Determination of iodide by volumetric titration in support of the oil eletrolabeling with ^{123}I

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In oil industry and petrochemical plants the radiotracer methodology is one of the most appropriate techniques for analyzing the flows of organic compounds and for the identification of any fault in the plant´s operation. For success in using a tracer, it is necessary that it presents the same or similar characteristics of the labeled material [1].

This report presents a study which aims to develop an electrochemical technique for oil labeling with iodine-123 and to determine the yield of production by measuring the concentration of iodide (I^-) during this process. The volumetric titration technique was applied as a basis for quantitative and qualitative measures to monitor the labeling process.

The labeling of organic compounds by the addition of iodine involves the production of elemental iodine (I_2). Among the existing methods for obtaining I_2 from the sodium iodide (NaI) [2], the emphasis will be on the electrochemical oxidation method. This technique involves cation I^+ generation from the electrochemical oxidation reaction.

The electrochemical oxidation technique has the advantage of determining the rate of formation of I_2 and this operation can be monitored by controlling the electric current supplied to the reaction cell. In addition, in procedures that require the application of radioactive iodine (I-123), the radiation exposure can be minimized, because the use of solutions with low iodine concentration is possible.

The volumetric titration method by precipitation is best suited to achieve the desired results while measuring and controlling the concentration of iodide during the oil labeling process. In this study, the precipitation method (Fajans Method) employed a silver nitrate solution ($AgNO_3$) 0.1 mol/L [3]. To determine the yield of the reaction from the use of iodide ions in the aqueous phase, the system was stirred so that the elemental iodine generated by the electrochemical process could be transferred to the organic phase. After separation of the phases, samples were taken in triplicate of samples of the aqueous electrolyte phase. The results expressed in figure 1 were obtained from the calibration curve.

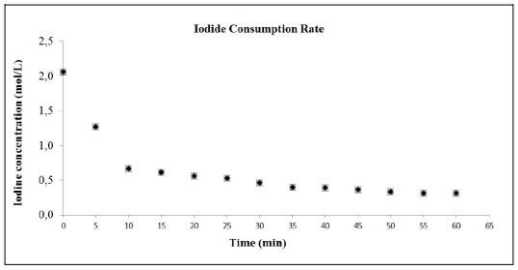

Figure 1: Consumption rate of iodide ions during the electrochemical process.

As noted in the initial stage of t = 0 to t = 10 minutes, the concentration corresponded to 2,062mol/L of iodide. Between t = 15minutes to t= 40 minutes there is a slight decrease in the consumption of iodide ions and a mean concentration of 0.493mol/L of this ion in aqueous solution was observed. Finally, in the interval from t= 45 minutes to t = 60minutes, there is stability of the system, with a final concentration of 0,315mol/L iodide. The results indicate that the technical proposal is a viable alternative for monitoring electro labeling processes of lubricating oils with iodine -123.

Future studies will evaluate the influence of the electrolyte solution pH and the change in system temperature to the income of the electrochemical reaction [4]. As regards more accurate measurements, a quantitative method will be studied for the determination of the elemental iodine concentration in the organic phase. The low cost of the reactants involved, the simplicity of the application of the analysis technique by volumetric titration, the low complexity of the experimental arrangement proposed - to carry out the electrochemical process - and the versatility of the application of the radiotracer indicated stand out as the greatest benefits to applying the methodology proposed.

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