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TREATMENT OF INDUSTRIAL WASTEWATER BY ELECTRON BEAMS

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The paper presents some of the results of viability studies on using high energy electron beams to clean industrial wastewater [1, 2].

Samples were collected from the publicly owned wastewater treatment plant which contains most of the industrial residues from São Paulo. They were irradiated by a batch system using Pyrex glass vessels (500 mL) at 20°C with doses from 0.5 to 100 kGy.

Electron irradiation was carried out using a Radiation Dynamics accelerator, at 1.5 MeV and currents in the range of 0.1 to 25 mA, to reach the desired doses, which were then measured with a cellulose triacetate film dosimeter.

The 'thickness' of the water layer (4 mm) and the mat velocity (6.72 m/min) were kept constant during irradiation. Using standard methods (APHA, AWWA and WPCF) for the examination of water and wastewater, the following analyses were performed before and after irradiation: apparent colour, true colour, total suspended

TABLE I. EFFECTS OF DOSE ON APPARENT AND TRUE^a COLOUR OF INDUSTRIAL WASTEWATER

Dose (kGy)	0	5	10	50
Sample				
Raw wastewater	3200 253 ^a	80 49 ^a	120 59 ^a	600 250 ^a
Primary effluents	3000 550 ^a	500 250 ^a	1300 250 ^a	1600 280 ^a
Biological treatment effluents	90 153 ^a	82 20 ^a	45 15 ^a	7.5 <2.5 ^a

^a Irradiated samples.

TABLE II. EFFECTS OF A DOSE OF 20 kGy ON CONVENTIONAL PARAMETERS

Samples	Units	Raw wastewater	Primary effluents	Biological treatment effluents
Apparent colour	—	450 250 ^a	400 200 ^a	1100 37 ^a
True colour	—	5 6 ^a	6 6 ^a	58 6 ^a
BOD	mg O ₂ /L	683 378 ^a	725 360 ^a	35 58 ^a
COD	mg O ₂ /L	1363 1426 ^a	1616 1476 ^a	313 253 ^a
Total suspended solids	mg/L	326 294 ^a	664 554 ^a	28 86 ^a
Turbidity	UFT	5.1 170 ^a	1.30 98 ^a	1.8 20 ^a

^a Irradiated samples.

solids, turbidity, biochemical oxygen demand (BOD) and chemical oxygen demand (COD).

From the measured values given in Table I, we observed an important reduction in the apparent and true colour in samples without any treatment, after primary treatment and in the effluent from biological treatment. It should be noted that after 5 kGy there is an increase in colour values of the primary and secondary effluents.

Table II gives the values of conventional parameters for the same points at a 20 kGy dose. It should be noted that there is a reduction in apparent and true colour at three points, and for effluents from biological treatment these values were 90% higher.

With regard to BOD, this value decreased by about 50% for the first and second parts of the treatment and increased in the last one, probably due to the presence of biodegradable subproducts. The same was observed for other parameters, such as total suspended solids and turbidity. When the effluents from biological treatment received different doses, the values for the apparent and true colour decreased as a function of the increased dose. The opposite was noted for turbidity and total suspended solids.

The studies performed with industrial wastewater effluents which contain soluble cutting fluid show that aeration at the same dose was reduced about 87% for oil and grease, suggesting that polar compounds were formed. It is important to note that the wastewater treatment plants do not remove mineral oil from these effluents.

The treatment process for industrial wastewater with high energy electron beams has great potential and additional research is required to improve this technique.

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