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Indicator Properties of Ferulic Acid Derivatives as a Basis for Its Determination

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Relevance:

Hydroxycinnamic acids and flavonoids are secondary plant metabolites with established pharmacological activity. The similarity of chemical structures and the proximity of physico-chemical properties is due to a single pathway of biogenesis, with hydroxycinnamic acids preceding flavonoids. This makes it impossible to selectively extract one of these phenylpropanoid groups without co-extracting the other, using any extraction methods, which makes it difficult to determine them. The methods presented in SP XV for the determination of hydroxycinnamic acids contain a mandatory step for their separation from related compounds. One of the possible ways to optimize sample preparation for spectrophotometric analysis of hydroxycinnamic acids is to convert them into colored nitrogen products with established physico-chemical characteristics.

The aim is to investigate the possibility of determining ferulic acid in the presence of quercetin through the indicator properties of its derivatives.

Materials and methods

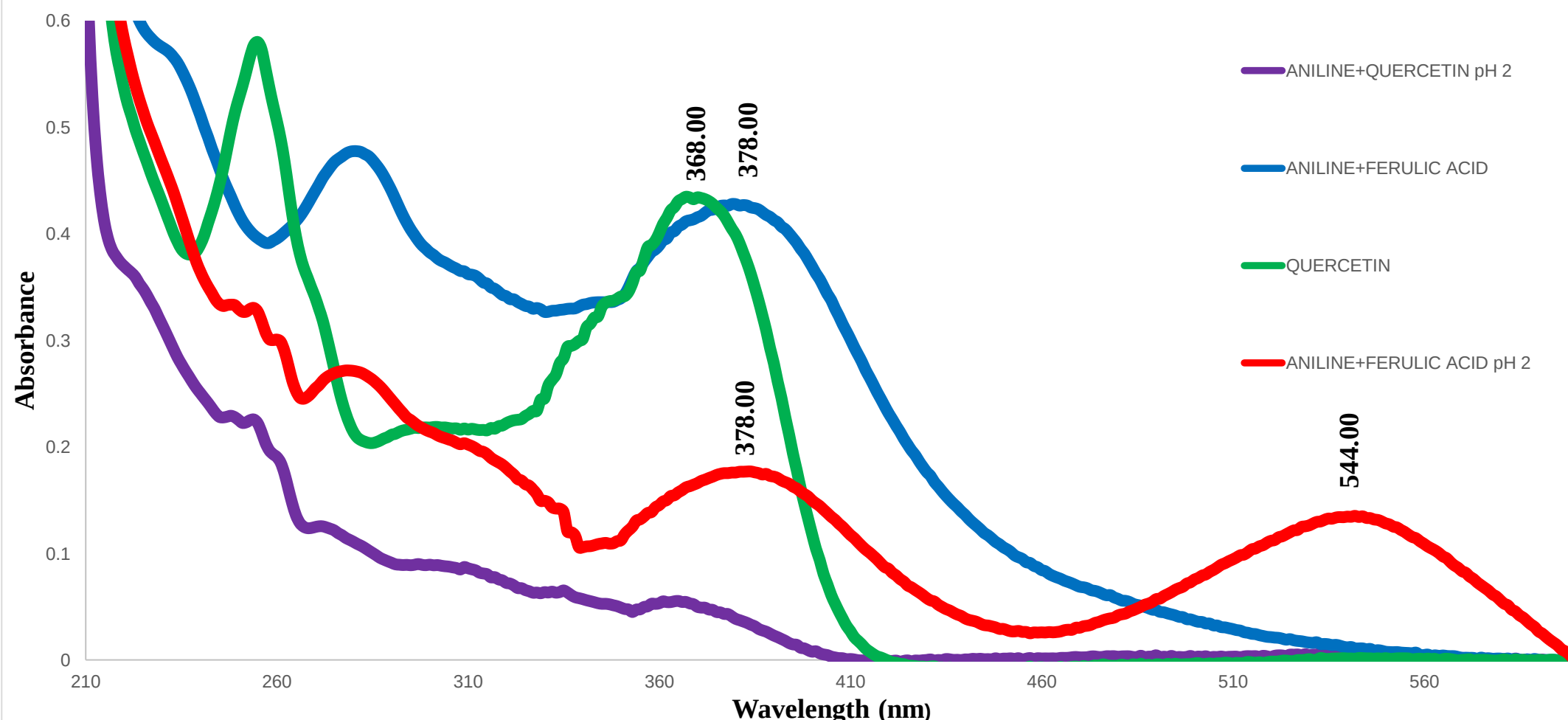
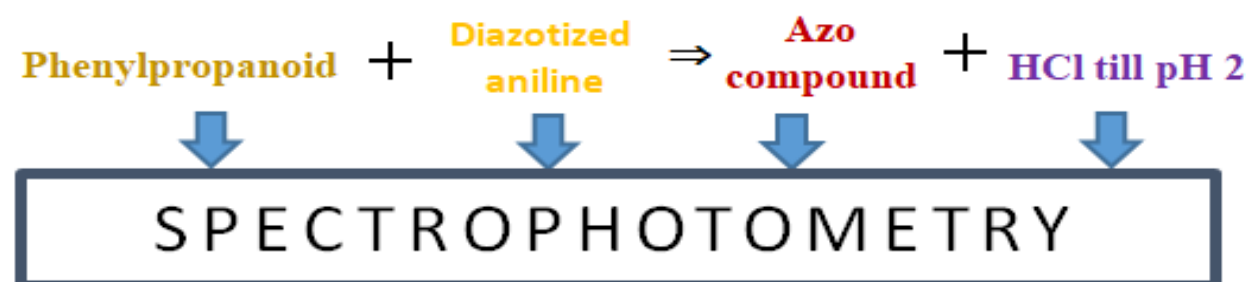
The following substances were used in the work: quercetin (Chemical Solutions LLC), ferulic acid (Chemical Solutions LLC) aniline (Chemical Solutions LLC). The Cary 100 spectrophotometer. Diazotization of aniline and its subsequent nitrogen combination with ferulic acid were performed. 