REMOVAL OF LINEAR ALKYLBENZENE SULFONATE (LAS) FROM WASTE WATER BY ELECTROCHEMICAL OXIDATION

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Domestic waste water is one of the important pollution sources affecting the water quality adversely in many developed countries. Especially waste waters containing detergents are among the basic constituents of organic pollutants and they cause great environmental damages by introducing into the soil, sears, lakes and rivers.

Detergents are the mixtures of surfactants and their isomers and preferred to soap because of their many superior properties. As a result of economic development and population growth, environmental problems caused by detergents are increasing day by day.

Surfactants can not be biologically degraded and become abundant into water bodies from domestic and industrial waste waters. This damages the natural balance of waters, threatens the health of aquatic organisms and humans who feed on them. For example linear alkylbenzene sulfonate (LAS) is a surfactant and is found in high amounts in domestic and industrial waste waters discharged from textile, leader, food, paint, polymer, cosmetics, mining, oil recovery and paper industries (1).

Besides the toxic effects of surfactants, their existence in water even under the toxic level causes many adverse effects on biological life. They cause pathological, physiological and biochemical effects on aquatic animals. In aquatic plant species, they cause the break-up of the chlorophyll-protein complex, death of the cell by damaging the membrane.

Advanced treatment technologies need to be applied to treat the surfactants to be discharged to receiving environments. Because biological treatment techniques require long time and cause to increase the cost they are considered not to be effective. Electrochemical techniques have an important role among these advanced technologies and applications.

In this study, electrochemical oxidation of surfactants has been carried out in a bipolar trickle tower reactor. The reactor consists of the two concentric glass pipes with the diameters of 4 cm. and 2.5 cm. Ruthenium oxide rashig rings were placed in the inner glass pipe as bipolar electrodes to be consisted of 28 layers.

Linear alkylbenzene sulfonate (LAS) was used as the surfactant. Model water was prepared by distilled water to have 50 mg L^{-1} initial surfactant concentration. To increase the conductivity of the solution which was initially 60 µs cm^{-1}, sodium sulfate (Na_2SO_4) with varying concentrations was added. The effects of initial surfactant concentration, current, flow rate and supporting electrolyte concentration were investigated.

As a result of the studies, the removal of surfactant of 50 mg L^{-1} was achieved with an efficiency of 94 % and energy consumption of 12.55 kWh g^{-1} at 5.6 mL min^{-1}. In an earlier study by Leu et all.(2), it was reported that the LAS concentrations needed to be limited to 10 mg L^{-1} due to foaming problem. Therefore electrochemical oxidation of 10 mg L^{-1} LAS, which is the most widely used concentration, was achieved with the removal efficiency of 90 % at the flow rate of 100 mL min^{-1} and the current of 0.5 A in this work. The concentration has decreased below the suggested concentration of 2 ppm with an energy consumption of 1 kWh g^{-1}.

References

(1) Hellston, M., Industrial Applications of Nonionic Surfactants, In Industrial Applications of Surfactants, ed. Karsa, D.R., The Royal Society of Chemistry, London, 1986.
(2) Leu, H.G., Lin, S. H. and Lin, T. M., Enhanced of Electrochemical Oxidation of Anionic Surfactants, J. Environmental Science and Technology, A33(4), 681-699, 1998.