ON THE VALORIZATION OF AGRO RESOURCE OF TIZI-OUZOU: EXTRACTION FOR PECTIN FROM MELON RINDS

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Abstract.- *The main objective of this work was to study the valorization of agricultural wastes and the by-products of food in our country. To this end, we opted for the extraction of pectin from melon rinds. Pectins are a very useful class of active ingredients, and they are identified as multifunctional compounds, with several pharmacological activities. The pectin yields obtained by means of aluminum sulphate and aluminum chloride as precipitating agents are 6.916% and 9.166% respectively. The pectins IR spectra obtained revealed that these pectins showed two broad absorption bands at 3400 cm^{-1} and 3396 cm^{-1} which seems to correspond to the type of vibration v elongation of the hydroxyl group. The presence of peaks at about 1740 cm^{-1} and 1269 cm^{-1} appears to correspond to the C=O bonds of the uronic acids and esters. The bands found in the pectins extracted with aluminum sulfate (1743 cm^{-1}) and (1239.15 cm^{-1}) can be attributed to sugars or non-esterified acid that are especially found in pectins. Pectins precipitated by aluminum sulfate showed a microstructure similar to those of commercial pectins. These substances could be a primary source for the development of new products for many industries. An environmental gain: reducing environmental pollution load.*

Key words: *Melon rinds, valorization, pectins.*

SUR LA VALORISATION DES AGRO-RESSOURCES DE LA REGION DE TIZI-OUZOU: EXTRACTION DES PECTINES À PARTIR LES ÉCORCES DE MELON

Résumé.- *Ce travail entre dans le cadre de la valorisation des déchets agricoles et des sous- produits de l'alimentation de notre pays. L'extraction des pectines à partir d'écorces de melon a été réalisée. Les pectines représentent une classe très intéressante de produits actifs, et sont identifiés comme composés multifonctionnels, avec plusieurs activités pharmacologiques. Les rendements en pectines obtenus en utilisant les sulfates d'aluminium et le chlorure d'aluminium comme agents de précipitation sont respectivement 6,916% et 9,166 %. Les spectres IR de pectines obtenues montrent deux bandes d'absorption larges à 3400 cm^{-1} et 3396 cm^{-1} qui correspondent à la vibration de type élongation du groupement hydroxyle v (O-H) et eau d'hydratation. Des bandes d'absorption à 1740 cm^{-1} et à 1269 cm^{-1} indiquant la présence de groupement C=O d'acides uroniques, sous forme de sels d'acides et des esters. Les pectines issues de sulfates d'aluminium se caractérisent par deux bandes à 1743 cm^{-1} et à 1239.15 cm^{-1} correspondent aux sucres et aux esters non esterifiés. Ces pectines ont présenté une microstructure et les mêmes groupes fonctionnels que ceux des pectines commerciales. Les pectines peuvent constituées une source primaire pour le développement de nouveaux produits de plusieurs industries est un gain environnemental en réduisant la pollution de l'environnement.*

Mots clés: *Ecorce de melon, valorisation, pectines.*

Introduction

Polysaccharides are known and used for many years by the industry because of their abundance, their renewable, non-toxic, and biodegradable sources, and because they are the source of many products after chemical and biochemical changes [1]. The pectin with a

natural additive, intensively used in food industry, is one of the fruits of the recovery of by-products. Its demand on the world market is above 30,000 tons annually and is growing by about 4-5% per year [2]. The melon is one of the main "vegetable" productions in Algeria. It is grown in summer in almost all the regions of Algeria. Farmers often use local varieties that give very good yields [3].

The cultivated area in the Wilaya of Tizi-Ouzou is around 760 hectares, with yields of 80 quintals per hectare [4]. The aim of our work is to contribute to current valuation by studying the possibility of extracting pectin from the melon rinds available in large quantities in the region of Tizi-Ouzou.

1.- Material and Methods

1.1.- Plant Material

The species used in the study is *Cucumis melos* bought in the local markets of the area of Tizi-Ouzou in May 2015.

1.2.- Assessments Methods

This part of work was carried out at the Laboratory of Chemistry and Microbiology of Mouloud Mammeri University of Tizi-Ouzou (Algeria) and the Laboratory of Pharmaceutical Chemistry of M'Hamed Bouguerra University of Boumerdès.

