ISSN : 0974 - 7435 Volume 9 Issue 6

BioTechnology
An Indian Journal

FULL PAPER

BTAIJ, 9(6), 2014 [248-251]

Modelling and purification of quercetin from skin of *Allium cepa* by soxhlet extractor

M.Manasa, S.Manoj Kumar, Meena Vangalapati*
Centre for Biotechnology, Department of Chemical Engineering, Andhra University, Visakhapatnam-03, Andhra Pradesh, (INDIA)
E-mail : meena_sekhar09@yahoo.co.in

ABSTRACT

Onion (*Allium cepa*) is the second most important horticulture crop all over the world. It is used as important source of phytoconstituents and food flavor. *Allium cepa* is one of the richest source of flavonoids and organosulphur compounds. The extraction was carried out by employing various organic solvents using Soxhlet extraction method. Methanol was found to be the best solvent for the extraction of quercetin from *A.cepa*. Soxhlet extractor was carried out using methanol at different extraction times to verify the mathematical model proposed in this work. The final form of the proposed models were $E_s = 5.942(t) + 125.9$ for Quercetin where E_s = yield extract (µg/mL of quercetin) and t = extraction time (hr) and for total phenolic content the final form was $E_s = 3.294(t) + 41.16$ where E_s = yield extract (µg/mL of Total phenolic content) and t = extraction time (hr). Purification of quercetin with 1:0.5 ratio of hexane and the partition coefficient was found to be 1.21. The proposed models showed good agreement with experimental data.

KEYWORDS

Allium cepa;
Quercetin;
Flavonoids;
Total phenolic content;
Solvent extraction;
Modelling equation;
Soxhlet extractor.

INTRODUCTION

Onion, pharmacologically know as *Allium cepa*, is found in every household. Onion is one of the richest sources of flavonoid compounds (mainly quercetin and its conjugates) organosulphur compounds and pigments such as anthocynins[1]. Compared to the Bulb,the Skin of *A.cepa* is a rich source of flavonoids and organosulphur compounds[2]. The extraction methods of valuable components from the waste of onion should be worth enough to pursuit in economic point of view and environmental benefit[3-5].

Although rarely used as a medicinal herb has a wide range of beneficial actions on the human health. *A.cepa* has many pharmacological properties such as Antimicrobial activity, Antioxidant activity, Anticarcinogenic activity[6], Antimutagenic activity[7], Anti-hyperglycaemic or Anti-diabetic potential etc.[8-11].

MATERIALS AND METHODS

Collection of material:

Onion skin was collected from a local market at Visakhapatnam, AP. The Skin was cleaned and dried.

The dried skin was powdered and used as a raw material and stored in an air tight container.

Chemicals and reagents

Folin-Denis reagent, sodium carbonate (Na_2CO_3), Aluminum chloride, Potassium acetate, methanol, ethanol, hexane and distilled water.

Estimation of the compounds

Total flavonoid content in terms of Quercetin and rutin were estimated according to the Aluminum chloride calorimetric assay method. Total phenolic content were estimated according to the method of Folin-Denis[12]

Solvent extraction using soxhlet extractor

Prior to the solvent extraction study, 200ml of of 80% methanol was prepared and was kept still of the extractor. 2 grams of Skin of *Allium cepa* was placed in thimble with the help of a filter paper and then the condenser was connected to it. Now the total apparatus was placed in the heater. Using the soxhlet apparatus continuous extraction was done for 10 hrs.

Figure 1 : Soxhlet Extraction Apparatus

The entire system was shown in Figure 1.

Solvent – Solvent extraction was done by hexane[13] as solvent, taking different ratios of extract and hexane in a conical flask, 1:0.5, 1:1, 1:1.5 and 1:2 ratios of extract and hexane were taken in different conical flasks and placed in an orbital shaker for about few hours. After few minutes of solvent extraction with hexane, two phases, extract and raffinate were separated. Readings were noted down for every one hour in order to note the exact time, when maximum extraction was observed..

Modelling of extraction of quercetin using soxhlet extractor apparatus:

In order to describe the quercetin transfer from Skin of *Allium cepa* to the bulk of the solvent the following hypothesis were used. The mass transfer coefficient is constant. The solvent in the extractor is perfectly mixed, while the transfer resistance in the liquid phase is negligible and the quercetin concentration in the solvent depends only on time. The transfer of the quercetin was a diffusion phenomenon and independent of time. The final form of the modelling equation was obtained from the extraction of quercetin by using Soxhlet extractor.

$E_s = A(t)+B$ for Quercetin

Where A & B are constants, E_s = yield extract (µg/mL of quercetin) and t = extraction time (hr)

RESULTS AND DISCUSSIONS

The highest amount of quercetin extracted from 80% methanol concentration. The final form of the proposed model equation $E_s = 5.942(t) + 125.9$ for Quercetin where E_s = yield extract (µg/mL of quercetin) and t = extraction time (hr).

