PHOTOELECTROCATALYTIC TREATMENT OF COLORED EFFLUENTS

"Water is not only a heritage from our predecessors; it is, above all, an inheritance passed on to our successors. Its protection constitutes a vital need, as well as man's moral obligation to present and future generations."

– Universal Declaration of Human Rights to Water, UN –

Source: www.istockphoto.com

Idea | **Laboratory** | Pilot scale | Scale-up | Industrial scale

► Process

Description

A reactor containing nanoporous electrodes and a UV source arranged so as to promote photoelectrocatalytic reactions, degrading dyes and mineralizing organic compounds in effluents.

Problem

The removal of color from effluents is one of the major problems that industry faces due to the diversity of compounds with different functional groups and the high biological stability of industrial dyes.
This stability makes degradation by available natural and conventional systems difficult, generating acute and chronic toxicity of high environmental impact in the waters that receive these effluents.
The treatment processes currently employed include advanced oxidative processes such as Fenton and Photo-Fenton reactions, chlorine and ozone gas. The first two alternatives generate subproducts that must also be treated, such as toxic sludge, while the use of chlorine generates organochlorinated substances, including some not recommended by the Stockholm Convention (Teixeira, 2009).
Processes involving ozone gas are expensive due to its low stability, as well as its complex handling (Teixeira, 2009).

Proposed solution

A physicochemical effluent degradation process that can degrade effluents containing a variety of highly biologically stable functional groups such as dyes, using a reactor containing nanoporous TiO_2 electrodes and an UV light source to rapidly generate effluents with low organic matter content.

Benefits

- 90-100% discoloration;
- 40 – 80% mineralization;
- Higher treatment efficiency without generating subproducts;
- 50 – 60% reduction of chemical oxygen demand (COD);
- 20% higher reduction of total organic carbon;
- Better quality effluent that can be reused;
- 30 to 120 min of treatment time;
- More agile process;
- Does not depend on chemical reagents or additional biological processes;
- Lower effluent treatment cost.

Market potential

The environmental laws of most countries oblige manufacturers to treat their industrial effluents prior to discharging them into water bodies. This requirement leads to the demand for more efficient treatment technologies for industrial effluents, especially for those generated by the textile, tanning, pulp and paper, and chemical industries.
The global trade in textile products showed a turnover of US$ 218.6 billion in 2006, with a projected growth of 6% per year (Iemi, 2008; ABDI, 2009).
Brazil's manufacturing industry, which includes the abovementioned industries, showed a growth of 14.3% in just one year (Feb 2010 - Feb 2011) (CNI - National Confederation of Industry, 2011).
Brazil is the world's seventh larger manufacturer of all types of pulp and the first in the market of short fiber pulp.

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