Pectin was extracted with a hot acid solution using the method put forward by KRATCHANOVA *et al*. (2004) [5]. Two precipitation processes were considered: precipitation with aluminum chloride salt [6] and precipitation with aluminum sulfate salt [7]. For the purpose of studying the rheological properties of pectin, the obtained pectin was dried at 60°C.

The yield of pectin was calculated as: $Y\ (\%) = W/W_0$

Where Y is pectin yield (%), W_o and W are the weight of the initial dried simple (100g) and the obtained dried pectin (g).

The microstructure of particles in differently dried pectin was studied by means of an environmental Scanning Electron Microscope SEM (PHILIPS ESEM XL.30; Heindoven, Netherlands).

2.- Results and discussion

The special feature of our study is to have chosen to work on the extraction of pectin from. melon rinds, a topic on which little research has been carried out, while many studies have investigated the extraction of pectin from different vegetal sources, more particularly from apple, lemon and beet [8;9].

The pectin yield directly correlates with the salts of precipitation. Aluminum chloride shows a better yield (9,166±3,818 %w/w) when compared with ammonium sulfate (6,916±0,661 % w/w)

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The yield of pectin depends on several factors**,** such as the initial quality of the fruit and the various technological operations and pretreatments possibly used in the extraction process. It also depends on the processing parameters**,** such as temperature, time of extraction, and type of solvent [9-11].

Many studies reported in the literature have shown the effectiveness of aluminum salt in terms of yield in comparison with alcohol [12, 6]. Indeed, DENNAPA *et al*. (2006) [6] were obtained from pulp papaya (*Carica papaya*) yields of pectin of 2.5% and 5.84%, respectively precipitated with ethanol and aluminum chloride.

Also, the mineral composition point of view, since this species shows sometimes differences depending on the microclimate, the composition of culture soil and the species itself, this makes it possible to consider varied yield pectin extraction [13; 2].

The SEM observation (Figure 1) shows that the pectin precipitated by ammonium *sulphate* (Fig 1a) have a structure resembling that of the marketed pectin (Fig 1b). Indeed these two pectins have an almost identical fine structure of superimposed sheets owning pore. Conversely, the structure of pectin precipitated by aluminum chloride (Fig 1c) is very rough and non-porous; it resembles the structure of polymers.

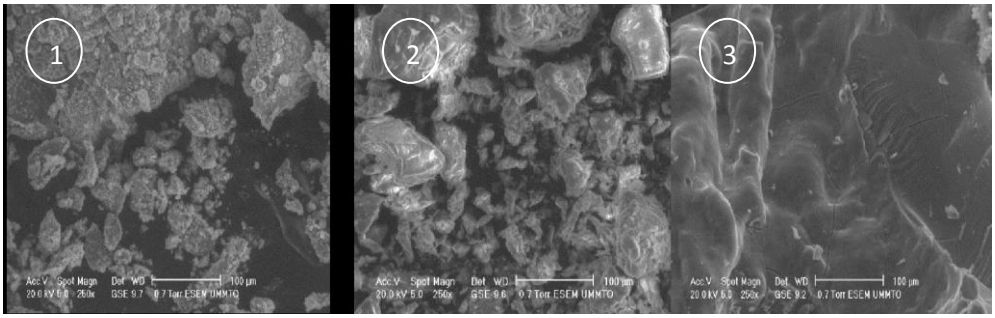

Figure 1.- SEM electron microscope structure of pectins
a): pectin precipitated by ammonium sulfate; b): commercial pectin;
c): pectin precipitated by aluminum chloride

This difference is due to the varied botanical origin of the pectins under study. As for our pectin, obtained from the rinds of the melon, the difference is presumably due to the precipitant. The IR spectra (figure 2) of the tested pectin samples show similar peaks, having three wide absorption bands at 3478 cm^{-1}, 3396 cm^{-1} and 3400 cm^{-1} which correspond to the elongation type of the vibration ν hydroxyl group (O-H) and water of hydration [14]. The three pectins have the same absorption band at 1630 cm^{-1}, and this is attributed to uronic acids. The presence of peaks at 1741cm^{-1} in commercial pectin - and 1743cm^{-1} in the precipitated aluminum salts can be attributed to esterified or not acidic sugars. However, there is a lack of these peaks in the pectin precipitated by means of sulfate salt. The presence of a peak at 2934.97 cm^{-1} in the commercial pectin and its absence in two other pectins are to be noted. This peak corresponds to ν bonds (C-H) [14]. In all three pectins, we have noticed absorption bands at 1638 cm^{-1}, 1637.52 and 1630.44, indicating the presence of uronic acids in the form of acid salts [14].

