



## Control of Lead and Cadmium in Cosmetic Product (Kohl) of Pits Dates by Cyclic Voltammetry

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### ABSTRACT

Kohl is an ancient eye cosmetic, traditionally made by grinding stibnite ( $Sb_2S_3$ ). It is widely used in North Africa, in the field of valuation pits dates, the cosmetic product (kohl) prepare base date is an alternative source of stibnite. One of the most problem relating to kohl application to eyes being responsible for causing lead poisoning. The aim of The present study is to control the lack of toxic element (lead and cadmium) in khol to date and natural khol . Dates variety Deglet-Nour , Ghars (tamar), Tantbocht (Tikrmiste) and Boufaroua) were purchased from the local market and pits were removed from the fruit. Date-pits were Roasted in fire for dried and finally crushed to give a dark brown powder and stored until used for analysis. The presence of lead and cadmium in the brown powder of date pits and in natural kohl are controlled by using the technical of cyclic voltammetry. The results of the study shows that the powder of four variety of dates pits (Deglet-Nour , Ghars, Tantbocht and Boufaroua ) didn't present no toxic heavy metals as lead and cadmium. Also our results showed the absence of cadmium and lead in natural kohl. Finally, the study shows That kohl prepared a base date pits presents no toxic effects are expected to the eye similarly to the natural kohl, which presented the importance of recycling waste dates.

**Keywords:** Pits dates; Lead; Cadmium; Kohl; Cyclic voltammetry

### INTRODUCTION

The date palm, *Phoenix dactylifera*, is one of most important plants of arid, desert area of the Middle East, Southern Asia and Northern Africa for over 5000 years [1]. The fruit of the date palm is composed of a fleshy pericarp and seed (i.e. pit). Pits of date palm are a waste product of many date fruit processing plants producing pitted dates, date powders, date syrup, date juice, chocolate coated dates and date confectionery [2]. Currently date-pits are mainly considered as a waste product and are used sometimes as a soil organic additive or as feed for various livestock. The world production of dates was 7.5 million tons in 2011 [3], which could generate approximately 750 thousand tons date seeds. Thus, utilization of such waste is very important to date cultivation and to increase the income to this sector. In addition, date-pits could be considered as a valuable source of functional ingredients and could therefore be used for different food products' formulation and for the development of different functional and medicinal supplements [3]. Kohl is widely used traditional eyeliner in all Islamic countries because its use is encouraged within the "sauna", the religious behavioral guidelines of the Islamic belief. Undoubtedly the "sauna" identifies kohl as a free lead substance. However, analysis consistently revealed that the main composition of kohl is lead [4]. The existence of organic and inorganic pollutants in the aquatic system can be detrimental to a variety of living species. Many industrial processes discharge aqueous effluents containing heavy metals and dyes. Heavy metals and dyes are non-biodegradable and tend to accumulate in living organisms, causing various disorders for living organisms [5]. Heavy metal ions are known to pose acute or chronic risks to ecosystem at very low concentrations because of their

high toxicities, high stabilities and propagated accumulation through food chains. As two major heavy metal pollutants, cadmium and lead are normally generated from industry and continuously present in soil, drinking water and aquatic environments [6]. The objectives of the present study were to detecting the heavy metals: lead and cadmium in date-pits powder as a cosmetic product (khôl) in the valorization of waste feed domain.

## MATERIALS AND METHODS

### Preparation of samples

Dates (variety: Ghars (tamar), Deglet Nour, Tantbocht (Tikrmiste), Boufaroua) were purchased from the local market and pits were removed from the fruit. Date-pits were Roasted in fire for dried and finally crushed to give a dark brown powder and stored until used for analysis. Kohl sample was purchased from the local market also. The dried date pits powder and the kohl sample (300 mg) were dissolved with 10 mL of concentrated nitric acid (69%) and heated for 2 hours in stove at 105°C. The resulting suspension was then filtered, The filtrates were transferred to the cell after dilution until (1M) where the electrochemical measurements were performed [7].

### Electrochemical measurement

The detection of the heavy metals (lead and cadmium) in the studied date pits powder samples after digestion was performed using an electrochemical method based on cyclic voltammetry techniques. Cyclic voltammetry measurement were carried out using PGP301 potentiostat (radiometer analytical SAS) connected to an electrochemical cell with a volumetric capacity of 50 mL containing a glassy carbon working electrode, a Pt wire counter (auxiliary) electrode and an Hg/Hg<sub>2</sub>Cl<sub>2</sub> reference electrode. The potential was swept in direct scanning mode starting from 1000 to -1500 mV with a scanning rate of 100 mV/s. All measurements were carried out at room temperature [4].

