Murano glass: Italy's pride plays the substitute card

Murano glass is part of Italy’s world-famed cultural heritage. The dexterity of generations of families of master glassmakers have kept one of the most exquisite forms of artistic craftsmanship alive on this island of the Venetian lagoon. Some producers, however, are ringing the changes on this know-how by replacing arsenic with alternatives that are safer for their artisans’ health. And that probably would never have happened without REACH.

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SMEs are not quite there with substitution yet.

Image: © Matteo Di Giovanni (p. 32-35)
"Arsenic has been used for centuries to endow glass with particularly fine clarity and as a refining and decolouring agent", says Sandro Hreglich, a chemist at the Stazione Sperimentale del Vetro (SSV), a Venice Chamber of Commerce agency whose job is to promote technical progress in the Italian glass industry.

The Ministry of Health tasked SSV to come up with replacements for the arsenic compounds used to make the celebrated Murano art glass. Traditionally, arsenic trioxide (As$_2$O$_3$) is used in the Venetian island’s workshops, the problem being that: it is a recognized carcinogen by inhalation and ingestion, and toxic for any kind of exposure. It is these characteristics that have led the European Chemicals Agency (ECHA) to identify it as a "substance of very high concern" (see p. 17). Under REACH – the EU’s chemicals regulation – arsenic trioxide will be banned from May 2015 for all uses except those specifically authorised by the European Commission.

It’s a hard blow for a key sector of the local economy and major tourist attraction already suffering from Asian knock-offs. For in order to carry on using this carcinogen, Murano’s glassmakers will have to engage a lengthy, complex and costly procedure for an authorisation which they will get only if they can show that there are no safer alternatives and that the socio-economic benefits of using it outweigh the risks.

To avoid this obstacle course, government-funded research was undertaken to replace arsenic trioxide by other raw materials less toxic to humans and the environment, leading to the identification in May 2012 of two alternatives: cerium dioxide and ground granulated blast furnace slag (GGBS).

The research included a risk analysis for workers’ health, which showed that, being non-carcinogenic, cerium oxide posed less of a health risk, while GGBS was found to be safe. Combining these two replacements is therefore a valid and safer alternative to arsenic compounds.

"This substitution project is unique in Europe", says Pietro Pistolese, the main representative of Italy’s REACH authority, proudly. "The idea came to me at a meeting..."
of the ECHA Member State Committee, when the Irish government representative asked me how Murano would go on if arsenic was banned as it likely would be”, he says from his Health Ministry office in Rome.

Back in Italy, Pietro Pistolese hooked up with the other competent ministries to rustle up the 40 000 euros needed to fund research and testing of possible substitutes for arsenic compounds. This shows that the EU rules are paying dividends and encouraging governments and businesses to run schemes aimed at replacing hazardous substances with safer alternatives.

No single recipe

Replacements were first tested out in laboratories and then in furnaces, and the results obtained with different mixtures were checked. Out of this, three possible substitutes were identified: sodium sulphate, GGBS and cerium oxide – the latter having only a marginal use as a refiner and especially as an oxidant.

“These substances work very well throughout the thermal cycle of continuous industrial melting at temperatures around 1 500°C”, explains Sandro Hreglich. “However, in art glass production, the thermal cycle is different, with top temperatures between 1 300°C and 1 400°C. What this means is that in the craft cycle, substitutes work somewhat less efficiently, which requires a longer melt cycle and consumes more energy”, concedes the chemist.

“The alternatives identified were then presented to firms. We held a series of information and training meetings while the project was running. Attendance was reasonable even though completely voluntary”, adds his colleague Nicola Favaro.

So how does the score sheet look, just over a year since alternatives were identified? “Some firms are already using them, others are gearing up to, but will only give up arsenic if it is taken off the market”, says Favaro bluntly.

“At any rate, I know many glassmakers are now using the substitutes, and others have tried them out with interesting results. But we have no data on the practical application of the replacement options that we tested out. And it would be really hard to carry out a survey into it”, notes Sandro Hreglich. “The aim of the project was to do away with arsenic in as many production systems as possible. If arsenic is banned tomorrow Murano will not shut down because replacements are being used in a huge variety of formulations. The new technology is there and usable in practice”, he adds.

“Murano is a highly complex world of widely-differing small-scale producers: the thing is, though, Murano glassmakers will often spend their Saturdays and Sundays trying to come up with new colours. For them, there is no single recipe...”, acknowledges the SSV chemist.

“We have been working for some time on completely replacing arsenic”, explains Alessandro Toso, the new technical director of Formia, a Murano business whose


50 employees and 26 furnaces generate 6 million euros in annual sales. "I was involved in testing replacements with the SSV from the start of the project, when I was working for the family firm, Cesare Toso, in 2009. I've been with Formia only for about a month, and the use of arsenic has gone down 70% in that time", says Toso with understandable pride.

"The main hurdle was changing mindsets, something I had already remarked on at meetings organized by the SSV. I suspect it is because change means laying out upfront costs, and that's especially hard today when all the resources are needed for production but it is necessary and even unavoidable. I want to completely do away with arsenic, but also other substances like cadmium, selenium, potassium dichromate and cobalt", explains the manager of Formia, a company that has developed partnerships with designer names like Armani and Roberto Cavalli.

