Contribution to the valorisation of pomegranate (Punica granatum L.)

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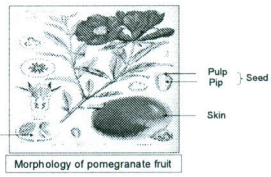
Introduction

Pomegranate (Punica granatum L.) is native from Iran to the Himalayas in Northern India and is cultivated and naturalized over the whole Mediterranean region since ancient times. The edible part of this fruit contains considerable amounts of acids, sugars, vitamins, polysaccharides, polyphenols and important minerals. "El Gabsi" pomegranate is the main Tunisian variety.

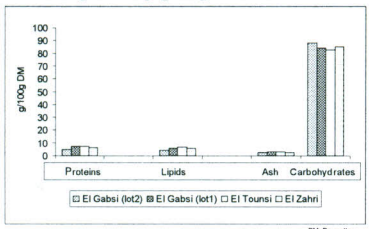
The aim of the present investigation is to open a way for an higher valorisation of pomegranate seeds, based essentially on the extraction of juice.

The first part of this study is focused on the chemical composition of seeds from 3 different varieties of pomegranate.
The second part considers the extraction and characterisation of juice and co-product (pip and pulp waste).

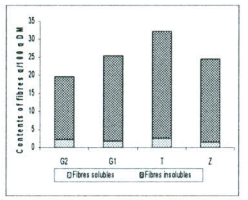


Morphology of pomegranate fruit

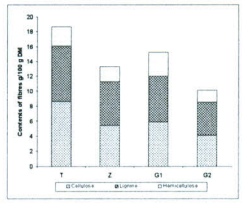
Chemical composition of pomegranate seeds



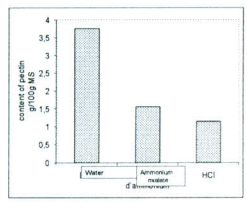
Chemical composition of the threepomegranates varieties



Fibres contents according to PROSKY method
G2: El Gabsi (second collect); G1: El Gabsi (first collect);
T: El Tounsi; Z: El Zahri



Composition of insoluble fibres
T: El Tounsi; Z: El Zahri; G1: El Gabsi (first collect);
G2: El Gabsi (second collect)



Content of pectin extracted by water, ammonium oxalate and HCl

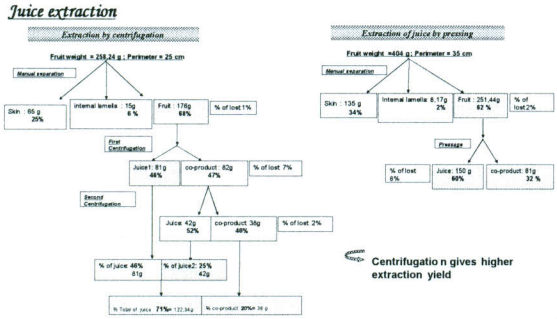
The chemical composition characterisation of three varieties of Tunisian pomegranates shows that the "El Tounsi"v ariety is richer in lipids, proteins and ash than "El Gabsi" (first collect) and "El Zahri"v arieties, which are rather rich in carbohydrates. More detailed analysis of the composition in fibres of the three varieties emphasizes that the pomegranate seeds are rich in insoluble fibres, in particular in cellulose and lignin. "El Tounsi" variety seems to be richer in insoluble fibres followed by "El Gabsi" (first collect) and "El Zahri" varieties. Pomegranate seeds from "El Gabsi" variety (second collect) present a pectin content which varies between 1% and 4%, depending on the extraction mode.

Sugar content in seeds

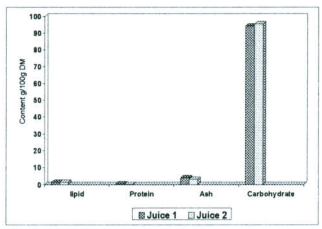
rhamnose	arabinose	xylose	mannose	galactose	glucose	fructose	saccharose
0,70	2,94	6,61	**8,40**	5,53	**22,20**	**22,83**	**1,61**

(*Expressed ing / 100g DM*variety El Gabsi second collect)

Juice extraction



Centrifugation gives higher extraction yield



Chemical composition of pomegranate juices (g/100 g D M)

Content of sugar in juice

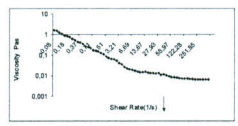
rhamnose	arabinose	xylose	mannose	galactose	glucose	fructose
0,35	0,57	0,50	**7,59**	0,85	**40,94**	**42,74**

Contents of fibres in juice

	Solubles fibres	Insolubles fibres	Total fibres
Juice 1	6,92 +/-0.14	2,34 +/-0.21	9,26 +/- 0.17
Juice 2	5,02 +/-0.03	1,27 +/-0.46	6,29 +/-0.25

(Expressed in g / 100g DM

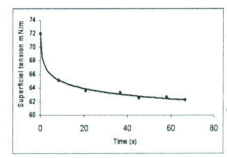
Two different methods for the juice extraction at laboratory scale are compared. Centrifugation extracts 71% while pressing extracts 60% of juice. The chemical composition analysis of two fractions of the juice extracted by centrifugation shows that the juice coming from the first extraction contains more lipids, proteins and ash than the juice coming from the second extraction phase. Soluble sugar composition from juice extract shows that glucose and fructose are the most abundant with 41 – 45 and 43 - 48% respectively. Juice shows rheofluidifiant behaviour and surface-active properties



Viscosity of the juice

Shear Rate < 50 s^{-1}
- Viscosity
- Rheofluidifiant Comportement

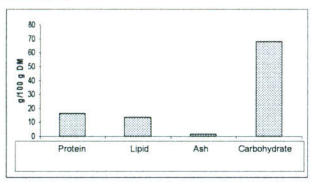
Shear Rate > 50 s^{-1}
- Constant Viscosity
- Newtonien Comportement



Evolution of surface tension as a function of time

- Surface tension
- **Pomegranate juice presents surface - active prope rties**

Co-product analysis



Chemical composition of co-product (Juice from El Gabsi first collect variety)

Contents of insolubles fibres

	Lignine	Hemicellulose	Cellulose
Insolubles fibres (g/100 g DM)	29 +/-0.03	13 +/-0.20	12 +/-0.10
Total fibres	**54 +/-1.34 g/ 100 g D M**		

Hydratation proprieties :

- Retention of oil = 343 g oil/ 100 g D M
- Retention of water = 321 g water/ 100g M S

The seed and pulp waste (co-product) of the extraction have a high content in insoluble fibres. And showed to be suitable as foods ingredient thanks to the interesting functional properties.

Conclusion

Our study focused on t he valorization of pomeg ranate sho ws that juice and co -product conta in some interesting compounds suc h as fibres which play an important role due to the ir benefi cial physiologi cal effects . Fibres are also able to provide water binding capacity and to increase viscosity . So it could be possible to consider the use of the co-product fro m juice extraction as ingredient i n food formulations .

The variety and date of collect have an influence on the compo sition of seeds. Indeed with an advanced traini ng course t he seed becomes increasingly rich in carbohyd rate. Consequent ly the c hoose of th is period is ver y important for the i ndustrial product. Due to the influence of e nvironmenta l and c ultivar difference on nutritional and technological val ues of the fruit more work in t his area is required.