## RESULTS AND DISCUSSION

The cyclic voltammogram show that the electroactivity domain of nitric acid is not in field of scan as show in figure 1. The cyclic voltammogram of the natural Kohl sample (Figure 2) show also that there is no characteristic peak of the lead or cadmium element which means that absence of these two elements in the sample, result suggest that this sample was not contaminated with Pb or Cd thus don't present any toxic effects for the user of this product.

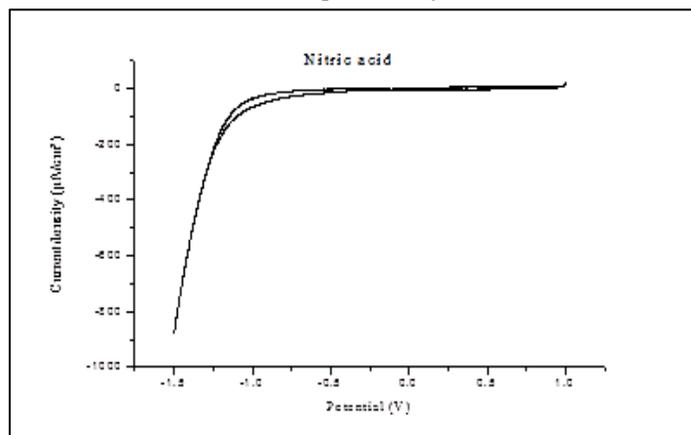


Figure 1: Cyclic voltammogram of diluted nitric acid (1M) at glassy carbon electrodes. E vs (Hg/Hg<sub>2</sub>Cl<sub>2</sub>)/V

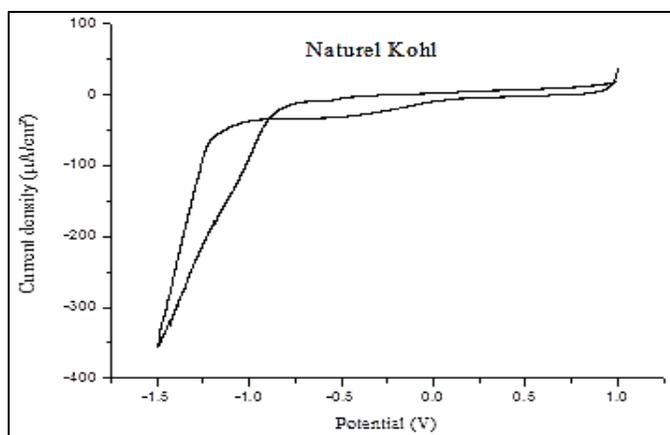


Figure 2: Cyclic voltammogram of 300 mg of Kohl was dissolved with 10 mL of concentrated nitric acid (69%) and diluted before electrochemical analysis until (1M) at glassy carbon electrodes. E vs (Hg/Hg<sub>2</sub>Cl<sub>2</sub>)/V

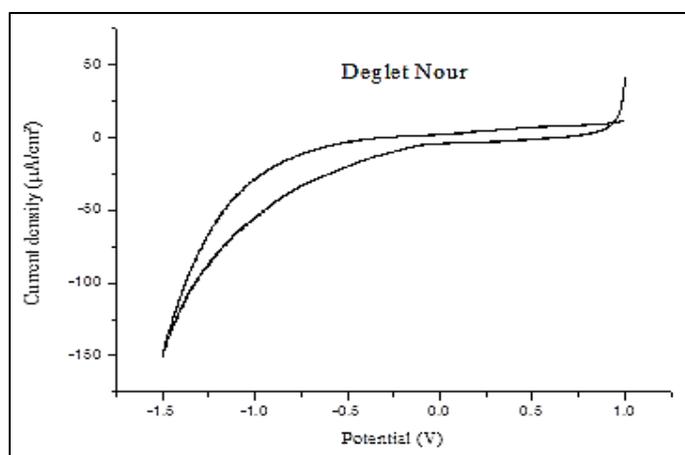


Figure 3: Cyclic voltammogram of 300 mg of date pits powder of Degler Nour variety was dissolved with 10 mL of concentrated nitric acid (69%) and diluted before electrochemical analysis until (1M) at glassy carbon electrodes. E vs (Hg/Hg<sub>2</sub>Cl<sub>2</sub>)/V

