

# Questions and answers on volatile organic substances

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## 1. What are volatile organic compounds?

VOC is simply the acronym for volatile organic substance. Organic are those substances containing at least one carbon atom in their molecule. "Volatile" means that under normal conditions they occur in the liquid state, but they easily tend to become gaseous (evaporation).

There are two definitions of VOC that regulate the world of coating materials. The first, deriving from the EU directive 99/13/EC, establishes all substances that at a temperature of 20 ° C have a vapor pressure greater than 0.01 kPa are considered VOC, while the second definition, established by the EU Directive 2004/42/EC, indicates as VOC all those substances which have a boiling point below 250 ° C.

## 2. Is it true that volatile organic substances can be replaced with other organic solvents not classified as VOC?

We should be very careful with such approach and we must initially consider what vapor pressure really means. Let's consider an experiment where we insert a volatile organic substance inside an empty box at the temperature of 20 ° C. A fraction of the substance present into the box will immediately begin to evaporate and will do so faster the more volatile the substance is.

Being a closed environment at a certain point, an equilibrium will be established between the molecules of the liquid that continue to evaporate and those that from the vapor phase return to the liquid state. Under such conditions the pressure that the vapor exerts on the walls of the box is called vapor pressure. The previously mentioned directive tells us that all substances whose vapor pressure is equal or greater than 0.01 kPa are classified as VOC but remember at 20 ° C (293.15 K)!

If in the previous experiment we increase the temperature of the box, the substance contained would evaporate more easily and the vapor pressure would consequently also increase. Therefore, if we buy a coating material containing liquid substances that are not classified as "volatile" at 20 ° C, but we use a 50 ° C oven to dry it, we could be not conforming to the EU directive. Such document in fact reports that "volatility" must be evaluated considering the particular conditions of use of the products!



## 3. Are solvents and thinners the same products?

Not exactly. The term solvent refers to the concept of "dissolving" while the role of thinners is that of reducing the concentration and consequently the viscosity of a liquid.

The various volatile organic substances differ in these two properties also in relation to the characteristics of the "solute" or the type of resin in the case of coatings. There are therefore VOC that better reduce the viscosity of one specific coating material than others and therefore their use could make the coating process more efficient, especially for the environment. In practice, a coating material

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could be applied using less thinner, choosing the right one.

#### 4. Are there coating materials without VOC (VOC = 0)?

Excluding some special cases, all coatings contain VOCs including water-based products even if in very small quantities. We have previously said that the resins contained in coating formulations need both to be dissolved, to produce a film on the substrate on which they are applied, and to be diluted to allow or in any case facilitate the application process.

Water can only perform the second function as it is not able to dissolve the resins with which

coatings are formulated. There is therefore always a little amount of solvents (normally called coalescent), even in the case of water-based products.



#### 5. Are there coating materials with VOC contents so low that they can be classified as “non-toxic”?

The European CLP regulation (classification, labelling and packaging of chemical substances) specifies not to use incongruous terms such as “non-toxic” or “ecological”. Therefore, coatings bearing these words should not circulate within the European Union.

#### 6. . Is it true that water-based coatings, containing less VOC, are less dangerous than solvent-based coatings?

The term “dangerous” is very generic and therefore we should first to understand what the possible risks are associated with the use of coatings, excluding the production phase.

In a very schematic way, we could divide the risks into three categories based on the impacts that coatings can theoretically determine.

- a. Risks for workers. Since solvents are directly responsible for many health risks, the lower content of water-based and photo-curable (UV) coatings suggests less danger for operators than solvent-based ones.
- b. Environmental risks. Also, in this case, a considerably lower risk of emissions into the atmosphere is caused by water and UV coatings compared to solvent-based ones.
- c. Risks for the end user. The evaluation in this case is not simple as the emissions of volatile organic substances from the finished product depend on many factors including: the amount of VOC initially present in the coating formulation, the type of VOC (“light” or “heavy”), the quantity of applied coating and drying conditions. Water-based coatings certainly contain less VOC than solvent-based products, but these substances are generally “heavier” meaning that they evaporate more slowly. The combination of all the factors mentioned above is not easily predictable and therefore the only possibility is to have data, values deriving from laboratory tests.

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## 7. Is it true that natural coatings do not contain VOC?

First of all, it is important to clarify that there is no univocal definition of natural coating. There are in fact various types of “natural” products on the market, including those that are so called simply because of the natural effect they confer to the treated surface.

In this panorama so wide there are therefore different types of coating products, some of which show a VOC content even higher than 50%. It is true that sometimes these substances can be of natural origin (natural turpentine for example), but from the emission point of view, nothing changes, existing regulations consider them as volatile organic substances.

### CATAS and volatile organic compounds

CATAS addresses the issue of volatile organic substances at 360 degrees, starting from the **chemical analyses** of raw materials.

The **qualitative and quantitative determination of the solvents** contained in coatings, adhesives and other products of the wood-furniture sector is performed by gas chromatography analysis for which our laboratory is also accredited (EN ISO 11890-2).

Still in terms of VOC “content”, CATAS is able to carry out the determination of **photoinitiators and residual monomers** in the dried coating films. This test, which is mainly applied to photo-curing coatings (UV), is performed according to an analytical protocol developed and validated to meet the specific needs of the market.

The other subject related to volatile organic compounds is that of **emissions from raw materials and finished products** and for which CATAS is accredited in reference to the standards EN ISO 16000-6 / 9 and EN 15516. For these tests, Catas can issue a declaration of compliance with the Italian minimum environmental criteria (CAM), French law or other specific schemes.

Finally, CATAS can carry out the analysis of the concentration of volatile organic substances both in **workplaces** and in **living environments** (offices, schools, domestic environments, etc.). The request for such type of investigations is significantly growing and for this reason CATAS has developed special procedures with short and long term investigations for a complete and exhaustive evaluation of such problems.

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