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EFFECT OF NATURAL RADIATION ON DIOSGENIN EXTRACTED FROM BALANITES AEGYPTIACA

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ABSTRACT

The present investigation is mainly concerned with the uptake of uranium by native medical plant (*B. aegyptiaca*) grown at naturally radioactive area, which is located at Wadi El-Gemal area, that is considered as one of the main Wadies in the South Eastern desert of Egypt. The uranium contents in the three samples of *B. aegyptiaca* collected from three regions of Wadi El-Gemal, are 0.08, 0.35 and 2.1 ppm.

Diosgenin in the main active constituent in *B. aegyptiaca* fruit samples, but the concentrations of uranium used in this investigation have not effect on the structure of diosgenin, as it was shown from IR spectrum.

INTRODUCTION

Environmental pollution especially by radioactive elements is one of the most effective factors in the destruction of the biosphere component, in which biota reveals potential effect to develop a resistance for this kind of pollution.

Medical plants are in great use due to the presence of numerous substances that have great effects on several kinds of pains. This investigation will deal with the effect of the radioactive substances on some wild medical plants growing naturally on radioactive area. The studied Wadi El-Gemal area represents an important target, and this is due to the presence of some uranium occurrences, also the area is expected to be one of the most important areas in Egypt in future, because of its great and diversified potentialities.

Nishita et al (1989), Sheppard and Evenden (1988), Sheppard et al (1989), Ghoudhury and Goswami (1990) and Zafrir (1992) showed that uranium uptake in tissues is quite variable depending on soil type, type of tissue and solubility of uranium in growth medium. Differential uptake of radionuclide by plant species was reviewed by Simane and Ibrahim (1988) and Ibrahim and Whicker (1988), in general leafy vegetable contain higher concentration than fruit and grain crops.

Pozalotina et al (2000) reported that analysis of chromosome aberration in root meristem cells showed that their spectrum is narrow and include chromosome fragment. In single cases significant effect of the radionuclide factor on the frequency of chromosome aberration in the seed progeny was revealed with background radiation levels of 22 to 11 μ Sv / h.

Mackerness et al (2001) found that the uv- β can activate NADPH oxidase and/or peroxidase, moreover Hernam et al (2002), reported that the increase in the thiobarbituric acid content is more indicator of general uv- β induced oxidative damage due to the impairment of cell defense system.

The aim of this investigation is to study the effect of radiation on the active material (Diosgenin), in wild plant (*Balanites aegyptiaca*) which popularly called the desert dale, grown in three different regions of Wadi El-Gemal, southeastern desert, Egypt.

MATERIALS AND METHODS

Plant sample:

Balanites aegyptiaca samples were collected from different sites of Wadi El-Gemal area. The collected plant samples were saved in paper bags until starting the lab analysis. The samples were prepared by removing the dust, dried naturally under the sun rays. Then crushed into 60 mesh size, after that they were analyzed to determine the uranium content, and active material (diosgenin). The structure of diosgenin is shown in Figure (1) as it is mentioned by Chapagain and Wiesman (2005).

Uranium analysis in plant samples:

The intensity of radioactivity measurements in the plant samples are performed by gamma spectroscopy after being carefully sealed for four weeks to reach secular equilibrium between ^{228}Ra (daughter of

^{238}U) and its corresponding daughter. The detected system was energy calibrated using ^{60}Co , ^{226}Ra and ^{137}Cs (standard series Amersham Co, Uk.) for efficiency (Helmer, 1982 and Moens and Hoste, 1983). The standard source was packed in a beaker similar to that of the sample. The standard sources are ^{232}Th of activity 1333.96 Bg/Kg and ^{238}U of activity 2120.37 Bg/Kg.

Extraction of saponin (diosgenin) was carried out using Obdoni and Ochuko method (2001). Determination of Diosgenin was accomplished using the methods of Baccou et al (1977), and Uematsu et al (2000) with some modification.

