

# Chemical Engineering Seminars – HT 2008

*Week 3: Tuesday 29 January, 4:15 - 5:15 pm  
Lecture Room 2, Thom Building, Engineering Science*

## **Use of hydrogen peroxide and UV radiation as post-treatment for bleaching plant wastewater from a Kraft pulp mill**

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### **Abstract**

The author will present some results on the application of hydrogen peroxide and UV radiation as the treatment of effluents from a Kraft pulp bleaching plant that were submitted to an anaerobic pre-treatment. The objective of the oxidative process was to increase the biodegradability and to remove recalcitrant compounds from the wastewater. The pre-treatment was performed in a fixed bed horizontal anaerobic reactor (FBHAR) and removed  $(60\pm 3)\%$  of the COD,  $(90\pm 5)\%$  of the BOD<sub>5</sub>,  $(70\pm 9)\%$  of the TOC and  $(55\pm 15)\%$  of the AOX. As expected, the anaerobic reactor did not remove lignin; on the contrary its content measured as phenol increased after the treatment. Also double and triple bound compounds, as indicated by absorbency of UV<sub>254</sub>, were not removed efficiently with the biological treatment. For the post-treatment experiments, the anaerobic reactor operating conditions were kept constant. Hydrogen peroxide dosages ranged from 50 to 500 mgL<sup>-1</sup> while UV was applied from 0 to 60 min. In terms of the remaining concentrations, the oxidative treatment resulted in additional removal of up to 10% of the COD, 35% decrease of the compounds detected by UV<sub>254</sub> absorbency, 30% reduction of the lignin and 54% of the AOX. Concerning the increase in biodegradability all dosages of hydrogen peroxide increased the ratio BOD<sub>5</sub>/COD improving the biodegradability, which was further confirmed by means of batch aerobic treatment essays. The use of the oxidative treatment was necessary to reach the permissible emission level of AOX, set below 0.4 kg<sub>AOX</sub> per air-dried tonne of cellulose pulp. At the end of the seminar, the author will present an overview of the project on sustainability of wastewater treatment plants that will take place during his sabbatical in the UK.

## ***Bio-sketch***

Eduardo C. Pires is a Mechanical Engineer (1977) from the Engineering School of São Carlos, University of São Paulo. Has a MSc (1981) in Mechanical Engineering from the Pontifical Catholic University of Rio de Janeiro and a PhD (1985) in Civil Engineering (Hydraulics and Sanitation) from the Engineering School of São Carlos. From October 1985 to November 1987 acted as a Visiting Assistant Professor at Miami University in Oxford, OH, USA with works on environmental problems related to paper manufacturing as well as on the development of new specialty papers for nickel-hydrogen batteries. During the spring semester of the 1995/1996 school year returned to Miami University as a Visiting Associate Professor to teach dynamic modeling of mechanical systems. In 1993 was promoted to Associate Professor after a thesis defense on mathematical modeling of sludge dewatering using vacuum belt presses. He received the title of Professor in Hydraulics and Sanitary Engineering of the University of São Paulo in 2002, defending a model to describe the interaction of thermal stratification and the treatment efficiency of stabilization ponds. During the summer of 2000 he taught an undergraduate course on wastewater treatment for manufacturing engineering students at the University of Cincinnati, USA. He is currently Head of the Department of Hydraulics and Sanitary Engineering at the Engineering School of São Carlos. His research projects include the use of biological and advanced oxidative processes for industrial wastewater treatment and the sustainability of waste treatment plants.