Engineered stone and silicosis: an acceptable risk?

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Editorial

Title:

Engineered stone and silicosis: an acceptable risk?

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Compulsory final declaration section

The use of engineered stone (ES) countertop products, introduced in the 1990s, has increased exponentially, largely replacing natural stone bathroom and kitchen countertops. In recent years, the range of applications for ES has also widened to include wall and floor coverings, among others. Quartz or silica agglomerates were one of the first types of ES to appear on the market. These materials are composed of more than 80% crystalline silica (mainly quartz or cristobalite), and 20% other compounds including resins that act as a binder and organic or metallic pigments. The widespread demand for these ES products requires workshops specialized in finishing and installing countertops, which sometimes have had poor dust controls and worker protections. The result has been a re-emergence of silicosis in our country[1] and in many others, causing Public Health Departments around the world to raise the alarm, demanding strict engineering controls, and has even led to its prohibition in Australia[2].

The first cases of silicosis caused by this material were published in 2010[3], confirming that this dust resulted in a more aggressive form of silicosis than that caused by natural stone. This disease affected young workers, many of whom developed accelerated silicosis[4], which also progresses rapidly even after exposure cessation[5]. Additionally, it is of great concern that a large proportion of workers have been affected. Hoy R et al. reported a prevalence of 28.3% in a comprehensive screening of stone benchtop industry workers. The prevalence increased to 30% among workers with high or very high exposure, and 11% among those with low or medium exposure. As in most occupational dust exposures, intensity and duration of exposure were significant risk factors for silicosis[6].

It is thought that the high silica content in ES is the main causative factor in this rapidly progressive disease, however, some data suggest that other constituents may participate synergistically, increasing the inflammatory and fibrotic phenomena induced by silica. Elements such as cobalt and aluminum may contribute to the toxicity of dust generated from ES [7]. Other studies have shown high levels of aluminum inside the silicotic nodules[8].

It should be noted that the silica and metal components of the dust are not the only reason for concern. Resins and other compounds that bind the mineral content are also emitted into the atmosphere during cutting and polishing processes and are inhaled by workers. The compounds detected include styrene, toluene, benzene, polycyclic aromatic hydrocarbons or phthalic anhydride, among others[8,9], which may cause a variety of respiratory diseases. In addition, benzene, like silica, is classified as a Class I human carcinogen[10]. These resin derived compounds, along with metals, may also potentiate silica toxicity resulting in increased inflammation and possibly their carcinogenicity.

Although reducing the silica content of resin-based agglomerates could theoretically be a solution, there is no minimum safe level of crystalline silica, especially when other elements including metals and resins may be contributing to the toxicity of ES silicosis.

Another characteristic of this material is the high concentration of respirable crystalline silica particles emitted when fabricating this material, reaching extremely high concentrations when performed without adequate engineering controls. Dry cutting and polishing must be combined with water sprays and local exhaust ventilation (LEV)[11] in order to achieve even a modicum of dust control. While some stone workshops may utilize these controls, it is very possible that construction workers installing these materials on floors, walls, and fixtures may be making final adjustments using a dry process in enclosed spaces with poor ventilation and no engineering controls, such as water and LEV.

Recently, new ES formulations have appeared on the market, called porcelain and sintered stone. These materials contain crystalline silica in a proportion of less than 15%, and the rest are amorphous silica, clays and feldspars together with other materials such as zirconium. Some of them claim to contain various components in the crystalline phase in addition to quartz, but do not detail the percentage of the total. Likewise, they contain, according to their safety data sheet, organic and inorganic additives and pigments, which are not detailed. Some commercial brands declare that their products are free of crystalline silica (less than 1%), but do not specify the rest of the minerals that compose it.

These new kinds of ES do not use resins as a binder but create the product using high heat and pressure. Some commercial brands use fiberglass embedded in synthetic resins as reinforcement, although they do not describe the percentage of these materials.

In general, safety data sheets for these new materials are often incomplete, making it difficult to assess the potential risks for workers. Kumarasamy et al., compared the information provided in the safety data sheets with their own analysis and find a wide variability between the content of crystalline silica described in the safety data sheets and those detected in their laboratory. They also describe potentially dangerous metals that are not mentioned in the safety data sheets[12].

Of great concern is the high concentration of respirable dust generated when working with these new materials. These levels are similar to those generated when working with granite or with silica agglomerates based on resins[13], although the fraction of respirable crystalline silica is lower and in proportion to that contained in the raw material. Lack of knowledge about the composition of this respirable dust makes it extremely difficult to evaluate the future risk for workers who are exposed.

High-silica resin-based agglomerates have caused an epidemic of accelerated silicosis cases globally[14]. In Spain, 55.9% of all compensable cases of silicosis were attributable to the natural stone processing and engineered stone fabrication and final processing industry. Although it is not possible to know which cases belong to the fabrication and processing of engineered stone, clinical reports and other evidence suggest the significant contribution of engineered stone to the resurgence of silicosis in Spain[1].

Newer formulations with lower silica content have not been well studied and present important unknowns and uncertainties about the risks to workers who use these materials.

It is urgent to consider strong measures, up to and including the prohibition of those types of ES that have already demonstrated a high degree of toxicity, or that are expected to do so based on their composition. This is especially important given that measures to reduce exposure in certain sectors are difficult to achieve and the safety of workers cannot be guaranteed[15]. A specific medical surveillance system for these workers is necessary, and preventive measures must be enforced. Manufacturers must fully detail the composition of their products and carry out safety studies not only aimed at consumers but also at workers who handle these materials.

Spain is one of the countries with the highest number of cases, and our authorities must prioritize controlling this exposure and preventing the resultant disease. There has already been an enormous cost in human lives which will continue in the coming years. There is great expense to these workers and society because of medical costs such as lung transplants and permanent disability in young workers, whose lives and well-being have been cut short by their work.

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