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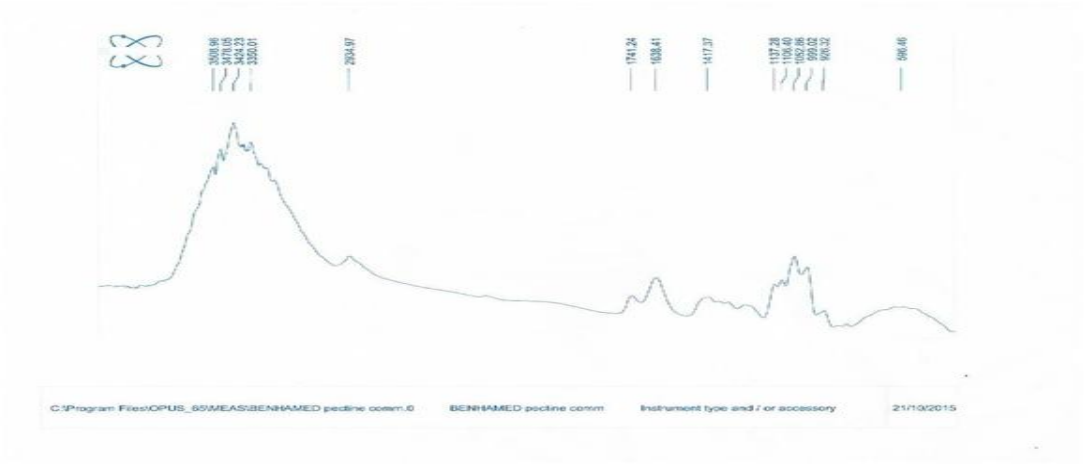
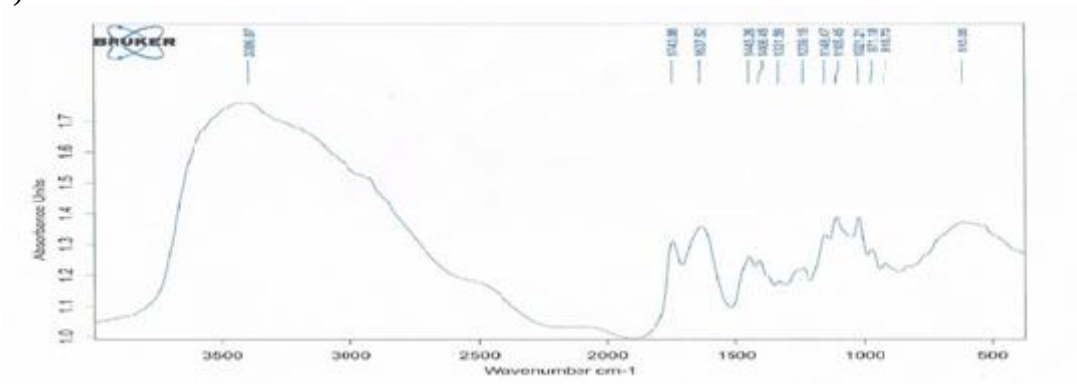


a)



