

The recent European provisions on diisocyanates, will importantly affect also the wood and furniture sector considering the variety of raw materials which can contain such dangerous chemicals.

With this short article we would like to briefly remember what these substances are, where they can be found and what are the potential risks associated with their use.

### What are diisocyanates and what are they used for?

Diisocyanates are a particular group of chemical substances characterized by high reactivity with other substances to generate new compounds.

The reactivity of diisocyanates is actually double (the prefix “di” precisely indicates this dual functionality). In this way a diisocyanate molecule can then

bind simultaneously to two molecules of other substances to generate molecular aggregates which can become very large and complex when the reactivity of the other substances with which it reacts is also double or higher.

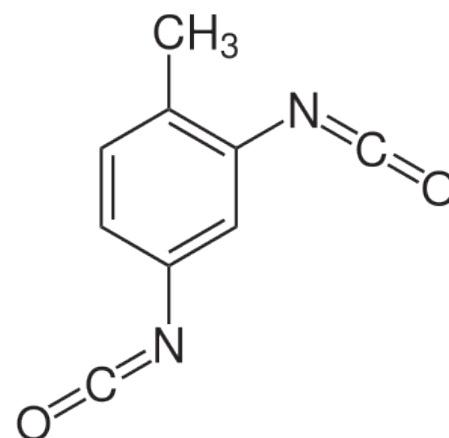


Fig. 1 A diisocyanate molecule (DI) reacts with two molecules of another substance (A)

The functionality of each molecule is highlighted with asterisks.



Fig. 2 A diisocyanate molecule (DI) reacts with two molecules of another substance (A).

The reaction can then continue involving other molecules of both diisocyanate and substance B potentially generating very large molecules.

The most common diisocyanates are toluene diisocyanate (TDI), methylene bisphenyl isocyanate (MDI) and hexamethylenediisocyanate (HDI) which are widely used especially in the production of polyurethane derivatives such as: foams, plastics, adhesives, coatings and primers for various applications.

In reality, many of these materials have been made with diisocyanates as basic ingredients, but the final product, i.e. the adhesive, the coating, etc., no longer contains them, since these chemical species have completely reacted with the other substances that were used to produce them.

However, there are exceptions that specifically concern some products that maintain their chemical reactivity when used. In particular we are talking about: some types of hardeners for coatings and adhesives (often called catalysts), the hot-melt polyurethane adhesives used in edging or lamination processes, the single-component polyurethane adhesives for the parquet laying and some types of primers sometimes classified as moisture-curing.

In all these products, which would be better identified as “isocyanate based” and not as “polyurethanes” to precisely highlight their fundamental characteristic of being chemically reactive, variable quantities of free diisocyanate molecules may be present. Therefore, they did not react (bind) to the other chemical substances during the production process. These species are sometimes called “diisocyanate monomers” to recall the evidence that they are the single (mono) parts (from the Greek word: meros) which are used to make the resins and polymers of which plastics, paints, etc. are made.

## Negative effects on workers' health

Given their high chemical reactivity, free diisocyanates have always been under the attention of occupational hygiene bodies for the negative effects they can cause when they penetrate the human body. Considering the wood and furniture sector, where the products listed above are used, the main route of potential occupational exposure is inhalation, especially in the case of aerosols when, for example, paints containing free diisocyanates are applied using spray systems. On the other hand, in theory, the risk of exposure to diisocyanate vapors is more limited, given the low tendency of these substances to evaporate. Obviously, the risk must be assessed on a case-by-case basis considering all the surrounding conditions.

It should be remembered that the exposure of workers can also occur through the direct contact with the skin, which can happen above all especially in the floor laying sector where the application is typically carried out by manually spreading the adhesive onto the substrate.

TDI and other isocyanates are potent eye and respiratory irritants. Direct contact can also cause marked skin inflammation. Respiratory irritation can also progress to acute or chronic respiratory disease.

Isocyanates can also represent dangerous sensitizing agents for some workers. Sensitization is a process that develops over time and which progressively leads the worker to suffer, for example, from asthma attacks when exposed to even very low concentrations of these substances. Very often, this sensitization prevents the possibility of working inside environments where products containing diisocyanates are used.

The World Health Organization has also stated that TDI should be treated as a potential human carcinogen.

## The recent European restriction on diisocyanates

The European Union restriction process for diisocyanates started in 2016 with a first report by the German authorities to the European Chemicals Agency (ECHA). The data collected had identified over 5,000 new cases of occupational diseases per year due to exposure to diisocyanates across the whole European Union. Based on this evidence, considered unacceptably high, a restriction measure was adopted in 2020 with the publication of Regulation 1149 by the European Commission.

This provision was issued pursuant to the REACH regulation which is the process of registration, evaluation, authorization, and restriction of chemical substances with the aim to improve the protection of human health and the environment from the potential risks of chemical substances.

# Who is afraid of diisocyanates?

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In few words, the restriction establishes that **diisocyanates cannot be used** as such, as constituents of other substances or in mixtures for industrial and professional uses after 24 August 2023, **unless**:

- a. the concentration of diisocyanates, considered individually and in combination, is **less than 0.1% by weight**,  
or
- b. the employer or self-employed person ensures that industrial or professional users have successfully completed **training on the safe use** of diisocyanates before using the substances or mixtures.

Starting from August 24th of this year, it will therefore be mandatory to check first of all that, among others, the hardeners (so-called catalysts) of polyurethane and acrylic coatings and also some of those used in combination with water-based coatings no longer contain more than 0.1% of free monomeric diisocyanates. In the same way, users of polyurethane (or rather polyisocyanate) hot melt adhesives in the edging and lamination processes must also pay attention to this indication. In addition to the coatings already mentioned, the floor sector will also have to check the polyurethane adhesives used for laying and some types of primers used, for example, as screed consolidators.

If the declared values exceed the 0.1% threshold, adequate training on the use of products containing diisocyanates will be required, as prescribed by the European Regulation.

Finally, we recall that **Catas also carries out analyzes to verify the exposure of workers to diisocyanates**, having also carried out specific monitoring campaigns in the past for some types of workers.



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