Sample prep-free determination of Arginine and Taurine in shampoo by using TLC-MS

Abstract

The application of modern thin-layer chromatography (TLC) offers a lot of advantages especially in the field of cosmetics. The ingredients can usually be separated directly from complex matrices and many samples can be analysed quickly and simultaneously under exactly the same conditions.

Below the analysis of taurine and arginine in shampoo is described. Because of the high matrix tolerance of TLC, only a minimum of sample preparation is necessary to detect the analytes in shampoo. Quantification is shown by densitometry and straight forward mass analysis is performed by coupling the TLC-MS Interface from Camag with an ESI mass detector.

Results

The developed TLC plates were treated with ninhydrin spray reagent to derivatise arginine and taurine and make it visible under white light. While taurine was observed at an hRf value of 24, arginine showed no mobility under the used conditions and was located at an hRf value of 0. Therefore only taurine was used for quantitative evaluation. By using the peak area, a triple determination of the shampoo sample and a 3-point calibration, the amount of taurine was determined to be 75 mg, based on the amount of cosmetic formulation used. This corresponds to the usual amount of 0.1% active ingredient in a formulation. Chromatographically separated TLC plate is shown after derivatisation in Figure 1a. By comparison of the shampoo sample to standards, band positions of arginine and taurine could be determined. Figure 1b shows the observed arginine and taurine signals on the TLC scan at 600 nm examining track 6.

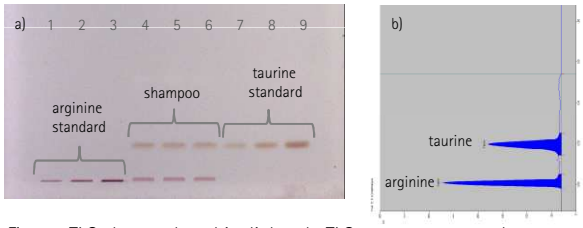

Fig. 1a: TLC plate under white light, 1b: TLC scan at 600 nm, chromatographic data shown on next page.

For assignment of the bands of interest mass spectrometry with an mass detector was performed after elution of the sample zone with the TLC-MS Interface. The mass spectra show the molecules at m/z 175.2 for arginine (Fig. 2) and m/z 124.1 for taurine (Fig. 3).

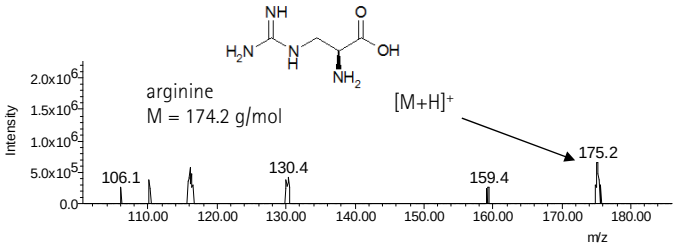

Fig. 2: Mass spectrum and structure of arginine, recorded at an hRf value of 0 at track 4, measured with positive ionization.

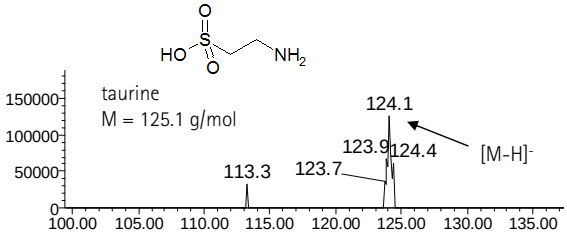

Fig. 3: Mass spectrum and structure of taurine, recorded at an hRf value of 24 at track 4, measured with negative ionization.

Conclusion

These results demonstrate that arginine and taurine can easily be measured by TLC-MS without the need of complex sample preparation.

Application data

Chromatography	Plate	HPTLC Silica gel 60 F_{254} MS-grade, 20x10 cm
	Sample preparation	15 min. stirring in 2-Propanol, filtration
	Sample application	ATS 4 sample applicator (Camag), 6 mm bandwise
	Application volume	0.5 – 5 µL
	Mobile phase	2-Propanol / Water (8/2 v/v)
	Migration distance	5 cm
	Migration time	50 min
Extraction	Extraction equipment	"TLC-MS Interface" from Camag
	Extraction solvent	Acetonitrile / Water (95/5 v/v) + 0.1% Formic acid
	Extraction flow	0.1 mL/min
Detection	Documentation equipment	documentation unit Reprostar / Digistore (Camag)
	Wavelength	white light, 600 nm
	Staining	Ninhydrin spray reagent
	MS equipment	single-quadrupole mass spectrometer
	MS detection	ESI (+/-) mode MS (m/z 100 – 500)

Chromatographic data

Track	Compound	Conc. [mg/mL]	Application volume [µL]	hRf	Detected mass m/z
1-3	Arginine standard	0.10	0.5, 1.0, 2.0	0	175.2
4-6	Shampoo sample	-	5.0	0/24	175.2 / 124.1
7-9	Taurine standard	0.10	0.5, 1.0, 2.0	24	124.1

Ordering information

HPTLC Silica gel 60 F_{254} MS-grade, 20x10 cm	1.00934
Acetonitrile hypergrade for LC-MS LiChrosolv®	1.00029
2-Propanol gradient grade for liquid chromatography LiChrosolv®	1.01040
Formic acid for analysis EMSURE®	1.00264
Ninhydrin spray solution for thin-layer chromatography	1.06705
Water for chromatography (LC-MS Grade) LiChrosolv®	1.15333
Millex®-FH filter, 0.45 µm hydrophobic PTFE, 25 mm, non-sterile	SLFH025NS