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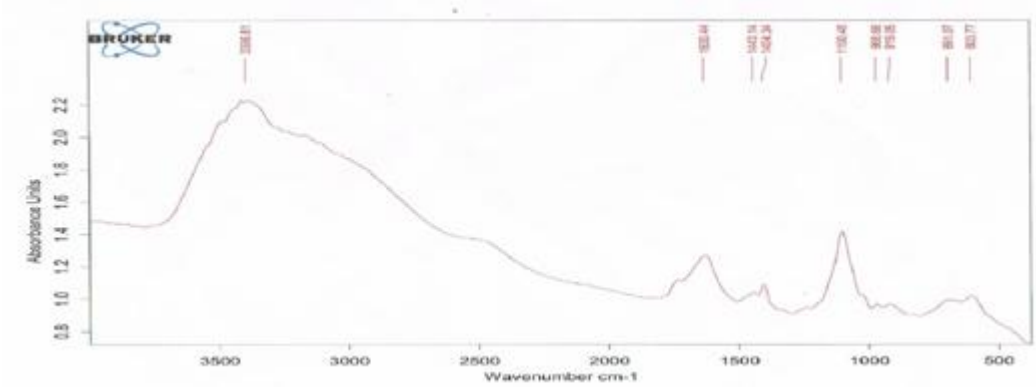

c)

Figure 2.- IR spectra of the tested pectin samples
a): pectin precipitated by ammonium sulfate; b): commercial pectin; c): pectin precipitated by aluminum chloride

Conclusion

This research highlights the melon rinds and its transformation into pectin using two types of salts: aluminum chloride and ammonium sulfate. All the results obtained in this study are only a first step towards recovery of the studied byproducts. Further accurate and thorough studies are still needed**.**

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References

[1]. Espiard E., 2002.- Introduction to the fruits industrial processing, Tec et Doc,. Lavoisier, Paris, 368p.

[2]. Yeoh S., Shi J. et Langrish T.A.G., 2008.- Comparisons between different techniques for water-based extraction of pectin from orange peels, Desalination, 218 , 1-3: 229-237.

[3].- Mesbah S. and Bouhaloufa S., 2012.- Physical-chemical characterization of two varieties of melon- manufacturing tests. Final dissertation. Mouloud Mammeri University of Tizi-Ouzou, 105p.

[4].- DSAT, 2015, Directorate of Agricultural. Services of the Wilaya of Tizi Ouzou, (Stats 2015).

[5].- Kratchanova M., Palvlova E. & Panchev I., 2004.- The effect of microwave heating of fresh orange peels on the fruit tissue and quality of extracted pectin, Carbohy. Polym., 56, 2: 181-185.

[6].- Dennapa B., Kamonrad R. and Hataichanoke N., 2006.- Extraction and physicochemical characteristics of acid-soluble pectin from raw Papaya (*Carica Papaya*) peel, Chiang Mai J. Sci., 33 1: 129-135.

[7].- Zhongdong L., Guohua W., Yunchang G. and Kennedy J.F. 2005, Image study of pectin extraction from orange skin assisted by microwave, Carbohy. Polym., 64, 4: 548-552.

[8].- Koubala B.B., Mbome L.I., Kansci G., Mbiapo F.T., Crepeau M.-J., Thibault J.-F. and Ralet M.-C. 2008.- Physicochemical properties of pectins from ambarella peels (*Spondias cytherea*) obtained using different extraction conditions. Food Chemi, 106: 1202-1207.

[9].- Faravash R.S. and Ashtiani F.Z. 2008.- The influence of acid volume, ethanol to extract ratio and acid-washing time on the yield of pectic substances extraction from peach pomace, Food Hydrocolloids, 22: 196-202.

[10].- Marcon M.V., Vriesmann L.C., WosiackI G., Beleski-Carneiro E. and Petkowicz C.L.O. 2005.- Pectins from apple pomace. Polimeras: Ciência Tecnologia, 15, 2: 127-129.

[11].- Yapo B.M., Robert C., Etienne I., Wathelet B. & Paquot M. 2006.- Effect of extraction conditions on the yield, purity and surface properties of sugar beet pulp pectin extracts, Food Chem, 35: 514-520.

[12].- Attri B.L. and Maini S.B. 1995.- Pectin from G algal (*Citrus Pseudolimon Tan*), peel. Bioresource Technology, 55: 89-91.

[13].- Kar F and Arslan N., 1999.- Effect of temperature and concentration on viscosity of orange peel pectin solutions and intrinsic viscosity–molecular weight relationship, Carbohydrate Polymers, 40, 4: 277–284.

[14].- Wu Y., Cui S.W. , Tang J., Wang Q and Gu X., 2007.- Preparation, partial characterization and bioactivity of water-soluble polysaccharides from boat-fruited sterculia seeds, Carbohydrate polymers, 70: 437-443.

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