Electrochemical treatment of swine wastewater for COD removal and hydrogen prodution

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# Materials and methods

## Characteristics of wastewater

Raw swine wastewater (fattening phase, RSW) was obtained from a pig farm located in Alentejo, Portugal, operating in a closed cycle, i.e, pigs are raised in a farrow-to-finish type. The effluents from the anaerobic digestion of the same wastewater (DSW) were obtained from batch assays carried out in serum bottles of 1000 mL, kept at a constant mesophilic temperature of 37 C. Both effluents were characterized and the values obtained are summarized in Table 1.

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| --- | --- | --- | --- |
| Parameter/Sample | Units | SW | AD |
|  |  |  |  |
| pH | - | 8.5 ± 0.0 |  |
| EC | mS.cm-1 | 38 ± 5 |  |
| TS | % | 0.9 ± 0.0 |  |
| TDS | mg.L-1 | 24500 ± 125 |  |
| COD | mg.L-1 | 23294 ± 125 |  |
| sCOD | mg.L-1 | 7018 ± 50 |  |

## Apparatus

A new electrochemical oxidation system used in this study was composed of a cylindrical reactor with 500 mL volume, anode, cathode, and DC power supplier (Fig. 1). A cylindrical Ti/IrO2– RuO2 anode with the diameter of 7 cm and height of 10 cm, a SS cathode with a length of 11 cm and width of 2.5 cm were im- mersed into 500 mL phenol contained solution. The applied voltage was controlled by a DC power supplier (APS 3005S). The voltage, current, and hydrogen gas produced were recorded every 24 h.

## Analytical methods

## Experimental design

To investigate the degradation of COD coupled with hydrogen gas production in solution, 300 mL of swine wastewater was feed into the electrolyzer. The effect of different electrolytes and current were conducted by using sodium sulfate, sodium chloride, sodium carbonate, sodium bicarbonate, sodium phosphate, disodium hydrogen phosphate, and sodium dihydrogen phosphate as the electrolyte with 500 mL phenol solution of 100 mg/L at 0.2 A and 0.5 A.

## FTIR studies

The Fourier transform infrared (FTIR) spectra of the dried RSW, DSW, and anode deposits post-electrolysis were obtained as a mean of 64 scans collected at a resolution of 4 cm−1 using an ATR-FTIR spectrometer(Nicolet 10, USA) in the in the wavenumber range from 4000–400 cm−1. Powdered samples were placed on the ATR crystal and compressed using a flat axial screw for analysis. The differences in spectral peaks were then evaluated.