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A COMPARATIVE STUDY OF FLAVONOIDS FROM ONION *(ALLIUM CEPA L.)* PEELS THROUGH MICROWAVE ASSISTED EXTRACTION AND CONVENTIONAL METHOD

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Abstract

Onion peels contain bio active compounds which is a magnificent source of phyto chemicals and can be used as a medicinal drugs for curing cancer, obesity, microbial agents and pharmacological drugs. Onion peel can be extracted in different methods and ways which can improved and developed in utilizing waste and likewise, in this research, MAE and conventional method (Soxhlet) is used for extracting flavonoids, phenolic content and antioxidant activity. In conventional method, different time (2hrs, 3 hrs, 4 hrs): temperature (50˚, 60˚, 70˚) combinations were employed and similarly in MAE different time (5 mins, 10 mins, 15 mins): power level (200W, 350 W, 400W) combinations were used. In conventional method, the amount of TFC were found to be the highest in treatment 60˚ for 3hrs i.e., 20.22 (mg QE/g). Similarly, on the other hand, in MAE method, the amount of TFC were found to be the highest in 200W for 15 mins i.e., 38.65 (mg QE/g). On comparing the methods of extraction, it was found that MAE was better in terms of the amount of TFC. This research emphasis the importance of bio active compounds present in onion peels such as flavonoids using MAE and Soxhlet extraction and their highest efficiency of these two methods was determined. Consequently, instead of discarding onion peel as a waste material polluting the environment with harmful odor, onion peels can be used as salubrious in the medical field and nutritional food which can improve well-being.

Keywords: Onion Peel, TFC, MAE, Soxhlet Extraction.

1. Introduction

Onion peels are a significant source of flavonoids, phenolic content and antioxidant activity and are excellent source of phytochemicals and bioactive compounds. Onion peels a, re considered as a waste material in some cases, causing odor and polluting the environment which includes industrial processing, household or kitchen which generates ample amount of waste. India produces 300-400 kg of onion peels per day and more than 500,000 tones in the European Union each year **(Das and Mandal, 2019)**.

Flavonoids belong to a larger group of plant chemicals called polyphenols. They are natural compounds that can be found in plants and are known to have several advantages on human

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health (***Sharma* et al., 2016).** Flavonoids have antioxidants properties which helps in repairing damaged cells which are caused by free radicals and several diseases and may help in reducing certain type of cancers, neurodegenerative disorders and heart diseases. Additionally, flavonoids can reduce the pathways of breast cancer and can act as a drug resistance (***Baker* 2022).** Flavonoids can be used as a drug since they possess antioxidant properties and therapeutic activities act as antiviral, antibacterial, anti-inflammatory, cardioprotective, anticancer, antidiabetic and other life threatening diseases **(*Pal and Jadeja* 2019).**

MAE is also known as Microwave assisted extraction and is an extraction technique which is way superior over other methods of extraction process. It is of low cost and provides better processed with a shorter time period, higher extraction rate and consumes less energy consumptions **(Ventura *et al*., 2017).** MAE is quick technique to extract since the heat is transmit directly to the solvent **(Lopez, 2000**). MAE is commonly used as a theoretical method due to its specific heating properties, better outputs and reasonable cost under atmospheric situations **(Sham et al., 2020**). MAE technique has low solvent requirement, lesser processing time, extraction rates which are higher compared to other methods and also accumulates better product at reasonable cost **(Prakash et al., 2014**).

Soxhlet extraction is a conventional method commonly used for the extraction of compounds from specific samples which has some attractive supremacy which includes simple properties that requires little training to operate and be extracted more samples than most of the alternatives extraction **(Castro and Capote, 2010)**. It is scientifically confirmed that onion peels are rich in flavonoid glycosides (**Das and Mandal, 2019)**. Thus, the aim of this study was to examine the impact of process parameters of the microwave assisted extraction and convention method of flavonoids from onion peels.