32 ml of 0.1M HCl solution, 6.4 ml of NaNO₂ from a sample of 0.0856 g, 32 ml of 0.1 M Na₂CO₃ solution, 0.3881 g ferulic acid, 91 µl aniline. A NaNO₂ solution was added drop by drop to a pre-cooled aniline solution in hydrochloric acid in an ice bath, aged for 15 minutes and mixed with a solution of ferulic acid and Na₂CO₃. A mixture with quercetin was prepared in the same way. In both cases, a red-brown precipitate was formed. The resulting precipitate was filtered under vacuum, dissolved in acetonitrile, and spectroscoped. The pH of the obtained solutions was adjusted to 2 with hydrochloric acid and re-spectroscoped. A color change in a test tube with ferulic acid to crimson was visually observed.

Conclusions

The appearance of a band of 540 ± 5 nm due to the characteristic absorption of the azo compound of ferulic acid and aniline at pH 2 can be used for the spectrophotometric determination of ferulic acid in the presence of quercetin.

Results and Discussions

Superposition of phenylpropanoid spectra and their derivatives



A bathochromic shift with an absorption maximum at 540 ± 5 nm is observed in the spectra of acidified to pH 2 solutions of the azo compound of ferulic acid and aniline, which is absent in the spectra of ferulic acid, quercetin and acidified to pH 2 solutions of the azo compound of quercetin and aniline. The curve describing the spectrum of a model mixture of ferulic acid and quercetin, subjected to nitrogen combination with aniline and brought to pH 2, has well-spaced maxima of 380 ± 5 nm and 540 ± 5 nm after the end of the reaction, reaching the baseline between them.