Short Reports

THE RESERCH OF QUANTITATIVE CONTENT OF ORGANIC ACID IN MULTIVITAMIN PLANT COLLECTION

[1]Marakhova A.I., [2]Sergunova E.V., [1]Stanishevskiy Ya.M.

[1]Peoples Friendship University of Russia, Moscow, e-mail: agentcat85@mail.ru; [2]I.M. Sechenov First Moscow State Medicinal University, Moscow

The article presents the results of a quantitative analysis of organic acids in the multivitamin plant collection № 2. The authors have developed a method of potentiometric titration of the amount of organic acids and ascorbic acid. The results are compared with the data of the indicator and coulometry titration. The advantage of using a potentiometer to more accurately establish the endpoint is proved.

Currently vitamin preparations are very popular. Vitamins are present in large amounts in the medicinal plant raw materials (PRM), predominantly accumulated in fruits. Plant vitamins are better absorbed by organism than synthetic analogs [1].

Multivitamin plant collection № 2 consists of fructus Rosae and fructus Sorbi in equal proportions. It is a source of vitamins such as K, B_2, P, carotenoids. Some of them, such as ascorbic acid, pass into infusion. A second hydrophilic group of compounds of the collection are organic acids [1]. They are involved in the metabolic processes, in the Krebs cycle, raise the tone. Quality score pH value of remedies with acidic reaction is important, because it is contraindicated to patients with gastritis and peptic ulcer gastrointestinal tract [1, 2].

In Russia, the quality of multivitamin collection № 2 regulated by normative document ND-42-0426382103, has not changed since 2004 [3]. It is clear that the documents requires a revision because of the development of the instrumental base and increase the quality requirements of drugs.

Standardizing of the Multivitamin plant collection № 2 is logical to carry out on compounds constituting the hydrophilic fraction and predominantly in the raw material, such as ascorbic acid and the sum of organic acids. Modern physico-chemical methods should be used for this purpose [2].

In connection with the above, purpose of the study was the quantitative determination of the amount of organic acid and ascorbic acid in the multivitamin plant collection № 2 and its components by different physico-chemical methods.

Materials and methods of research. The objects of study were industrial samples of fructus Rosae and fructus Sorbi, multivitamin plant collection № 2 and the infusion prepared from it. Infusion prepared in accordance with the general pharmacopoeial article «Infusions and decoctions» of Russian Pharmacopoeia (RP) XI Ed., Vol. 2, P. 147–148.

Determination of pH of aqueous extracts was performed using the pH meter Seven Excellence ™ (METTLER TOLEDO). Quantitative determination of the amount of organic acids and ascorbic acid were carried out by titration using indicators according to the procedure provided in Article 38 of the private pharmacopoeial article «Fructus» RP XI Ed., Vol. 2, P. 294–297 and [4]. Determination of free organic acid by potentiometric titration was performed using the pH meter Seven Excellence ™ (METTLER TOLEDO). Determination of the amount of organic acids was carried out by coulometric titration using the device, «Expert-006» at a current of 5 mA.

Results of research and their discussion

Quantitative determination of ascorbic acid. The results of the content of ascorbic acid in the multivitamin collection and its components obtained by titration with sodium 2,6 – dichlorphenolindophenol (2,6-DCPIP Na) and titration by potassium iodate are presented in Table 1.

Data in table 1 shows the convergence of the results obtained by different methods. Therefore, the amount of ascorbic acid in the multivitamin plant collection № 2 and its components may be determined by titration by potassium iodate.

Quantitative determination of the amount of free organic acids. Potentiometric titration of the amount of organic acids was carried out by the following procedure.

Table 1

Content of the amount of ascorbic acid in the multivitamin plant collection № 2 and its components ($n = 5$; $p = 0,95$)

Herbal raw material	Fructus Rosae	Fructus Sorbi	Multivitamin collection № 2
titration with 2,6-DCPIP Na	0,20 ± 0,01 %	0,23 ± 0,01 %	0,20 ± 0,01 %
titration by KIO_3	0,18 ± 0,04 %	0,21 ± 0,01 %	0,18 ± 0,04 %

Table 2

The summary content of organic acids in terms to malic acid in the multivitamin plant collection № 2 and its components ($n = 5$; $p = 0,95$)

