Reclaiming industrial waste water in minutes

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Grad student Ali Kamel H. Al jibouri has developed an advanced oxidation process for the treatment of non-biodegradable pollutants in industrial waste water. Credit: Ryerson University

Treatment of industrial waste water is one of the biggest and most urgent environmental challenges of our time. All major energy production and manufacturing industries require water as a critical input. In 2013, Statistics Canada estimated the yearly national usage at approximately 30.2 billion cubic metres, resulting in 700 million cubic metres of unusable waste water. This waste water is often kept in large settling

ponds for decades, waiting for the containments to slowly break down, putting the water supply at risk for spills and leakages.

However, such systems may be a thing of the past thanks to new patented research from a Ryerson University engineer. Ali Kamel H. Al jibouri, who recently finished his PhD study in the Department of Chemical Engineering, has developed an advanced oxidation process (AOP) for the treatment of non-biodegradable pollutants in industrial waste water that saves both time and money.

"We cannot turn the clock back before the industrial revolution era, but we can reduce its impact on our environment," Al jibouri says. "Therefore, we need to act quickly by finding efficient ways to remove these pollutants; this is what we tried to do in our research."

He chose to focus his research on the treatment of toxic and non-biodegradable Naphthenic acids (NAs) due to its importance as a major pollutant in the Canadian oil and oil sands industries. When left to the natural bio-degradation process, the half-life of NAs is around 13 years, meaning at least 13 years are needed to reduce NA concentration to half of its original concentration levels—levels which are often still too high to be returned to the general water supply.

Al jibouri's new process not only removes all non-biodegradable pollutants and its toxicity, but does so in less than three minutes. After treatment through his process, the industrial waste water was considered to contain only rapid biodegradable pollutants, allowing it to then be treated in a way similar to municipal wastewater. At the same time, the ozone gas consumption required to treat the wastewater was reduced to a minimum, in turn reducing the economic cost associated with the process. Al jibouri estimates his process saves roughly 35 to 80 per cent in operating costs compared to other traditional advanced oxidation wastewater treatment approaches.

His breakthrough could not have come at a better time, as the Alberta government recently announced new regulations that all oil sands operators in the province must follow including a requirement that tailings ponds must be reclaimed within 10 years of the end of a mine's life, meaning that solutions such as these are urgently and desperately needed. As such, Al jibouri's process has already been registered with the United States Patent and Trademark Office and is currently under review by Canada's Oil Sands Innovation Alliance for adoption in the treatment of oil sand process-affected water.

Al jibouri's supervisor, Jianging Wu from Ryerson's Department of Chemical Engineering, calls Al jibouri's work innovative, and noted that his research is leading to a "scientifically sound and economically feasible remediation strategy for the urgent oil sands process-affected water problem."

Provided by Ryerson University