



Tata Steel's new process innovation to remove total cyanide during steel production delivers tremendous cost saving and positive environmental impact.

THE CONTEXT

The Central Pollution Control Board (CPCB) mandates total cyanide discharge at less than 0.2 ppm during steel production. Conventionally, total cyanide is removed from coking waste water by the 'solid sludge precipitation' technique, which entails a high operating cost. Consuming large quantities of chemicals, this method also substantially increases the TDS of the water and generates toxic sludge, which is difficult to dispose. To address these concerns, the team at Tata Steel's plant began exploring cost-effective and safer methods of removing total cyanide in their production processes.

THE INNOVATION

The toxic cyanide ions were photodegraded and encapsulated from the steel production wastewater using UV radiation with H₂O₂, a strong oxidant, along with a specially developed supramolecular cage complex. The free form cyanide and bound (metallic) cyanide thus generated were destroyed by the OH radical produced by a combination of H₂O₂ and UV irradiation. This technique for breaking down all types of cyanide into a non-toxic form on a large scale comes at a marginal cost compared to conventional techniques.

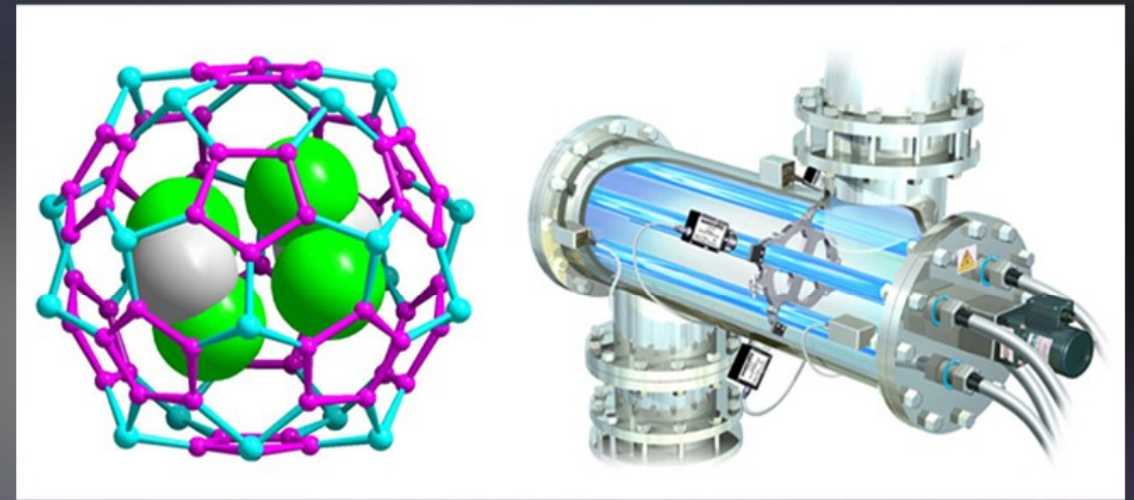
KEY CHALLENGES

IMPLEMENTING THE NEW TECHNIQUE REQUIRED NEW, CUSTOM-DESIGNED UV REACTORS FITTED WITH MULTIPLE UV LIGHT SOURCES

These reactors take up very little space with an outfit similar to the small diameter shell of tube heat exchangers. Each reactor can hold up to 10 UV light sources. Tata Steel identified a vendor who is capable of fabricating the UV reactors.

UPSCALING THE PROCESS TECHNOLOGY TO HANDLE THE INCREASED VOLUME OF WATER GENERATED – FROM 5 m³/hr TO 150 m³/hr

The team addressed this problem during the pilot operation by introducing a recycling reactor and arriving at an internal recycle ratio in accordance with the pollutants' removal efficiency. As a result, the innovated process can be scaled to any level as per the internal recycle ratio. This has helped reduce the number of reactors as well as the volume of the feed tank.



POTENTIAL IMPACT

The new process has helped reduce the cost for removal of total cyanide by almost half - from Rs. 190/m³ of water to around Rs100/m³ of water. This innovation has the potential to deliver benefits worth Rs7.56 crore at one plant. The benefits will multiply if the technique is replicated across the Tata Steel business units in Jamshedpur and Angul.