ISSN - 2250-1991 | IF : 5.215 | IC Value : 79.96

Original Research Paper Engineering

Use of acid for the extraction of pectin of the Pitahaya *Hylocereus triangularis*

José Vicente Villarroel Bastidas	Faculty of Sciences of the Engineering, State Technical University of Quevedo (UTEQ), Quevedo, The Rivers EC.120501, Ecuador
Mary Elizabeth Muñoz Quintana	Faculty of Sciences of the Engineering, State Technical University of Quevedo (UTEQ), Quevedo, The Rivers EC.120501, Ecuador
Iván Fredy Jaramillo Chuqui	
Cesar Ramiro Bermeo	
Luis Tarquino Llerena	
Moisés Menace Almea	
Rogelio Manuel Navarrete Gómez	

ABSTRACT

The present investigation has like aim extract pectin of the exocarpo and endocarpo of the Pitahayaby means of hidrolisis acida.For which, sand used a factorial arrangementA*B*C in which the factor A: itcorresponds to the state of maturity, factor B: part of the fruit and factor C: type of acid. The experimental answers of the process of extraction of pectin were: humidity, ash, acidity, pH and performance, cada treatment is conformed by 200 g. Of Pitahaya to the same that applied the different analyses of agreement to the treatments and of this way determine the performance in each one of the treatments. The best extraction of pectin obtained of the treatment to, b_1c_2 that does referenceindex of maturity (green state)of 9.85%, the best part of the fruit is endocarpo and with the use of nitric acid with values in performance (7.23%).

KEYWORDS exocarpo, endocarpo, maturity and temperature.

INTRODUCTION

The main components that confer him rigidity to the fruits are situated in the cellular wall and arep rincipalmente cellulose, hemicelulosa, pectin and lignin (Carabalí, *et al. 2009*).The bark of citruses and the bagazo residual of the extraction of the juice of apple are the main sources of commercial pectin Yuste, *et al*(2003).The pectin is a colloid that has the property to absorb a big quantity of water, belongs to the group of the polysaccharides and finds in the majority of the vegetables especially in the citrus fruits Chacín, *et al*(2010).The pectins are the gelificador by excellence obtained of the fruits, which has big application in the alimentary industry in the preparation of compotes, aspics, and in the chemist like coagulante blood and emulsificante Guerrero, *et al*(1971).

Besides the development and utilisation of the different types of pectin is increasing and has been fundamental for the preparation of jams and jams to give him properties of gel and like estabilizantes (Devia, 2003). Lto pectin is widely used like functional ingredient in the industry of the foods and like source of dietary fibre, because of his skill to form geles aqueous Chasquibo, *et al.*(2008),p ploughs lto obtaining of pectin withcarries four fundamental steps that are the extraction,solubilización, dilution and purification of which will depend the quality so much of the pectin as of the product.

The main aim is:The extraction of pectin of the different components of the pitajaya by means of hidrolisis acida.

MATERIALS And METHODS

The process of extraction of pectin made in the laboratories of chemistry of the career of Agro-industrial engineering of the Faculty of Sciences of the Engineering of the State University of Quevedo the analyses bromatológicos effected in the laboratories of the Faculty of Engineering in Sciences Agropecuarias of the same Institution.

For the present study applied a statistical design in a factorial arrangement A*B*C with twolevels in the Factor A (State of Maturity), two levels in Factor B (Part of the Fruit) and three levels in the Factor C (Types of Acido).

FACTORS		
State of Maturity	a_0	Pitahaya Mature
	a_1	Pitahaya Green
Part of the Fruit	b_0	Exocarpo Of Pitahaya
	b_1	Endocarpo Of Pitahaya
Type of Acid	C_0	Acid Clorhídrico
	C_1	Sulphurous acid
	C_2	Nitric acid

Picture. 1. Factors Study

Extraction of pectin.

The vegetal materials degrade by the presence of microorganisms, for the inactivación bacteriana planted the samples during 10 minutosin water (1.5 L) to 100ºC with this

method controls the proliferation of microorganisms that can deteriorate the prime matter. Lto separation of the endocarpo and exocarpo effected in shape manual with a bistoury for afterwards be weighed and afterwards be separated the exocarpo and endocarpo, the extraction of pectin applied 3 types of acids: Clorhídrico, sulphurous and nitric, weighed samples of 200g. método Similar of Vernon et al.(1995), which consisted to plant the endocarpo and exocarpo in a glass of precipitation of 1000 mL to add water acidulada in a volume of 800mL, the f iltración has like end the separation of the fibre and the liquid, the product obtained entered it to him to a stove to 65ºC by 18 hours and obtained the solid pectin, for the obtaining of a size of uniform particle proceeded to powder, once obtained the pectin proceeded to determine the ashes, pH, humidity and performance of the pectin.

