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TABLETING: ALTERNATE WAY OF VALORIZATION OF AGRO-RESOURCES

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Abstract

In this work we attempt to investigate the possibility of use tableting as alternate way for valorization of some agro-resource species, including, certain date (Phoenix dactylifera L.) fruit varieties as ordinary edible fruit, strawberry tree (*Arbutus* unedo) berries and numerous medicinal plants. The preliminary results obtained are conclusive. In all cases, the date fruit powder is used as base matrix because of its capacity to undergo tableting. The combination of various plant species with date fruits allowed to obtain tablets with convenient physical proprieties in terms of hardness, disintegration time, erosion…Also, the final product acquired an appetizing flavor which is of a particular interest when the initial non-food matrix has a disagreeable taste. Thus, the formulation of such tablets from medicinal plants hides the bitterness, making the product more acceptable to consumers, especially those suffering from various diseases. Also, the fast dissolution of the date powder, thanks to the presence of natural simple sugars, make the obtained tablets very convenient for some patients. The physical-chemical proprieties of powder and then tablets from lyophilized strawberry berries are also investigated. Taking into account its high content in vitamin C, this powder can be employed as other natural ingredient enhancing the nutritional value of tablets, as well as their stability. Finally, the effervescent ability of date powder is studied, varying the proportions of some chemical reactants like tartaric acid, citric acid, sodium carbonate and bicarbonate.

Keywords: *tableting, valorization, agro – resources species*

Introduction

Tablets are obtained from various powder ingredients which can be classified into two main active and inactive (excipient) components. There are three main methods of developing powders for tablet making (Document Techceuticals, 2011): direct compression, wet granulating and dry granulating.

Among the different habitually used processes the food powders undergo, among others, compaction with view to obtain products with some functional characteristics (Dhanalakshmi et al., 2011).

Many food and non-food materials are subjected to tabletting: seaweeds (*Eucheuma cottonii*) (Abidin et al., 2011), bitter melon (*Momordica charantia*) (Hasan & Khatoon, 2012), pitaya powder (Yusof et al., 2011).

It is already underlined that date fruits may be considered as a more or less perfect food, providing potential health benefits (Al-Shahib & Marshall, 2003). Recently, we have reported about the possibility to produce tablets from certain date varieties of low commercial value (Adiba et al., 2011), whereas Ngwuluka et al. (2010) have investigated date fruit powder for its binding properties in comparison with acacia and tragacanth.

In the present work, tableting ability of powders from Algerian agro-resources, including date (Phoenix dactylifera L.) fruits, strawberry tree (*Arbutus* unedo) berries and olive (*Olea europaea L.*) leaves are investigated.

Material and methods

The powders used for tableting are prepared in laboratory using either thermal vacuum (200 mbar)-drying at 75°C (laboratory oven of type Heraeus) (for date fruits) or freeze- drying (for strawberry tree berries and olive leaves). The different tablets obtained are evaluated for their different properties: modeling of adsorption isotherms at different conditions and effervescent ability (date powder tablets), sensory and physical properties (date powder tablets added with olive leaf extract) and release properties (tablets from arbutus berries). Concerning adsorption isotherms, the different curves are obtained following the procedure described by Labuza et al. (1985). Also, the Brunauer Emmet Teller (BET) and Guggenheim Anderson Boer (GAB) models are tested to describe experimental data, using Statistica 8.0 software.

Compaction can be described as a large irrecoverable deformation during which the powder is changed into a dense compact (Sinka, 2007). Presently, two types of presses are used: single-station presse of type Herzog (in case of natural date powder and date powder added with olive leave extract) and laboratory hydraulic pellet presse initially intended for IR analysis (in case of powder from arbutus berries).

The method followed to study the feasibility of effervescent date tablet formulation is adapted from that described by Nguyen and Pham (2011).

Results and discussion

Figures 1 and 2 present the examples of the shapes of the adsorption isotherms related to tablets obtained from date powder with different sizes and compacted with different forces.