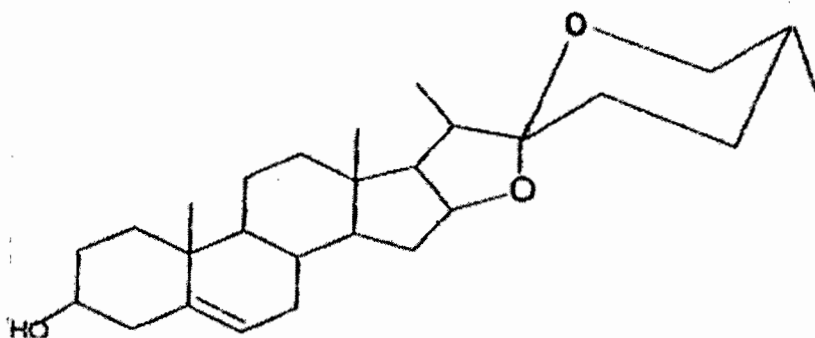


Fig. (1): Chemical structure of Diosgenin (Chapagain and Wiesman; 2005)

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RESULTS AND DISCUSSION

Uranium contents in plant samples:

Uranium contents in *B. aegyptiaca* fruit samples grown in three different regions of Wadi El-Gemal area are 0.08, 0.35 and 2.1 ppm respectively.

Effect of uranium on the active material in *B. aegyptiaca*:

The infrared absorbance band (cm^{-1}) of pure saponin and the saponin extracted from three samples of *B. aegyptiaca* grown in different regions of Wadi El-Gemal area are shown in Fig. (2) and Table (1).

From the four IR spectra, it was absorbed two bands at 1082.6 & 1183.9; 1057.4 & 1476.1; 1062.5 & 1463.8 and 1062.5 & 1488.2 cm^{-1} respectively, for pure saponin and saponin extracted from *B. aegyptiaca* grown in three different regions in the area respectively. These two bands indicate a presence of OH bending and C-O stretching in secondary alcohol.

The band observed in 1183.9, 1200 and 1200 cm^{-1} in four spectra refers to C-O-C respectively.

The band observed at 1520, 1524, 1524.6 and 1512.5 cm^{-1} in four spectra refers respectively to C-H in alkanes, where band observed at 1725, 2510, 2510 and 2510 cm^{-1} respectively, refers to C = C in alkenes.

The intense absorption band in 3110, 3112, 3112 and 3105.8 cm^{-1} in four spectra (Fig. 2) respectively indicates to C - H stretching in alkanes, where band appeared at 3221.3, 3245.7, 3233.6 and 3227.4 cm^{-1} refers to C - H in alkanes.

In the four spectra abroad intense band was absorbed at 3732.3, 3732.8, 3725.1 and 3738.4 cm^{-1} respectively, these indicate a presence of OH group.

