "zero VOC" can be misleading because, owing to the definitions used for solvents and VOCs, not all of the substances responsible for emissions are taken into consideration. In this case, "solvent-free" in fact does not mean completely free of solvents.