

China's first wastewater plant using radiation opens

By Miklos Gaspar



A side by side comparison of wastewater after it has been treated using electron beam technology and other methods.

(Photo: Nuclear and Energy Technology Institute, Tsinghua University)

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— Jianlong Wang, Deputy Director, Institute of Nuclear and New Energy Technology, Tsinghua University, Beijing

China has inaugurated its first facility that uses electron beams to treat industrial wastewater, ushering in a new era of radiation technology for the world's leading textile producer.

Textile dyeing accounts for a fifth of all industrial wastewater pollution generated worldwide. Although several industrialized countries have used radiation to treat some of the effluent from textile dyeing plants, the relocation of much of the industry to developing countries in Asia in recent years has meant that a lot of the wastewater goes untreated.

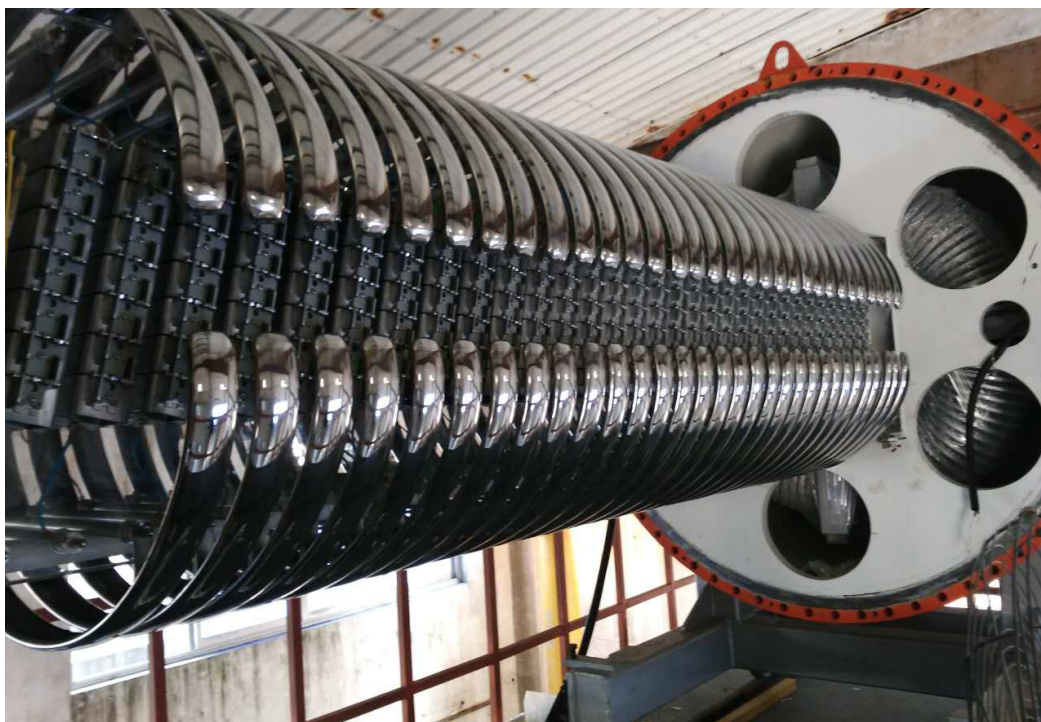
“Despite advances in conventional wastewater treatment technology in recent years, radiation remains the only technology that can treat the most stubborn colourants in wastewater,” said Sunil Sabharwal, a radiation processing specialist at the IAEA. “The problem is that the technology exists in developed countries, while most of the need is now in the developing world.”

To bridge the knowledge gap, the IAEA ran a coordinated research project on this technology, including its transfer to several

countries, mostly facilitated in Asia. Chinese researchers, for instance, have benefited from the advice of experts from Hungary, the Republic of Korea and Poland in the adoption of the technology and the construction of the plant, said Jianlong Wang, Deputy Director of the Institute of Nuclear and New Energy Technology at Tsinghua University in Beijing and the principal researcher behind the project.

The new plant in Jinhua city, 300 kilometres south of Shanghai, will treat 1500 cubic metres of wastewater per day using radiation technology (see The Science box), which is around a sixth of the plant's output. “If everything goes smoothly, we will be able to roll out the technology to the rest of the plant and eventually to other plants across the country,” said Wang.

Before opting for radiation technology using electron beams, Chinese researchers had conducted extensive feasibility experiments using the effluent from the plant, comparing electron beam technology with other methods. “Electron beam technology was the clear winner as both the more ecological and more effective option,” Wang explained.



Electron beam technology is used to clean industrial wastewater at a textile dyeing facility in Jinhua city.

(Photo: Nuclear and Energy Technology Institute, Tsinghua University)

Other countries with significant textile manufacturing industries, such as Bangladesh, India and Sri Lanka, are also considering introducing the technology with IAEA assistance, said Sabharwal. India is already using gamma irradiation to treat municipal sewage sludge, he added.

Chinese researchers are also considering using electron beam technology to treat residues from pharmaceutical plants that produce antibiotics. These residues are

currently handled as hazardous waste because they contain antibiotics and antibiotic resistance genes that cannot be destroyed using conventional technologies, such as composting or oxidation. However, research has revealed that electron beam technology can effectively decompose the residual antibiotics and antibiotic resistance genes, Wang explained. The establishment of a demonstration plant at an industrial scale is planned for late 2017, he added.

THE SCIENCE

Compounds too long for bacteria

Bacteria are the workhorses of wastewater treatment: they digest and break down pollutants.

Wastewater from textile dyeing, however, contains molecules that cannot be treated with bacteria. The compounds used to colour textiles have large, long and complex molecule chains. Wastewater from the industry can contain more than 70 complex chemicals that do not easily degrade.

By irradiating the effluent using electron beams, scientists can break these complex chemicals into smaller molecules, which can then be treated and removed using normal biological processes, such as breakdown by bacteria. Irradiation is done using short lived reactive radicals that can interact with a wide range of pollutants and break them down.