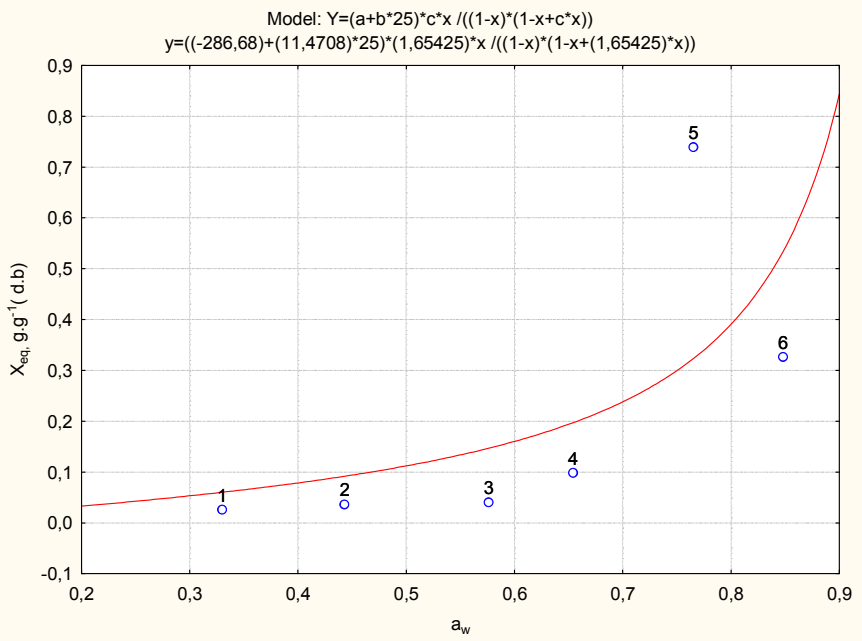

Figure 1: Adsorption isotherm related to tablets from date powder obtained by vacuum drying), applying BET model (powder size= 200-250 µm; compression force = 10 kN; Temperature = 25°C)

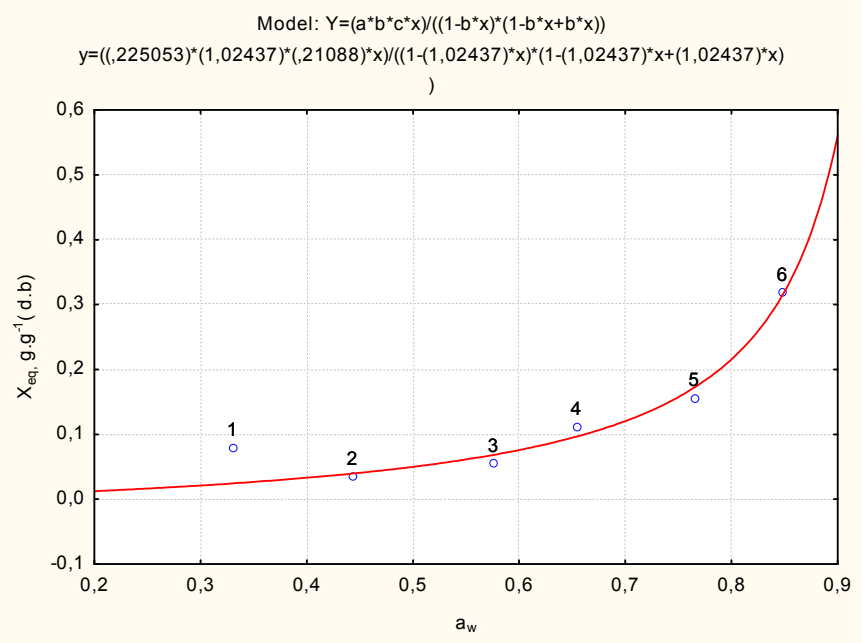

Figure 2: Adsorption isotherm related to tablets from date powder obtained by vacuum drying), applying GAB model (powder size= 200-250 µm; compression force = 5 kN ; Temperature = 25°C).