2. MATERIALS AND METHODS

Sample preparation

For preparing onion peel powder for MAE extraction, onion peels was procured from a local market and restaurants in Prayagraj, India. Onion peels are washed and then dried for preparing its powdered form. After grinding, the powder is sieved using a sieve shaker of 50 mesh sized and packed in a zip locked packaged (LDPE) which has to be sealed so that there is no moisture loss and stored in a refrigerator 5±2°C for further treatments.

Conventional Method

In this process the solvent used was Ethanol. The solute and solvent used in the ratio of 50:50 (ethanol+ water). The sample was placed in a thimble. The procedure was performed at 50°, 60°, and 70° at three different time period of 2 hrs, 3 hrs, and 4 hrs. After this process the extract was cool down and centrifuged at 5000 rpm for 5 minutes and then filtered with Whatman No. 1 filter paper. The solvent used for extraction was removed by a rotary evaporator and the obtained powder was re-solubilized in hexane standardized volume for the spectrophotometer analysis (**Castro and Capote, 2010).**

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 12, Iss 2, 2023

Table 1: Formulation table of Conventional Method

Sample	Temperature	Time
T0	50°C	2 hrs
T1	50°C	3 hrs
T2	50°C	4 hrs
T3	60°C	2 hrs
T4	60°C	3 hrs
T5	60°C	4 hrs
T6	70°C	2 hrs
T7	70°C	3 hrs
T8	70˚C	4 hrs

Microwave Assisted Extraction

LG MC2149BB (Prayagraj, India) was used for extracting TPC and TFC from onion peel. The treatments were performed from 200 W, 350 W and 450W and extraction time (5, 10, 15 min) and methanol concentration (10–100% v/v). After extraction, the extracts were centrifuged at 4000 rpm for 15 mins (model R-8C BL) and the extracts were evaporated using a rotary vacuum evaporator. Furthermore, the extracts are used for analysis for total flavonoids content.

Table 2: Formulation table of MAE

Sample	Watts	Time
T9	200 W	5 mins
T10	200 W	10 mins
T11	200 W	15 mins
T12	300 W	5 mins
T13	300 W	10 mins
T14	300 W	15 mins
T15	450 W	5 mins
T16	450 W	10 mins
T17	450 W	15 mins

Determination of Total Flavonoid Content (TFC)

The determination of total flavonoid content was determined as per the method of **Benıtez *et al.* (2011)** with minor modifications. Onion peel extract was taken in quantity of 0.5 mL in test tube from different samples. Methanol (80%, 1.5 mL) was added into each test tube. Further, 0.1 mL aluminium chloride (10%) and 0.1 mL of potassium acetate (1 M) was poured. Distilled water (2.8 mL) was poured and incubated for 30 min at room temperature (25˚C). The absorbance was measured at 410 nm via UV–Vis Spectrophotometer REMI (model R-8C BL).

Determination of Flavonoid yield samples

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Research paper UGC CARE Listed (Group -I) Journal Volume 12, Iss 2, 2023

The flavonoid yield was calculated using the formula given by Nan et al., 2019

Flavonoid yield (mg/g) = $\frac{c \times v \times n}{m} \times 4$

STATISTICAL ANALYSIS

The results were statistically analyzed using the analysis (ANOVA). Two-way ANOVA was used and effect of both treatments and replications on the analyzing parameter was checked.

3. Results and Discussions

Conventional Soxhlet extraction of Total Flavonoid Content from onion peel

The effect of time and temperature of total flavonoid content on onion peel is presented in Fig.1. The minimum TFC of onion peel through Soxhlet extraction was obtained at low temperature and as temperature increases the TPC rate also increased, but at a certain temperature the TPC rate also decreases as shown in Fig. 1. It was found maximum at 60˚ for 4 hours that is 20.22 mg QE/g in T5 and followed by T4 at 60°C for 3 hours that is 20.03 mg QE/g minimum at 70˚ for 4 hours that is 17.95 mg QE/ g in T8 and . **Pal and Jadeja (2019)** observed similar results in extraction of TFC from onion peel.

