THE ESTABLISHMENT OF METROLOGICAL CHARACTERISTICS OF THREE ANALYTICAL METHODS DURING THE QUANTIFICATION OF VOLATILE COMPOUNDS IN ALCOHOLIC PRODUCTS

Anton Korban\textsuperscript{1,2}, Siarhei Charapitsa\textsuperscript{1}, Svetlana Sytova\textsuperscript{1}

\textsuperscript{1} Institute for Nuclear Problems of Belarusian State University, Belarus
\textsuperscript{2} Faculty of Chemistry, Belarusian State University, Belarus

karbonat7@gmail.com

Six standard solutions of volatile compounds in water-ethanol mixture were prepared gravimetrically. These solutions were analysed with three analytical methods: traditional method of internal standard (IS), advanced method of IS and external standard (ES) method. The advanced IS method is called “Ethanol as Internal Standard” and consists in the calculation of relative response factors (RRF) relatively ethanol [1]. The absence of the necessity of IS compound artificial addition and the determination of alcohol by volume content makes the method “Ethanol as Internal Standard” technically better.

The main features of the two most used analytical methods and advanced one were determined by the interlaboratory experiments. Such important analytical characteristics as relative standard deviation (RSD), limit of quantification (LOQ) were obtained for each of the nine most spread volatile impurities. All the experimental data was obtained through the gas chromatography measurements, as it is indicated in the regulatory document [2].

Relative bias, as one of the most demonstrative parameter, which shows the accuracy of a method was calculated for five prepared standard solutions (except one solution used as a calibration point) according to the formula:

\[
\text{bias, } \% = \frac{|C_i (mg/L AA) - C_i^\text{ref} (mg/L AA)|}{C_i^\text{ref} (mg/L AA)} \times 100\% \tag{1}
\]

Then the demonstrative histograms of relative biases of the three methods were obtained. Each line is relevant to a single analytical method. Lower biases of a method cause smaller area of polygon. Two used IS methods showed high similarity in bias values relatively each other. Oppositely, ES method polygon generally appeared to be quite bigger than the polygons of IS methods. In addition, RSD and LOQ values for ES method had greater values. This can characterize ES method as the worst method among used in the experiment.

Fig. 1. The example of obtained histogram of biases (%) comparison of three analytical methods.

Analysis of obtained data shows that advanced method of internal standard is comparable with traditional one from analytical point of view. It was showed that this method is robust and can be applied at a great range of volatiles concentrations: from few to more than 5000 mg/L of absolute alcohol. As the result direct quantitative determination of volatile compounds in alcoholic products becomes cheaper faster and easier when the method “Ethanol as Internal Standard” is applied.