Moreover, the table 1 indicates the adequacy of models applied to describe the adsorption isotherms.

Table 1: Parameters of the two models (BET and GAB) and determination coefficient related to adsorption isotherms. Case of tablets obtained from date powder with 200-250 µm size.

	a	B	c	R^2
BET (5 kN)	252.22	10.09	0.94	**0.96**
BET (10 kN)	286. 68	11.47	1.65	0.62
GAB (5 kN)	0.22	1.02	0.21	**0.96**
GAB (10 kN)	0.42	0.86	0.41	0.66

As it can be seen, the both models describe correctly the adsorption isotherms of date tablets obtained under compression force of 5 kN. These findings are in concordance with those communicated by Fadini et al. (2006) who demonstrated that for tablets from macadamia nuts (at 25 °C) the GAB model was the most suitable, followed by the BET and Oswin models. It must be underlined that, the cited reference is the unique scientific work found to be devoted to adsorption isotherms of tablets.

On the other hand, the effect of environmental relative humidity on color stability of the tablets is clearly demonstrated (Figure 3) which thus highlights the importance of water activity as an essential parameter of the storage conditions of the formulated product.

a_w (%)	44,3	84,8
Size (µm)	250-315	200-250
Compaction force (KN)	5	5
Results		

Figure 3: Effect of water activity on color stability of tablets (left: original color).

Some physical properties of tablets from combination of date powders with 3% (w/w) freeze-dried olive leaf extract are summarized in Table 2.

Table 2: Some physical properties of tablets obtained from combination of powders from date fruit and olive leaves

Parameter	Value
Weight (g)	0.48±0.04
Diameter (mm)	12.20±0.07
Thickness (mm)	3.48±0.19
Hardness (KP)	10
Friability (%)	<1
Disintegration time (min)	15

The obtained hardness is compared with that of tablets from pure date powder (not presented here). In opposite, the general acceptability of tablets by consumers (results also not showed in this paper) is positively influenced by this fortification.

Concerning tablets from arbutus berries, their release ability, expressed by means of conductivity is illustrated by the figure 4.

It can be easily noticed that the tablets show a good ability to release various nutrients (especially electrolytes: minerals, organic acids…). In addition, the temperature seems to influence considerably the release kinetics.

Regarding effervescent ability of date powder tablets, the effervescent time of about 1 min was reached when the ratio of effervescent agent (sodium bicarbonate and citric and tartaric acids) was 50%. We think that, apart from added chemical agents, the high sugar content of

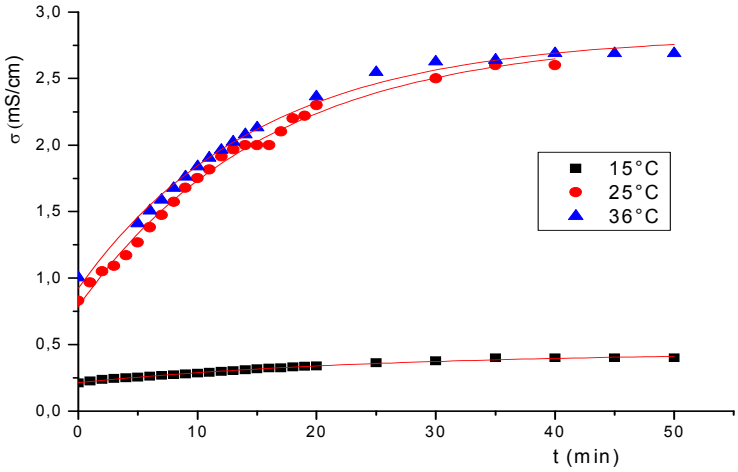

Figure 4: Conductivity versus time. Case of dissolution liquid medium (distilled water) of tablets obtained from powder of arbutus berries (compaction force=1000 Pascal).

Date powder may contribute to disintegration mechanism of tablets.

Conclusion

The possibility of formulation tablets from various local agro-resources is highlighted by the results presently displayed. Nevertheless, further investigations are needed to enhance the quality of the obtained final products.

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