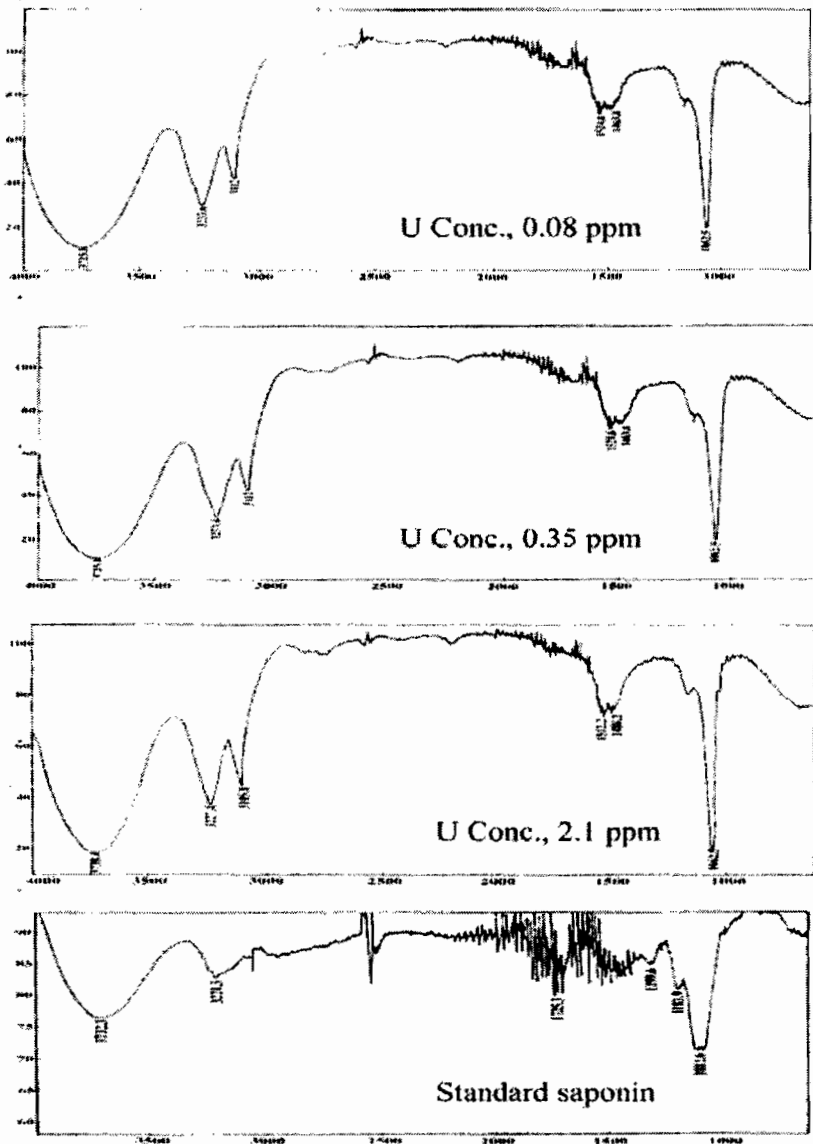


Fig. (2): Diosgenin structure under different U concentration in comparison to standard diosgenin

From the previous data it can be concluded structure that structure of extracted saponin from three samples of *B. aegyptiaca* is similar to pure saponin, moreover the structure of this saponin was not affected by radiation in these regions, since the amount of uranium in the three samples of plant ranges between 0.08 – 2.1 ppm, and may be the increase of uranium amount more than these above ranges led to change in the structure of saponin.

Table (1) Infrared absorbance band cm^{-1} of pure saponin, and the saponin extracted from three plant samples of *B. aegyptiaca* grown in different three regions

Type of bond	Finger print of absorbance cm^{-1}			
	B. aegyptiaca			
	Pure saponin	Sample 1	Sample 2	Sample 3
OH bending and C-O stretching	1082.6 & 1299.6	1057.4 & 1476.1	1062.5 & 1463.8	1062.5 & 1488.2
C – O – C	1183.9	1200	1200	1200
C–H in alkanes	1520	1524.6	1524.6	1512.5
C=C in alkenes	1725	2510	2510	2510
C–H stretching in alkane	3110	3112	3112	3105.8
C – H in alkane	3221.3	3245.7	3233.6	3227.4
oH group	3732.3	3732.8	3725.1	3738.4

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تأثير الأشعاع الطبيعي على الصابونين المستخلص من نبات

Balanites aegyptiaca

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يهدف هذا البحث الى دراسة مدى امتصاص النبات الطبى الببرى (*B. aegyptiaca*) لليورانيوم - حيث ينمو هذا النبات طبيعيا فى المساحات المشعه والموجودة فى وادى الجمال والذى يعتبر أحد الوديان الرئيسية فى جنوب الصحراء الشرقية.

تحتوى الثلاث عينات من نبات *B. aegyptiaca* الذى تم جمعهم من ثلاث مناطق مختلفة من وادى الجمال على محتوى يورانيوم 0.08 و 0.35 و 2.1 جزء فى المليون ويعتبر الصابونين (Diosgenin) هو المركب الرئيسى فى عينات ثمره *B. aegyptiaca*. ولقد لوحظ ان تركيزات اليورانيوم سالفة الذكر لم تؤثر على التركيب البنائى للصابونين وقد اتضح ذلك من IR spectroscopy .