Research Round Up

Title of the project: Degradation of Oestrogenic and Carcinogenic Substances in Water using Alternative Water Treatment Technologies

Project Leader: Rose Amal, Heather Coleman, Greg Leslie
Organisation: School of Chemical Sciences and Engineering, University of New South Wales, Sydney, NSW 2052
Contact Details: Heather Coleman
Phone: 02 9385 5947 **Fax:** 02 9313 8624 **E-Mail:** h.coleman@unsw.edu.au

Funding Body: Australian Research Council Linkage Project

Collaborating organisations: Orange County Water District, USA; National Water Research Institute, USA; CH2M Hill, Australia.

Key issue/s addressed:

- Removal of natural and synthetic oestrogens and 1,4-dioxane in water using advanced oxidation technologies for recycling applications.

Objectives:

- To investigate the advanced oxidation technologies (AOTs) - titanium dioxide photocatalysis, H_2O_2/UV and UV processes for the removal of natural and synthetic oestrogens and 1,4-dioxane in water.
- To determine if all oestrogenic activity is removed from water samples after treatment with AOTs, monitored using a yeast screen bioassay.
- To investigate different photocatalytic reactors, different photocatalysts (commercial and lab-made) and lamps (UVA, UVC and solar) in the photocatalytic process.
- Compare the photocatalysis process with the H_2O_2/UV process currently used by industrial partner Orange County Water District, USA.

Planned Outputs/Outcome (by when):

- Project completed in December 2006 – see 'key findings' below for outcomes.

Methodological approach:

- Photocatalytic reactors, a UVC disinfection reactor and a H_2O_2/UVC reactor set up for the degradation of natural and synthetic oestrogens and 1,4-dioxane in water.
- Analytical methods set up to monitor the degradation of the reactions – including on-line fluorescence spectroscopy, HPLC, an ELISA and a yeast screen bioassay as a test for oestrogenicity.
- Degradation of the reaction molecules were monitored using on-line fluorescence spectroscopy and HPLC.
- Removal of oestrogenic activity was monitored using the oestrogenic yeast screen bioassay.
- Different photocatalysts and reactors (magnetic photocatalyst, solgel reactor, commercial P25 photocatalytic reactor) were prepared and compared along with different lamps (UVA, UVC and solar).
- Varying concentrations of H_2O_2 in the H_2O_2/UV process were investigated and the optimum concentration determined.

Key findings so far:

- Advanced oxidation technologies (titanium dioxide photocatalysis, hydrogen peroxide/UV and UV light processes) are all capable of degrading oestrogens in water.
- For degradation of the oestrogens, hydrogen peroxide/UV was the most effective process, followed by titanium dioxide photocatalysis and finally UV light. For degradation of 1,4-dioxane, titanium dioxide photocatalysis was the most effective process, followed by hydrogen peroxide/UV and UV light alone.
- All processes are capable of removing oestrogenic activity from water samples containing oestrogens as monitored by a yeast screen bioassay.
- Titanium dioxide photocatalysis using solar illumination is effective for the degradation of oestrogens and 1,4-dioxane in water.

Please tick the relevant theme below:

Monitoring/ Analysis ☑ Exposure assessment ☐ Environmental Fate ☐ Effects ☐

Treatment Technology ☑ Risk Assessment ☐ Other ☐