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Review Article

Thin-Layer Chromatographic Analysis of Steroids: A Review

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Abstract

Thin layer chromatography has been used for the analysis of natural and synthetic steroids in various environmental materials. This review focuses mainly on steroid analysis in environmental materials such as pharmaceuticals, plant products and other biological specimens. The most widely investigated biological specimens are urine and blood plasma or serum. Various chromatographic systems useful for the identification; separation and quantification of surfactants are also reported in this review.

Keywords: *Steroids; Thin layer chromatography; Environmental materials; Biological specimens*

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INTRODUCTION

Steroids are terpenoid lipids characterized by the sterane or steroid nucleus: a carbon skeleton with four fused rings, generally arranged in a 6-6-6-5 fashion. Steroids vary by the functional groups attached to these rings and the oxidation state of the rings. The specificity of their different biological actions is due to the various groups attached to a common nucleus. When alcohol groups (OH) are attached, steroids should properly be called sterols (e.g., cortisol), whereas ketone groups (C=O) make them sterones (e.g., aldosterone).

Steroids comprise a large group of substances that mediate a very varied set of biological responses. The most widespread in the body is cholesterol, an essential component of cell membranes and the starting point for the synthesis of other steroids - sex hormones, adrenal cortical hormones, and the bile salts. Steroids (e..g., glucocorticoids, mineralocorticoids, androgens,estrogens and progestagens) have major responsibilities as hormones, controlling metabolism, salt balance, and the development and function of the sexual organs as well as other biological differences between the sexes. Steroids in the form of bile salts (e.g., salts of cholic and deoxycholic acid and their glycine and taurine conjugates) assist in digestive processes, while another steroid is a vitamin (calcitriol) that takes part in calcium control. Steroids (naturally occurring or synthetic) such as methylprednisolone, hydrocortisone, gluco-cortisteroids, corticosteroids, squalamine, oestrogens, androgens, are also used for the treatment of various diseases such as allergic reactions, arthritis, some malignancies, and diseases resulting from hormone deficiencies or abnormal production. In addition, synthetic steroids (e.g., mifepristone) that mimic the action of progesterone are widely used as oral contraceptive agents. Other synthetic steroids (e.g., oxandrolone) are designed to mimic the stimulation of protein synthesis and muscle-building action of naturally occurring androgens. Steroids, such as nandrolone, dromostanolone, stanozolol, are often used illegally to increase the performance of competitive athletes of almost all age groups. They are banned in most sports competitions such as the Olympic Games.

Classification of Steroids

Steroids have been classified into a number of groups by Scott [1] based on their functions as follows: (i) sterols and steroid alcohols, usually with double bonds; (ii) sex hormones - steroids produced mainly in the testis (androgens) or ovary (estrogens); (iii) adrenocortical hormones - steroids produced in the cortex of the adrenal gland; (iv) bile acids - steroids usually bonded to taurine or glycine and functioning as emulsion-stabilizing agents in the intestine; (v) sapogenins - plant products with a steroid bonded to carbohydrates; (vi) cardiac glycosides - plant products similar to sapogenins and used as heart stimulants; and (vii) vitamin D

ANALYSIS OF STEROIDS

Many procedures used for the quality control and quality assurance of steroids are based on classical methods of analysis. However, the need for improved precision and accuracy has led to the increased use of instrumental analysis. Thus, the development of fast and reliable analytical methods for quality control, including the identification of synthesis by-products and purity tests, are both important and challenging. Thin-layer chromatography (TLC) continues to be an important method for qualitative analysis of steroids because of its inherent advantages - many samples can be analyzed simultaneously and quickly, and multiple separation techniques and detection procedures can be applied. This review presents the contribution of thin-layer chromatography in the analysis of steroids from 1990-2009. It addresses most aspects of thin-layer chromatography, including detection, separation and quantification of steroids.