Statistical analysis

For the analysis of data made proofs of normality and homogeneity of variance using the proofs of Kolmogorov-Smirnov and Levene, respectively. It used an ADEVA to determine the statistical differences between the variables measured in the experiment. Finally it made the proof post hoc of comparison of ranks multiples HDS Tukey. I fix a level of significancia of < P 0,5. The statistical analyses made with the statistical program StatGraphics v. 16.1.

Results and Discussion

Ash

In what the results of ash in the extraction of pectin the Factor A: (Been Maturity), observed that the best result presents it the levela_1 (Pitahaya Green) (14,06 %) in relation with thes data reported byChasquibo, et al.(2008) and(Ferreira, 2007)which possess similar values to the obtained of the pectin of the Pitahaya by his content of minerals, with what respecta to the Factor B: (Part of Fruit), there was not difference by which can select any part of the fruit, the Factor C: (Type of Acid), the best result presented it the level c1 (sulphurous Acid 0,5%) launching a value of (17,67%).

Factor A	Averages	n	E.E.	Significancia
Pitahaya Mature	8,49	12	0,78	A
Pitahaya Green	14,06	12	0,78	B

Picture 2. Averages of the factor To regardingAsh

Factor C	Averages	n	E.E.	Significancia
Nitricacid	7,94	8	0,95	A
Acid Clorhídrico	8,22	8	0,95	A
Sulphurousacid	17,67	8	0,95	B

Picture 3. Averages of the factor C regarding Ash

Regarding the interaction*A* B* C* (Been Maturity *Splits of the Fruit * Type of Acid) observes that the highest value obtained it the treatment $_{12}a_1b_1c_1$ (47,43%) of ash (Pitahaya Green * Endocarpo * Sour Sulphurous 0.5%), what agrees with the reported D´Addosio, *et al.*(2005) it is due to that his components are similar regarding the content of minerals in the two fruits.

Factor A	Factor B	Factor C	Averages	n	E.E.	Significancia
Pitahaya Green	Endocarpo	Nitric acid	2,14	2	1,91	A
Pitahaya Mature	Endocarpo	Acid Clorhídrico	2,58	2	1,91	A
Pitahaya Green	Endocarpo	Acid Clorhídrico	3,46	2	1,91	A
Pitahaya Mature	Endocarpo	Sulphurous acid	3,94	2	1,91	A
Pitahaya Mature	Endocarpo	Nitric acid	6,31	2	1,91	A
Pitahaya Green	ExocarpOr	Sulphurous acid	8,48	2	1,91	A
Pitahaya Green	Exocarpo	Nitric acid	10,0	2	1,91	A
Pitahaya Mature	Exocarpo	Sulphurous acid	10,8	2	1,91	A
Pitahaya Green	Exocarpo	Acid Clorhídrico	12,8	2	1,91	A
Pitahaya Mature	Exocarpo	Nitric acid	13,3	2	1,91	B
Pitahaya Mature	Exocarpo	Acid Clorhídrico	13,9	2	1,91	C
Pitahaya Green	Endocarpo	Sulphurous acid	47,4	2	1,91	D
Averages with a common letter are not significantly different (p > 0,05)						

Picture 4. AshAccording to Interaction To*B*C (BeenMaturity* Splits of the Fruit* Type of Acid)

Humidity

Regarding the result of the content of humidity in the extraction of pectin, in the factor To *(Been Maturity)*, the best result of content of humidity presents it the levela1 (Pitahaya Green), launching a value of (11,26%) which finds inside the parameters of the studyof Chasquibo, *et al.*(2008), with what respecta to the *factor B: (Part of Fruit),* the best result presented it the level b1 (Endocarpo) withor n value (11,44%), the *factor C: (Type of Acid)*, the best result presented it the level c_2 (Nitric Acid) launching a value of (12,55 %) similar to the ones of the investigation ofD´Addosio, *et al.*(2005) to weigh that the fruit of the Pitahaya possesses an elder contained of humidity in the process of extraction this diminishes it to him by the time of dried.