Method	Analyzing object	The summery content of organic acids, %
Titration with indicators	Fructus Rosae	2,87 ± 0,01
	Fructus Sorbi	3,78 ± 0,02
	Multivitamin plant collection № 2	3,06 ± 0,02
Potentiometric titration	Fructus Rosae	2,79 ± 0,02
	Fructus Sorbi	3,68 ± 0,08
	Multivitamin plant collection № 2	3,01 ± 0,06
Coulometric titration	Fructus Rosae	2,60 ± 0,05
	Fructus Sorbi	3,59 ± 0,07
	Multivitamin plant collection № 2	3,15 ± 0,08

About 25 grams (accurately weighed) of raw material, milled to a particle size passing through a sieve with openings of 2 mm diameter were placed in a 250 ml flask, was poured 200 ml of purified water and allowed to stand for 2 hours on a boiling water bath under backflow condenser. Then extraction was cooled, filtered, transferred to a volumetric flask of 250 ml. The volume of extract was adjusted to the mark with water and mixed (solution A). By the pipette were measured 25 ml of solution A in a measuring cup, dropped a glass and silver chloride electrodes are connected to the appropriate terminals on ionometer. The solution titrated by 0,1 M sodium hydroxide solution using a microburette with constant stirring. Fixed pH values. According to the results of the titration curves were constructed in coordinates $pH = f(V)$ for the determination of the equivalence point. For more accurate determination of the equivalent volume constructed differential titration curves in the coordinates $dpH/dV = f(V)$. Calculation carried by the formula:

$$X = \frac{V \cdot 0,0067 \cdot K \cdot 250 \cdot 100 \cdot 100}{V_a \cdot m \cdot (100 - W)},$$

where 0,0067 – amount of malic acid of 1 ml of sodium hydroxide (0,1 mol/l) in grams; V – the volume of sodium hydroxide solution (0,1 mol/L) was spent on titration in ml; K – correction factor; V_a – the amount of extract taken for titration, in ml; m – mass of raw material, in grams; W – loss on drying, in percent; 250 – volume of the extract, in ml.

Integral and differential curves of organic acids titration in infusion of the multivitamin collection is presented in Figure 1 and 2, respectively.

Coulometric titration is carried out by the following procedure. 50 ml of electrolyte solution (100 ml of saturated K_2SO_4 solution was adjusted with purified water to a volume of 800 ml (ratio 1:7)) were measured to beaker. After generation of hydroxide ions introduced pipetted aliquot of solution A ($V_a = 0,5$ ml). Titration was performed by hydroxide ions generated at the electrode. The percent content of free organic acid reference to the malic acid (X) in absolutely dry raw material was calculated by the formula:

$$X = \frac{x \cdot 10^{-6} \cdot 250 \cdot 100 \cdot 100}{V_a \cdot m \cdot (100 - W)},$$

where x – coulometer indications, the content of organic acids in referens to malic acid in micrograms; V_a – the amount of extract taken for titration, in ml; m – mass of raw material, in grams; W – loss on drying, in percent; 250 – volume of the extract, in ml.

Results of the quantitative determination of organic acids sum in the multivitamin plant collection № 2 and its components obtained by different methods are presented in the Table. 2.

The data in Table 2 show the comparability of the results obtained by potentiometric, coulometric titration, and titration with the indicator. Potentiometery and coulometry can be used for standartisation of the multivitamin plant collection № 2 and its components. Using of indicators can lead to errors in determining the endpoint because of its visual assessment.

Conclusion

The possibility of ascorbic acid titration in multivitamin plant collection and its components by potassium iodate is showed. A potentiometric and coulometric titration method for summery determination of organic acids was developed. It was shown the advantage of instrumental methods over the titration using the indicator.

References

1. Sergunova E.V., Samylina I.A., Sorokina A.A. Research about standardization of plant compositions with fructus Rosae // Farmatcia. – 2004. – P. 16–17.

2. Marakhova A.I. The use of physical and chemical methods in the analysis of raw medicinal plants of the family Lamiaceae // PHD diss. – Perm, 2009. – 24 p.

3. Pharmacopeia USSR: Ed. 2. General methods of analysis. Herbal raw materials // MH USSR. – 11-th ed. – Moscow: Medicine. 1987. – 400 p.

4. Hudhes Davi Emlyn. Titrometric determination of ascorbic acid with 2,6-dichlorphenolindophenol in commercial liquid diets // J. Pharm. Sci. – 1983. – Vol. 72. – P. 29–34.