



Detection of Sitosterol in *Chenopodium album* of Iraq by GC/MS Analysis

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ABSTRACT

Chenopodium album L the Greek name *Chenopodium* means goose foot. The plant is native to Asia and Europe. Nutritional analysis proved it to be a potential source of energy, proteins, carbohydrates; ascorbic acid and beta carotene and minerals. From the phytochemical point of view, the plant was reported to contain: flavonoids, glycosides, alkaloids, terpenes, sterols and saponins. β -sitosterol was isolated as white amorphous powder from the leaves of *Chenopodium album*. The sterols in the Iraqi plant were detected by TLC using spray reagent. It's presence was confirmed by GC/MS analysis.

Keywords: *Chenopodium album*, β -sitosterol, GC/MS, analysis.

INTRODUCTION

Chenopodium album Linn is an annual, 20-200 cm mealy white, erect, many-branched herb (Figure 1).¹



Figure 1: *Chenopodium album* herb

Stems are rarely slender, angled, usually striped green, red or purple. Young stems are coated with a fine mealy pubescence, while older stems become more glabrous. (Figure 2).²



Figure 2: Stems of *chenopodium album*

Nutritional analysis proved it to be a potential source of energy, proteins, carbohydrates; ascorbic acid and beta

carotene and minerals (potassium, sodium, calcium, phosphorous, magnesium, iron and zinc).³

From the phytochemical point of view, the plant was reported to contain: flavonoids, glycosides, alkaloids, terpenes, sterols and saponins.⁴

B-Sitosterol

Sitosterol is a Phytosterols (plant sterols and stanols) which are naturally occurring C₂₈ and C₂₉ carbon-compounds. The most well-known, and scientifically proven, benefit of phytosterols is their cholesterol – lowering action, they actually compete for absorption with cholesterol in the digestive tract.⁵ A variety of phytosterols exist in the plants, campesterol, stigmasterol and β -sitosterol are the most abundant in the diet, with the prevalence of β -sitosterol being particularly noteworthy. β -sitosterol was isolated as white amorphous powder with m.p.: 139-142°C from the leaves of *Chenopodium album*.⁶ The aim of this study is to investigate the presence of this compound in the Iraqi *chenopodium album* since it is an important compound in therapy.

MATERIALS AND METHODS

Plant material

The aerial parts (stems and leaves) of *Chenopodium album* were collected from area Al-Yousifiya in Baghdad and was authenticated by the National herbarium in Abu-Graib Baghdad. The plant material was collected during March and dried at room temperature in the shade, then grinded as powder and weighed.

Extraction of terpene

Powdered plant aerial part (200 g) was extracted by soxhlet apparatus with hexane (1400ml). The extract was concentrated using rotary evaporator. Hexane extract

was analyzed for the presence of terpenes using TLC with spray reagent and then analyze by GC-MS analysis.

Gas Chromatography-Mass Spectrometry (GC-MS)

GC-MS conditions for investigation of terpenes were: the carrier gas was helium, the injection volume was 1 μ L, and split ratio was 2.0. Injection temperature: 250 $^{\circ}$ C. Column temperatures: from 80 $^{\circ}$ C and rose up to 310 $^{\circ}$ C at a rate of 10 $^{\circ}$ C/min.

RESULTS AND DISCUSSION

Hexane extract of the plant was investigated by TLC which revealed the presence of terpene, as indicated by the development of violet spot after spraying by vanillin sulphuric acid spray reagent as shown in Figure 3.⁸

GC/MS analysis

The chromatogram showed peak with retention time 30.317 min, corresponding to the molecular ion peak at m/e 414 identified in comparison with NIST08 database

as β - sitosterol. The mass spectrum of β - sitosterol can be seen in Figure4.