Factor A	Averages	n	E.E.	Ranks
Pitahaya Green	11,26	12	0,1	A
Pitahaya Mature	14,94	12	0,1	B

Picture 5. Averages of the factor To regardingHumidity

Factor B	Averages	n	E.E.	Ranks
Endocarpo	11,44	12	0,1	A
Exocarpio	14,76	12	0,1	B

Picture 6. Averages of the factor B regardingHumidity

Factor C	Averages	N	E.E.	Ranks
Nitric acid	12,55	8	0,12	A
Acid Clorhídrico	13,07	8	0,12	B
Sulphurous acid	13,68	8	0,12	C

Picture 7. Averages of the factor C

Regarding the interactionA* B* C (Been Maturity *Splits of the Fruit * Type of Acid) observor that the highest value obtained it the treatment $a_1b_1c_2$ (6,69 %) (Pitahaya Green * Endocarpo * Sour Nitric) this value finds inside the parameters established by D´Addosio, *et al.*(2005), in which it specifies like maximum percentage the 6,76 % of Humidity by the use of acid applied and the state of the fruit that still has not completed his physiological maturity.

Factor A	Factor B	Factor C	Averages	n	E.E.	Ranks
Pitahaya Green	Endocarpo	Nitric acid	6,69	2	0,25	A
Pitahaya Green	Endocarpo	Sulphurous acid	8,49	2	0,25	B
Pitahaya Green	Endocarpo	Acid Clorhídrico	8,56	2	0,25	B
Pitahaya Mature	Endocarpo	Acid Clorhídrico	13,31	2	0,25	C
Pitahaya Green	Exocarpo	Nitric acid	13,45	2	0,25	C
Pitahaya Mature	Exocarpo	Nitric acid	14,61	2	0,25	C
Pitahaya Green	Exocarpo	Sulphurous acid	14,78	2	0,25	D
Pitahaya Mature	Exocarpo	Acid Clorhídrico	14,84	2	0,25	D
Pitahaya Mature	Exocarpo	Sulphurous acid	15,32	2	0,25	E
Pitahaya Mature	Endocarpo	Nitric acid	15,45	2	0,25	E
Pitahaya Green	Exocarpo	Acid Clorhídrico	15,57	2	0,25	E
Pitahaya Mature	Endocarpo	Sulphurous acid	16,12	2	0,25	F
Averages with a common letter are not significantly different (p > 0,05)						

Picture 8. HumidityAccording to Interaction To*B*C (BeenMaturity* Splits of the Fruit* Sour Type)

Performance

Regarding the performance the best results has observed that in the Factor A:(BeenMaturity) the same that it does not present statistical difference for the process of obtaining of the pectin can use any state of maturity, the Factor B that corresponds (Part of Fruit) the best result presented it the level b1 (Endocarpo) launching a value of3,23%; the factor C of the types of acids does not present difference by which can use any type of acid that is

upper to the reported by Maldonado, et al., (2010), with 2,15% and 2,10% of performance owed to the state of maturity to the that extracted the pectin.

Picture 9. Averages of the factor B regarding Performance

Factor B	Averages	n	E.E.	Significancia
Exocarpo	1,18	12	0,42	A
Endocarpo	3,23	12	0,42	B

With the concerning the intersectionA*B*C the besttreatment is the 12 ($a_1b_1c_2$) (Pitahaya Seeof * Endocarpo * Sour Nitric) with values of 7,23%the same that I consider it to him like better for having greater performance in comparison with the others treatments. This agrees with what established by Granda M. Extraction and Characterisation of the Pectin in Three Species of the Gender Vasconcellea, Native south of the Ecuador" 2010.

Picture 10. Performance According to Interaction To*B*C (Been Maturity * Splits of the Fruit * Type of Acid).

