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## **Sixto Malato, expert in solar-powered water decontamination technologies**



### **“Almost nobody decides spontaneously to apply environmentally correct industrial processes”**

Sixto Malato works at the Almeria Solar Platform (PSA) of the Centre for Energetic, Environmental and Technological Research (CIEMAT), where he studies the use of solar energy to treat and decontaminate water through photocatalytic processes. Presented with the 2011 King Jaume I Award for Environmental Protection, he recently gave a conference at UAB on this subject to PhD students in Chemistry. In addition to explaining the technologies being developed, the following interview includes Mr Malato's concerns about the administration's role in supporting the use of these types of technologies and the future of research in Spain.

Sixto Malato holds a PhD in Chemical Sciences. As researcher at the Almeria Solar Platform (PSA), he is in charge of the Unit for Solar Treatment of Water and directs CIESOL, a centre

affiliated to the University of Almeria and CIEMAT. He has participated in over thirty local and European projects related to the use of solar energy and the development of photoreactors for water treatments. He is also project consultant in several Latin American countries and coordinates the transfer of technologies developed by PSA and other research centres and businesses. Sixto Malato has published over 40 chapters in books and more than 170 articles in international journals included in the Science Citation Index. His h-index is 45.

### **What is concentrated solar technology and how can it be used?**

It basically consists in concentrating sunlight, normally to heat up fluids. It is called concentrated because it is based on devices that follow the Sun's trajectory, redirecting its light into one concentrated point, known as the focus, with the aim of increasing its temperature. In contrast to solar panels, which directly convert solar radiation into electricity, concentrated solar power mainly is used to heat and evaporate water, producing electricity thanks to a steam turbine. It also has photochemical applications.

### **You study how to apply this technology to the decontamination of water?**

Yes, this is where we touch upon the photochemistry applications I mentioned. By concentrating photons we produce, through a process of photocatalysis, a chemical reaction in the water which produces oxidative species which destroy the contamination. Fundamentally, our technology is based on the development of solar collectors, known as compound parabolic collectors, especially designed to introduce solar photons into the water, but in this case without having to heat the water.

### **What type of contamination can be eliminated?**

All that which usually cannot be eliminated using traditional systems, such as at the water treatment plants we see, which mainly work to eliminate human originated contaminants. Solar power based on photocatalysis helps us eliminate compounds such as dyes, pesticides, solvents, etc. - products which we call recalcitrant because they are very resistant to conventional treatments.

### **Can they be found in the water we use?**

No, purification plants usually have systems that prevent these from reaching human consumption. But that does not mean that they cannot be found often in natural waters (rivers, oceans, and even in polar ice), causing substantial problems but which for now are not all too serious.

### **What advantage does this system have over others?**

Most systems now used need electricity (which currently is not produced using renewable energy sources) and chemical reagents. Our system does not harm the environment in two ways: it decontaminates the water and it uses clean and renewable energy sources. Plus, the costs are similar to other conventional treatment methods. It should be pointed out that this technology is fully ready to be implemented.

### **In which phase is the technology now?**

If we refer to R&D&I, we are in the third phase, in innovation, in which we transfer to the market a process resulting from over 20 years of research conducted in the laboratory. This has led to the creation of pilot plants with specific solar collectors, offering a mature process which can be

implemented competitively. There are demonstration plants in different parts of Spain, two in Almeria for example, in which specific problems are being resolved, such as the treatment of water contaminated with pesticides and compounds used for drug synthesis. But they are still not fully commercialised.

#### **Do you think it will be difficult to implement them in the near future?**

The future of the process we are researching is part of the same context in which any other clean and renewable energy source finds itself. To start, we must understand that renewable energies must be used in several applications, including water treatments, because we cannot continue to consume fossil fuels and dump pollutants eternally.

#### **How do we achieve this?**

Unfortunately, experience has demonstrated that almost nobody decides spontaneously to apply environmentally correct industrial processes. Therefore, implementing these methods greatly depends on the passing of laws. The governments must make it a priority to solve today's water contamination problems, which can be solved with clean energy technologies such as the one we have developed.

#### **What must be done to convince them?**

Pressure usually goes hand in hand with the scarcity or the abundance of clean sweet water. When there are periods of drought governments are more receptive to the promotion and creation of laws in favour of water decontamination with the aim of recycling water. In wet periods, when water is abundant, the pressure decreases and finding solutions is no longer a priority. Therefore, implementing these technologies must be accompanied by the development of medium and long term strategies in water management.

#### **Which position does Spain occupy in producing and researching into solar energy?**

As a producer of solar-powered electrical energy Spain ranks as one of the top five countries, as it does in research. As a country, our lines of research into solar power are of the most advanced in the world. We hope to maintain this position as leaders and hope that it is made clear that reducing expenditure on R&D&I is a strategic error if we aim for quality and competitiveness.

#### **This will be difficult in view of future investments in science...**

Spain's political leaders should know that many countries now are dealing with the crisis much better than we are because they have been working on a competitive scientific system for the past 30 years. If we look at the statistics of countries that best endure this crisis, they are all countries exporting technology: Germany, Japan, Switzerland, Scandinavian countries, and they can do so because one of the main pillars of their economy is research. If we cut back on investments, it will take decades to recover the level we presently have. The situation worsens when we take into account the amount of competent and brilliant young people moving to other countries who later may find it very difficult to return.

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