For total phenolic content the final form was $E_s = 3.294(t) + 41.16$ where E_s = yield extract (µg/mL of Total phenolic content) and t = extraction time (hr)

The results were showed in TABLE 1 and 2. The model showed a good agreement with the experimental data as shown in Figures 2 and 3.

Purification of flavonoids

Methanolic extract that was obtained after soxhlet extractor is subjected to purification by Liquid – Liquid extraction.

Liquid – Liquid Extraction

This is one of the purification step carried out for the purification of flavonoids. Among different ratios 1:0.5, 1:1, 1:1.5 and 1:2 of extract and hexane, 1:0.5 had shown optimum purification after 1 hr of solvent – solvent extraction(TABLE 3). Initial concentrations of

FULL PAPER

TABLE 1 : Effect of Extraction yield with Extraction time for quercetin

Time(hrs)	Concentration (µg/mL)	
	Quercetin	Rutin
1	120.036	65.3
2	140.56	82.4
3	147.127	86.9
4	152.309	96.54
5	159.67	98.14
6	167.49	100.7
7	170.58	102.83
8	174.76	105.67
9	168	101.11

TABLE 2 : Effect of Extraction yield with Extraction time for TPC

Time(hrs)	Concentration of TPC (µg/mL)
1	39.18
2	50.35
3	52.3
4	54.18
5	58.77
6	63.85
7	65.53
8	68.82
9	65.71