"Company management has put its trust in me, and we are seeing the financial benefits of substitution, because the price of arsenic has risen out of all proportion recently: it now costs 150 to 200 euros per kilo. Before long, arsenic will be banned and continuing to use it will involve a massive amount of red tape which will bring huge costs", he says. "I wouldn't say that the idea of replacing arsenic has been universally well received, though he admits.

And indeed, faced with a sluggish economy and "cheap" Chinese competition, other smaller producers are much less welcoming of the idea of replacement.

"We are ready to replace arsenic because we are concerned to protect the health and safety of our workers, but what we can't put up with is the red tape and the burden of the obligations to fulfill. They cost too much and the authorities that are foisting them on us have lost all credibility in our eyes because of all the waste and the cronyism they are guilty of", fumes Giorgio Giuma, master glassblower with Linea Arianna, a firm with close to a dozen workers specialising in sculpted portraits.

"Where raw materials are concerned, we have got rid of some colours in minerals and reduced the level of some hazardous components. We use less arsenic. We have gone from 1.5% to 1% by weight, which makes the glass slightly less pure and a bit greener. We still use about 50 kg of arsenic a year", says Alberto Dona who with his sons Andrea and Davide runs Componenti Dona, a family business specializing in parts for lamps and designer items which employs 16 people. Replacing arsenic by cerium oxide means having purification plants, says the businessman, and that requires big investments at a time when many of these SMEs are struggling to survive.

A closed circle

"Chinese products have cost the island 30% of its sales", frets Michele Pettenò, the local official of FILCTEM, the Italian Federation of Chemical, Textile, Energy and Manufacturing Workers. "Where there were thousands of workers in the Murano glass industry – i.e., forty-odd companies – a few years ago, there are now only about 1 100; and in fact no more than 500 of these are actually working; the rest have been laid off and are on the integration fund, the Cassa Integrazione Guadagni", says the union official ruefully.

In these conditions, action on health or the environment is no easy matter.
"As a union, we check on every firm to see if they have done a risk assessment and refer any issues to the local health agency’s (ASL) health and safety at work and working environment department”, says Pettenò.

But the union has little real clout in a sector dominated by very small firms: “You only get a joint shop stewards’ committee and workers’ safety representatives in big companies like Venini, Cenedese and Formia that also have in-house prevention and protection services”.

"Some firms will only give up arsenic if it is taken off the market."
Arsenic: an unfashionable poison

“The risk of exposure to arsenic comes mainly through the composition of raw materials put together for melting, and then during cutting when sand and water are used to polish the item and cool it to prevent breakage”, explains Dario Gambaro, chemical analyst at the Stazione Sperimentale del Vetro testing lab.

Venetian glassmakers have been using arsenic since the late 17th century. Arsenic oxide combined with lead oxide gave an opalescent or opaque glass depending on the relative proportions used.

“The situation has at any rate improved since 1999 when I started inspecting glassworks. At that time, for example, arsenic containers were still often left open. Since 2001, batching plants have been fitted with extraction systems, and masks and gloves are also worn. As far as environmental protection goes, cutting produces no water effluents because it is done in a closed cycle and the sludge is treated by specialized firms”, notes the technician.

Another expert in Murano glass production, Lucio Moretti, a now-retired former technical director with upmarket companies like Venini and De Maio says that “all the hazardous substances are slowly being replaced by others that are not. Antimony has frequently been used instead of arsenic for some time”.

As to the risks of arsenic exposure, Lucio Moretti considers it “a risk that is now under control, because where it is still used, the raw materials are mixed in tower sections so that operators don’t inhale the dust; furnace filling is done by a purpose-developed semi-automatic system that prevents dust dispersal”.

By his estimate, “80% of firms have made the substitution and, in many cases, cadmium sulphide, selenium and other hazardous colouring agents have also been reduced.”

Michele Pettenò wants to see a stronger role for the SSV, not just in research but also in training and management of health and safety. The union official singles out not just the business cycle but also the “mindset” of the handmade glass industry as a barrier to change.

Murano is essentially a microcosm of family-run micro-businesses in permanent competition and trapped in a mindset where the boundaries between art and craft are blurred. “This prevents them from seeing how it would be better to join up to solve issues ranging from energy costs to protection of the environment and promotion of the Murano brand across the world”, laments Pettenò.

“When they had to set up a system for cutting pollutant emissions, they each went it alone when by working together they could have spent much less. The same goes for sourcing raw materials: each business jealously guards its formulas and so is reluctant to let others know how much of any particular component it uses”, says the union official.

FILCTEM had a big hand in setting up the Consorzio Promovetro alliance to tackle counterfeiting and defend authentic Murano glass made according to traditional techniques and processes. The union is also campaigning against speculative hotel-building in former glass furnace plants, symbolised by the conversion of the largest furnace – the Conterie – into a hotel with outbuildings turned into apartments...

Even with these initiatives, Michele Pettenò takes a sombre view of the future of traditional Murano glass.

“Murano glassworks are in crisis because they have never developed an effective marketing policy. All the system is a small circle in which the glassmakers produce and showrooms sell items through agreements with hotels and tourism promotion organizations to attract customers. There are also firms that have moved to the mainland producing under the Murano brand and claiming that the art of production is what makes the difference. That way, Murano runs the risk of going under”.

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