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ABSORPTION SPECTRA OF SOME PENTACYCLIC TRITERPENOIDS IN SULFURIC ACID

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Concentrated sulfuric acid is widely used for the identification of many organic compounds, particularly in the study of the absorption spectra of cardiac glycosides and their aglycones [1, 2].

With triterpenoids, concentrated sulfuric acid in the pure form and also in admixture with other compounds gives colored reaction products [3].

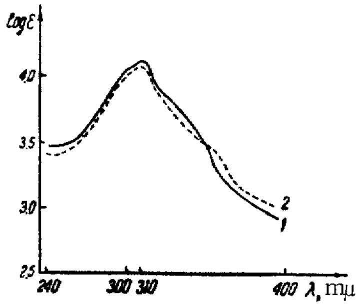

Fig. 1. Spectra of ursolic (1) and oleanolic (2) acids in sulfuric acid.

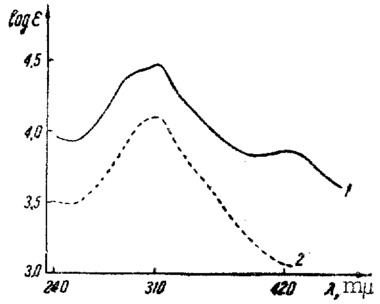

Fig. 2. Spectra of uvaol (1) and amyrin (2) in sulfuric acid.

Brieskorn and Capuano [4] found that the action of sulfuric acid on triterpenoids led to the dehydration of the molecule of the triterpenoids with the formation of diene derivatives containing conjugated double bonds in rings C and D of the triterpenoid molecules.

We have considered the possibility of identifying certain triterpenoids from their absorption spectra in the UV region.

Samples of the substances weighing 0.4 mg were dissolved in 10-ml portions of concentrated sulfuric acid (sp. gr. 1.835). The resulting solutions were thermostated at 60° C for 15 min. After cooling, the reaction mixtures were subjected to spectroscopic investigation relative to pure sulfuric acid. To determine the time in which the reaction proceeded to completion, the spectra were recorded after each hour. It was found that the reaction of sulfuric acid with the triterpenoids proceeds for 12-14 hr and therefore the spectra were taken 12 hr after the substance had been dissolved in sulfuric acid.

As representatives of the pentacyclic triterpenoids we used uvaol, ursolic acid, β-amyrin, oleanolic acid, lupeol, taraxerol, and fridelanol. The spectra of these substances in concentrated sulfuric acid are given in Figs. 1-3. It can be seen from the figures that in sulfuric acid these triterpenoids have a characteristic absorption band at 310 mμ. This is apparently due to the appearance of conjugation in rings C and D of the triterpenoids. Ursolic acid and uvaol-α-amyrin derivatives-undergo similar changes in sulfuric acid. They are characterized by an inflection in the spectral curve in the 300-305 mμ region.

The structures of ursolic acid and uvaol differ in the replacement of a carboxy group at C_{17} by a hydroxymethylene group, which evidently causes the appearance of a second maximum in uvaol at 410 mμ.

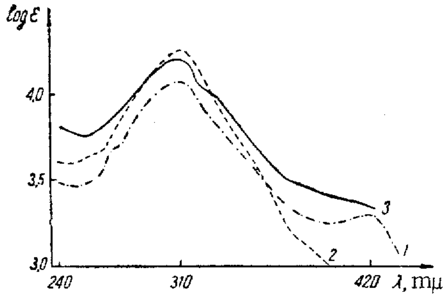

Fig. 3. Spectra of lupeol (1), fridelanol (2), and taraxerol (3) in sulfuric acid.

Oleanolic acid, which is isomeric with ursolic acid, differs from the latter by the arrangement of methyl groups in ring E. It is possible that this difference explains the absence of an inflection in the spectrum of oleanolic acid at 300–305 mμ found in ursolic acid. Oleanolic acid belongs to the β-amyrin series. β-Amyrin has no inflection in the 300–305 mμ region, either.

Lupeol belongs to the triterpenoids in which ring E is a five-membered ring and the side chain at C_{19} has one unsaturated bond. The spectrum of lupeol has a second maximum in the 420 mμ region. Below we give the values of log ε and the concentrations of the triterpenoids studied.

Substance	Concentration, mole/l	Log ε
Ursolic acid	$8.73\ 10^{-6}$	4.11
Oleanolic acid	$8.73\ 10^{-6}$	4.08
Uvaol	$9.0\ 10^{-6}$	4.47
β-Amyrin	$9.37\ 10^{-6}$	4.10
Lupeol	$9.37\ 10^{-6}$	4.07
Taraxerol	$9.37\ 10^{-6}$	4.20
Fridelanol	$9.32\ 10^{-6}$	4.25

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