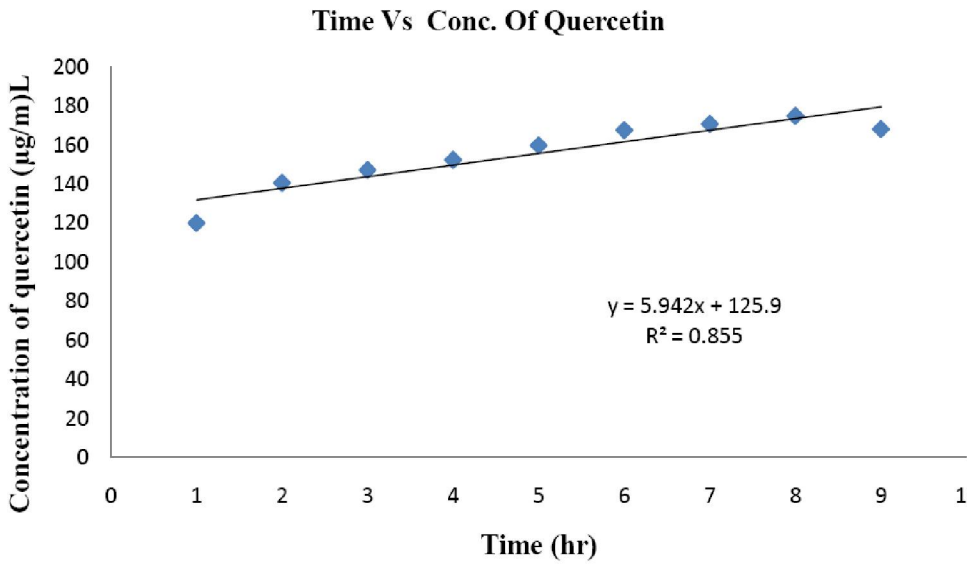

Figure 2 : Effect of Extraction yield with Extraction time for quercetin

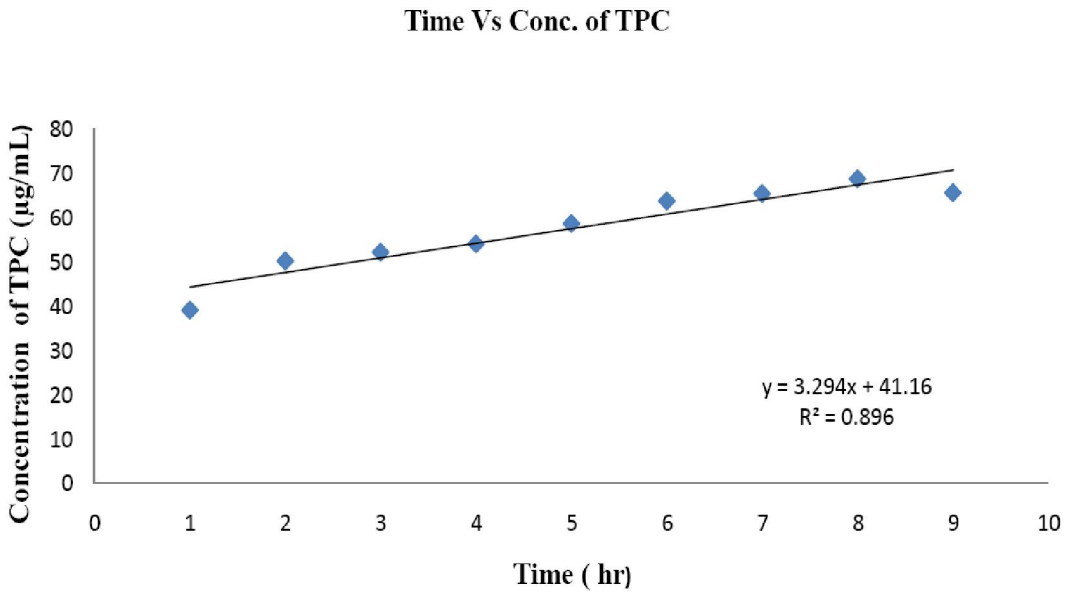

Figure 3 : Effect of Extraction yield with Extraction time for TPC

quercetin and rutin for crude extract were found to be 174.76 µg/mL and 101.11 µg/mL. After extraction with hexane for 1hr their concentrations have been raised to 182.88 µg/mL and 111.19 µg/mL respectively and the Partition coefficient was found to be 1.21.

Partition coefficient = $\frac{182.88}{150.94}$ =1.21

TABLE 3 : Purification of flavonoids with different ratios of hexane

Extract : hexane	Extraction time: 1 hr		2 hrs	
	Quercetin µg/mL	Rutin µg/mL	Quercetin µg/mL	Rutin µg/mL
1 : 0.5	182.88	111.19	178.07	108.74
1 : 1	180.82	109.79	177.43	106.54
1 : 1.5	178.23	108.74	176.23	104.98
1 : 2.0	176.55	106.89	174.22	102.23

CONCLUSION

Methanol was found to be the best solvent for the extraction of quercetin from skin of *Allium cepa* by Soxhlet Extractor. Among the different concentrations, 80% methanol shows highest yield. The final form of the proposed models E_s = 5.942(t)+ 125.9 for Quercetin where E_s = yield extract (µg/mL of quercetin) and t = extraction time (hr). For total phenolic content the final form was E_s = 3.294(t)+ 41.16 where E_s = yield extract (µg/mL of Total phenolic content) and t = extraction time (hr).

From the present results the maximum solvent-solvent extraction was observed with 1:0.5 ratio of extract to hexane. The initial quercetin concentration in crude extract was found to be 174.76 µg/mL after extraction with hexane for 1hr the concentrations have been raised to 182.88 µg/mL and the partition coefficient was found to be 1.21. The proposed models showed good agreement with experimental data.

REFERENCES

[1] M.Manasa, S.Manoj Kumar, Meena Vangalapati; Natural Products: An Indian Journal, **9(7)**, 277-283 **(2013)**.

[2] M.Manasa, S.Manoj Kumar, Meena Vangalapati; Asian academic research journal of multidisciplinary, **1(12)**, 245-251 **(2013)**.

[3] S.J.Kim, G.H.Kim; Food Sci.Biotechnol., **15**, 39-43 **(2006)**.

[4] Eun Young Jin, Seokwon Lim, Sang Oh Kim, Young-Seo Park, Jae Kweon Jang, Myong-Soo Chung, Hoon Park, Kun-Sub Shim, Young Jin Choi; Food Sci.Biotechnol., **20**, 1727-1733 **(2011)**.

[5] M.Manasa, S.Manoj Kumar, Meena Vangalapati; International Journal of Innovative Research in Science, Engineering and Technology, **2(7)**, 3125-3129 **(2013)**.

[6] Jonathan Santas, Marý´a Pilar Almajano, Rosa Carbo; International Journal of Food Science and Technology., **45**, 403–409 **(2010)**.

[7] Hang Xiao, Kirk L.Parkin; Elsevier Phytochemistry, **68**, 1059–1067 **(2007)**.

[8] Abhishek Bhanot, Richa Shri; Journal of Pharmacognosy Reseach., **2(6)**, 374–384 **(2010)**.

[9] I.L.Goldman, M.Kopelberg, J.E.P.Debaene, B.S.Schwartz; Antiplatelet activity of onion (Allium cepa) is sulfur dependent.Journal of Thromb Haemost, **76**, 450-453 **(1996)**.

[10] Chitra shenoy, M.B.Patil1, Ravi Kumar, Swati Patil; International journal of pharmacy and pharmaceutical sciences, **2(2)**, **(2009)**.

[11] E.T.Arung, S.Furuta, H.Ishikawa, I.W.Kusuma, K.Shimizu, R.Kondo; Journal of Food Chem., **124**, 1024-1028 **(2011)**.

[12] Harpreet Wall, Subodh Kumar, Saroj Arora; Journal of medicinal plants research, **59(13)**, 2608 **(2011)**.

[13] S.H.Schanderl; In Method in food analysis academic press, New York, 709 **(1970)**.