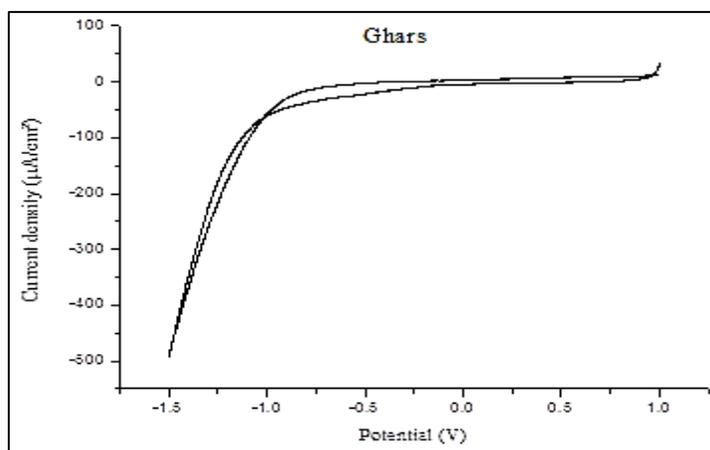
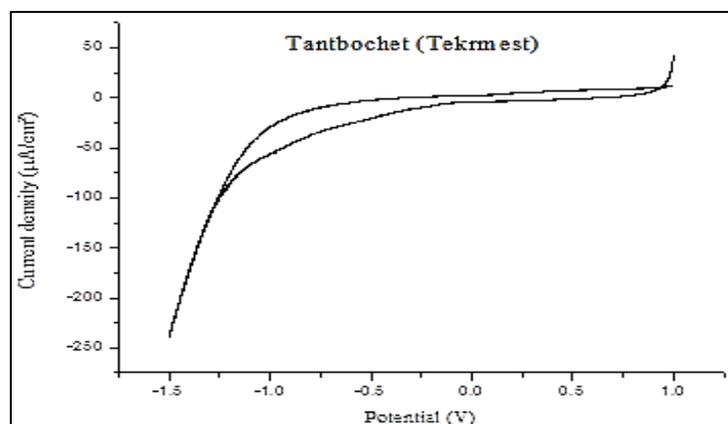
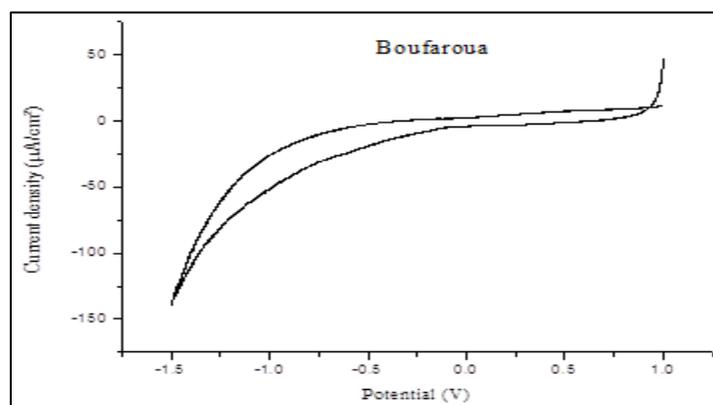


Figure 4: Cyclic voltammogram of 300 mg of date pits powder of Ghars variety was dissolved with 10 mL of concentrated nitric acid (69%) and diluted before electrochemical analysis until (1M) at glassy carbon electrodes. E vs (Hg/Hg<sub>2</sub>Cl<sub>2</sub>)/V



**Figure 5:** Cyclic voltammogram of 300 mg of date pits powder of Tantbochet ( Tekrmest) variety was dissolved with 10 mL of concentrated nitric acid (69%) and diluted before electrochemical analysis until (1M) at glassy carbon electrodes. E vs (Hg/Hg<sub>2</sub>Cl<sub>2</sub>)/V

The cyclic voltammograms of Deglet Nour, Ghars and Tantbochet date varieties (Figures 3-5) show that no oxidation characteristic peaks of lead (Pb) and cadmium (Cd) element which means that absence of these two elements in the powder of these sample, results suggest that the date pits were not contaminated with this heavy metals what can be recycling and used like a cosmetic product (khol) without any toxic effects for the user of these products.



**Figure 6:** Cyclic voltammogram of 300 mg of date pits powder of Boufaroua variety was dissolved with 10 mL of concentrated nitric acid (69%) and diluted before electrochemical analysis until (1M) at glassy carbon electrodes. E vs (Hg/Hg<sub>2</sub>Cl<sub>2</sub>)/V

The cyclic voltammogram of Boufaroua date variety (Figure 6) show that no oxidation peaks of lead (Pb) and cadmium (Cd) that suggest that this variety was not contaminated with these heavy metals. This shows that the by-product of date or infected date are not done to the human use can use their nuclei for the production of cosmetics product such as kohl without any toxic effect due to heavy metals such as cadmium and lead.

## CONCLUSION

In conclusion, this study suggests that the date pits powder can be used like a cosmetic product (khôl) and don't presents no toxic effects are expected to the eye similarly to the natural kohl, which presented the importance of recycling waste dates.

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