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TREATMENT OF SURFACTANTS IN THE FOAMING COLUMN

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1. INTRODUCTION

The previous research works [1-3] showed that in the foaming water column stressed by pulsed electrical discharge a simultaneous formation of hydrogen peroxide, dissolved ozone, OH radicals and of small amount of gaseous ozone occurs. These formed active species can be used for the treatment of the various dyes dissolved in water, such as ethyl violet, methylene blue, indigo blue and humic acid. This paper discusses the influence of various parameters on the treatment of surfactants by electrical discharge initiated in the dynamic water foam.

2. EXPERIMENTAL SET-UP

Foam was formed in the cylindrical column reactor, equipped with a ceramic diffuser located at the bottom of the column. The gas flow was perpendicular to the diffuser and determined the formation and quality of the foam. The coaxial electrode system consisted of a stressed needle electrode of 1.5 mm diameter located in the center of grounded ring-shaped electrode (40 mm of diameter, 30 mm of height) in the homogenous foam zone. The pulsed power supply was operated at various amplitudes and frequencies. Discharge voltage and current were measured using the high voltage and current probes coupled with an oscilloscope. The photograph of the reactor and sketch of the electrical circuit are depicted in Fig.1 and Fig.2.

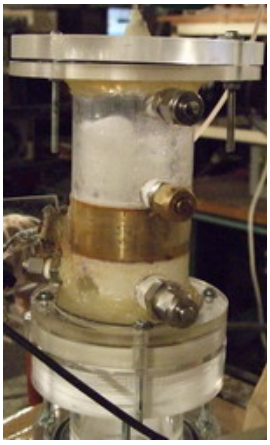

FIGURE 1. Discharge reactor.

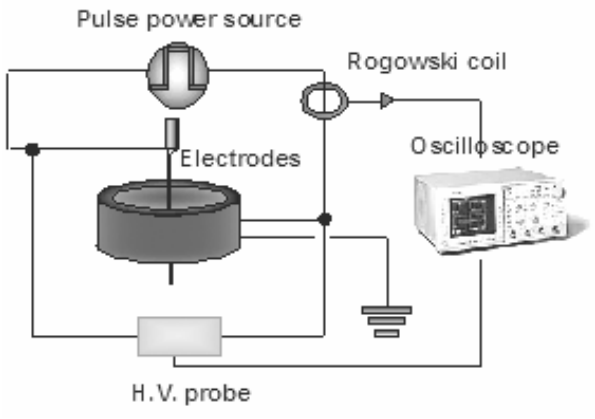

FIGURE 2. Electrical circuit.

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3. RESULTS AND DISCUSSION

Tween 20 (polyoxyethylene sorbitan monolaurate) [4], *Triton X-100* (polyoxyethylene octyl phenyl ether) and *P5NPE* (polyoxyethylene (5) nonyl phenyl ether) [5], the large molecule nonionic surfactants (Fig. 3), were chosen as the model pollutants. These surface active compounds of low toxicity have plenty domestic, medical and industrial applications as mild and non-denaturing detergents. They show excellent chemical stability, are good solvents of moderate foaming properties but they also have tendency to bioaccumulation.

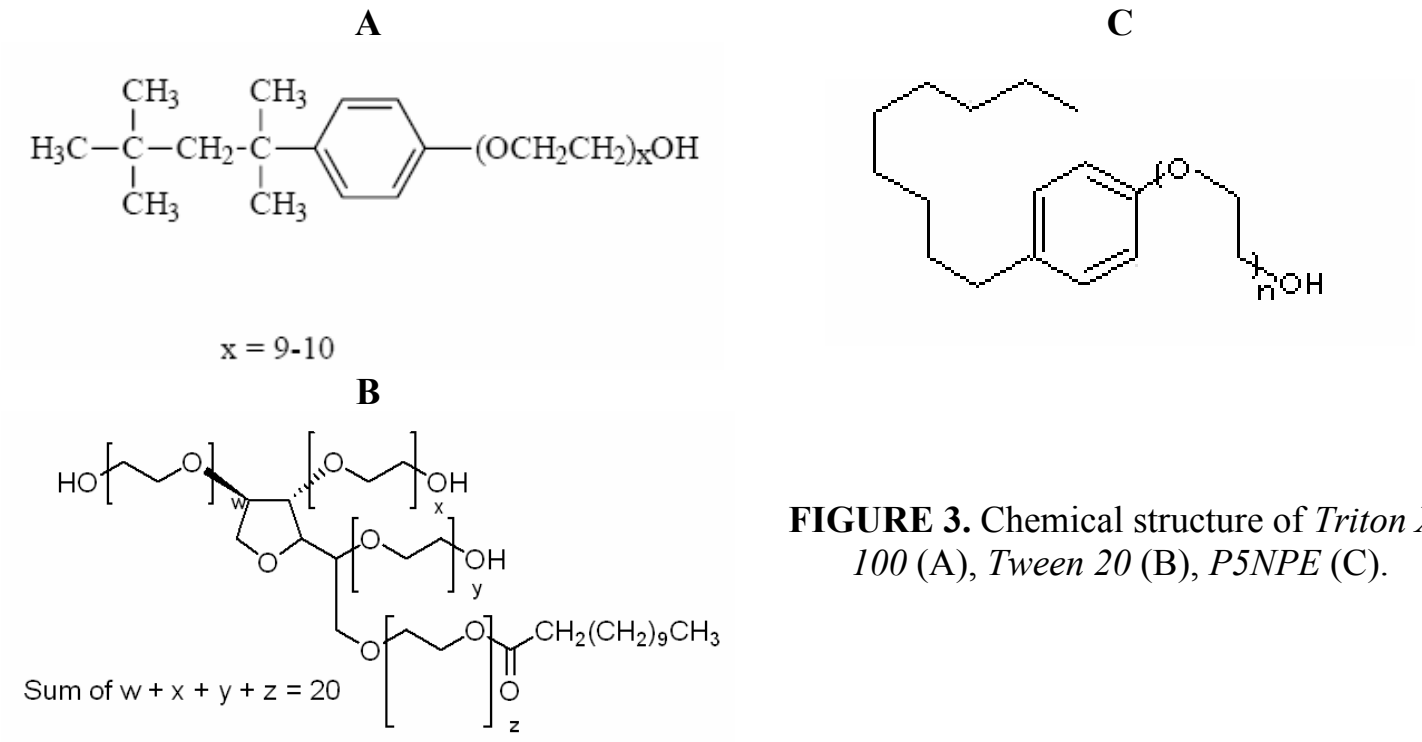

FIGURE 3. Chemical structure of *Triton X-100* (A), *Tween 20* (B), *P5NPE* (C).

Change of COD during the treatment by the discharge in foam was measured for each pollutant. For the high power input, the applied voltage of 17 kV, oxygen flow rate fixed at 1 l/min and after 20 minutes of the treatment, the 53%, 87%, 58% removal efficiency was achieved for 0.025% water solutions of *Tween 20*, *P5NPE*, and *Triton X-100*, respectively. However, at low applied voltages after the COD reduction in the first 10 minutes, the rapid increase of COD, exceeding the primary untreated value was, observed.

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