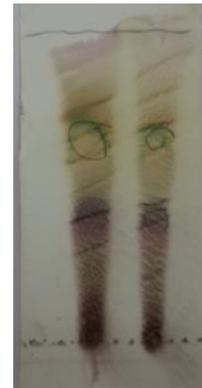


Figure 3: TLC plate sprayed with vaniline-sulphuric acid reagent

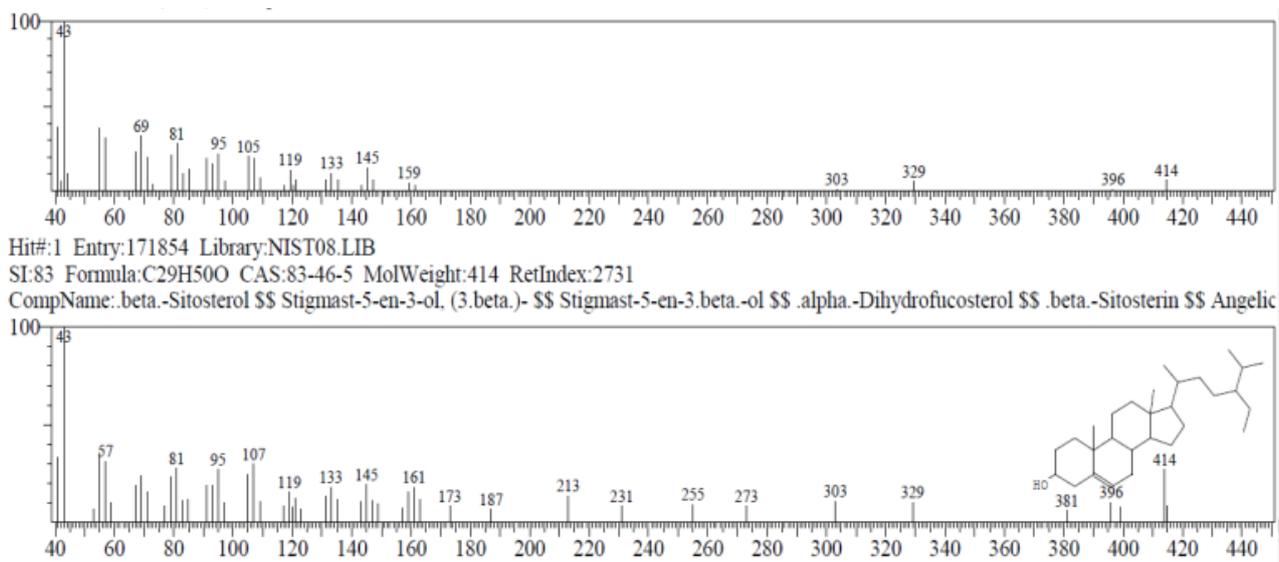


Figure 4: GC MS chromatogram of β -sitosterol

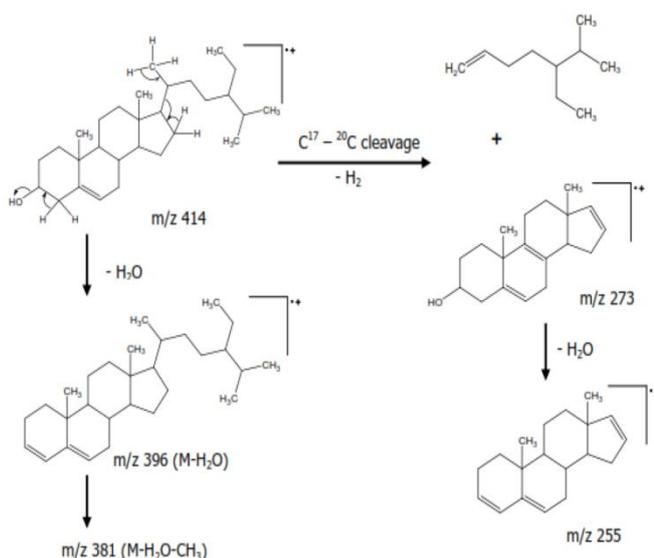


Figure 5: Fragmentation pattern of β - sitosterol

Fragmentation pattern of β - sitosterol

The molecular ion of β - sitosterol was observed at m/z 414 that corresponds to the molecular formula $C_{29}H_{50}O$.⁹ The loss of water molecule from the molecular ion would give peak at m/z 396 which would further dealkylated giving ion at m/z 381. The peak at m/z 273 is the fragment from C^{17} - C^{20} cleavage. Elimination of water molecule from fragment at m/z 273 accounts for the presence of m/z 255 figure 5.¹⁰

CONCLUSION AND RECOMMENDATION

Iraqi *chenopodium album* contains a significant amount of the important phytosterol sitostereols. Further studies need to calculate the percentage of this compound in the plant.

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