Factor A	Factor B	Factor C	Averages	n	E.E.	Ranks
Pitahaya Green	Endocarpo	Sulphurous acid	0,76	2	1,04	A
Pitahaya Green	Exocarpo	Sulphurous acid	0,96	2	1,04	A
Pitahaya Mature	Exocarpo	Acid Clorhídrico	1,07	2	1,04	A
Pitahaya Mature	Exocarpo	Nitric acid	1,1	2	1,04	A
Pitahaya Mature	Endocarpo	Nitric acid	1,22	2	1,04	A
Pitahaya Green	Exocarpo	Nitric acid	1,23	2	1,04	A
Pitahaya Green	Exocarpo	Acid Clorhídrico	1,32	2	1,04	B
Pitahaya Mature	Exocarpo	Sulphurous acid	1,39	2	1,04	B
Pitahaya Mature	Endocarpo	Sulphurous acid	2,38	2	1,04	B
Pitahaya Mature	Endocarpo	Acid Clorhídrico	3,14	2	1,04	B
Pitahaya Green	Endocarpo	Acid Clorhídrico	4,63	2	1,04	B
Pitahaya Green	Endocarpo	Nitric acid	7,23	2	1,04	B
Averages with a common letter are not significantly different (p > 0,05)						

CONCLUSIONS

It concludes that the three factors; andstado of maturity, p art of the fruit and tipo of acid influencesn significantly in the performance of the pectin obtained. This means that to minor been of better maturity content of pectin and therefore it gives greater performance.

Likewise, andl optimum state of p itahaya with an index of maturity of 9,85%in which it obtained greater extraction of pectin since lyou processes of maturity increases the solubility of the substances pépticas presents in the fruit and therefore exists a greater availability of them when the fruit has not completed this process.

Finally, broasted in exposed results concludes that the best extraction of pectin is the best index of maturity is 9,85% and the best part of the fruit is endocarpo since it obtained a performance (7,23), besides with better results with the concerning pH, humidity and acidity.

References

1. Beautiful, J., Balois, R., Sumaya, M. P., Rodríguez, To., Sánchez, L., & Jiménez, And. (2014). Extraction and characterisation reológica of starch and pectin in fruits of banana 'Pear' (Muse ABB). Mexican magazine of Agricultural Sciences c(8), 1501-1507.
2. Carabalí, I., Narváez, C., & Restrepo, L. (2009). Extraction and Measure of Activity of Pectin Metil Estearasa in Pitaya Yellow (Acanthocereus Pitajaya), Enzyme Related with the Ablandamiento. Revistas.unal.edu.com.
3. Chacín, J., Marín, M., & D´Addosio, R. (210). Evaluation of the content of pectin in different genotypes of guava of the zone south of the Lake of Maracaibo*. MULTICIENCIAS, 10(1), 7-12.
4. Chasquibo, L., Brook, And., & Morals, J. (2008). Extraction and characterisation of pectins obtained from fruits of the Peruvian biodiversity. Industrial engineering (26), 175-199.
5. D´Addosio, R., Páez, G., Marín, M., Marble, Z., & Ferrer, J. (2005). Obtaining and characterisation of pectin from the shell of parchita (Passiflora edulis f. flavicarpa Degener). Scielo, 22(3).
6. Devia, J. (2003). Process to produce citrus Pectins. MAGAZINE University EAFIT (129), 21-30.
7. Escalante, M., Santos, I., Rojas, L., & Lárez, C. (2012). Aprovechamiento Of organic wastes: 1. Extraction and characterisation of the oil of seeds. Advances in Chemistry, 7(3), 181-186.
8. Loyola, N., Núñez, P., & it Coins, C. (2013). Extraction and analysis of pectins from cranberry (Vaccinium corymbosum L.). Magazine of the Faculty of Agricultural Sciences, 45(1), 79-89.
9. Maldonado, And., Salazar, S., Millions, C., Torres, And., & Vásquez, And. (2010). Extraction of pectin by means of the method of sour hydrolysis in fruits of maushan (Vasconcellea weberbaueri (Harms) V.M. Badillo) From the district of San Miguel of Soloco, region Amazons. Contribution Santiaguino, 3(2), 177-184.
10. Sindoni, V., Hidalgo, M., Spanish, G., Núñez, K., & Boroughs, M. (2013). Effect of two phases of maduration on the quantity of pectin obtained in two varieties of parchita (Passiflora edulis F. FLAVICARPA DEGENER) Of different Origin. Magazine Iberoamericana of Technology Postcosecha, 14(2), 93-100.
11. Vernon, And., Carter, R., Pedroza, And., & Aguilar, And. (1995). Extraction of pectin from tejocote "crataegus Mexican" by means of sour hydrolysis and resins of ionic exchange. Spanish magazine of science and technology of foods, 35(2), 151-160.
12. Yuste, J., & Garza, S. (2003). The geles of pectin and his application in the alimentary industry. Alimentary: Magazine of technology and hygiene of the foods (42), 93-98.