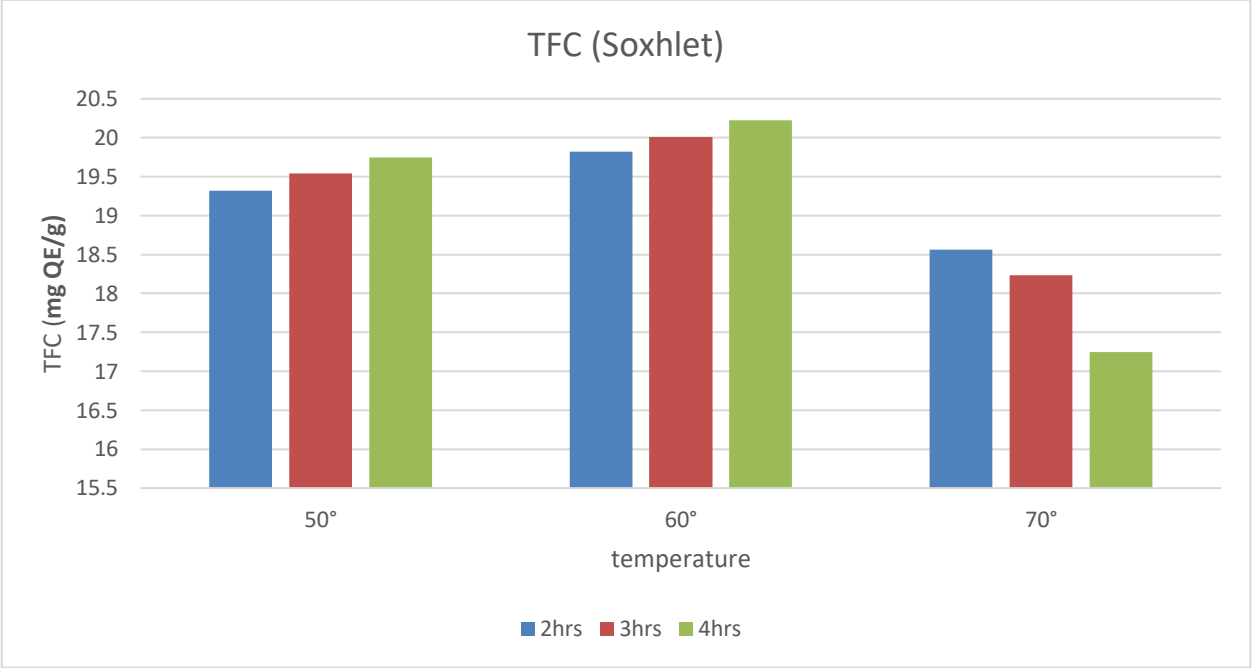
Table 3. Treatment table of Conventional Method

Treatment	**T0**	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**	**Total**	**Mean**
R1	19.32	19.54	19.75	19.82	20.01	20.22	18.56	18.23	17.95	173.40	19.27
R2	19.31	19.53	19.72	19.81	20.02	20.24	18.53	18.21	17.91	173.28	19.25
R3	19.33	19.54	19.73	19.81	20.03	20.23	18.54	18.22	17.92	173.35	19.26
Total	57.96	58.61	59.20	59.44	60.06	60.69	55.63	54.66	53.78	520.03	104.01
Mean	19.32	19.54	19.73	19.81	20.02	20.23	18.54	18.22	17.93	104.01	
sd	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.02		
C.D	0.2										

Figure 1: Conventional Soxhlet extraction of Total Flavonoid Content from onion peel

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 12, Iss 2, 2023



Microwave assisted extraction of Total Flavonoid from onion peel

The impact of different microwave power level and time on total flavonoid of onion peel is presented in Fig. The minimum TFC of onion peel through MAE was obtained at low power level and as power level increases the TFC rate also increased, but at high power level the rate also decreases as shown in Fig 4.12. It was found maximum at 200 W for 15 mins that is 38.65 mg GAE/ g in T11, followed by 200 W for 10 mins that is 38.65 mg GAE/g and minimum at 450 W for 15 mins that is 24.01 mg GAE/ g in T8 and. **Das and Mandal (2015)** observed similar results in extraction of TFC from onion peel.

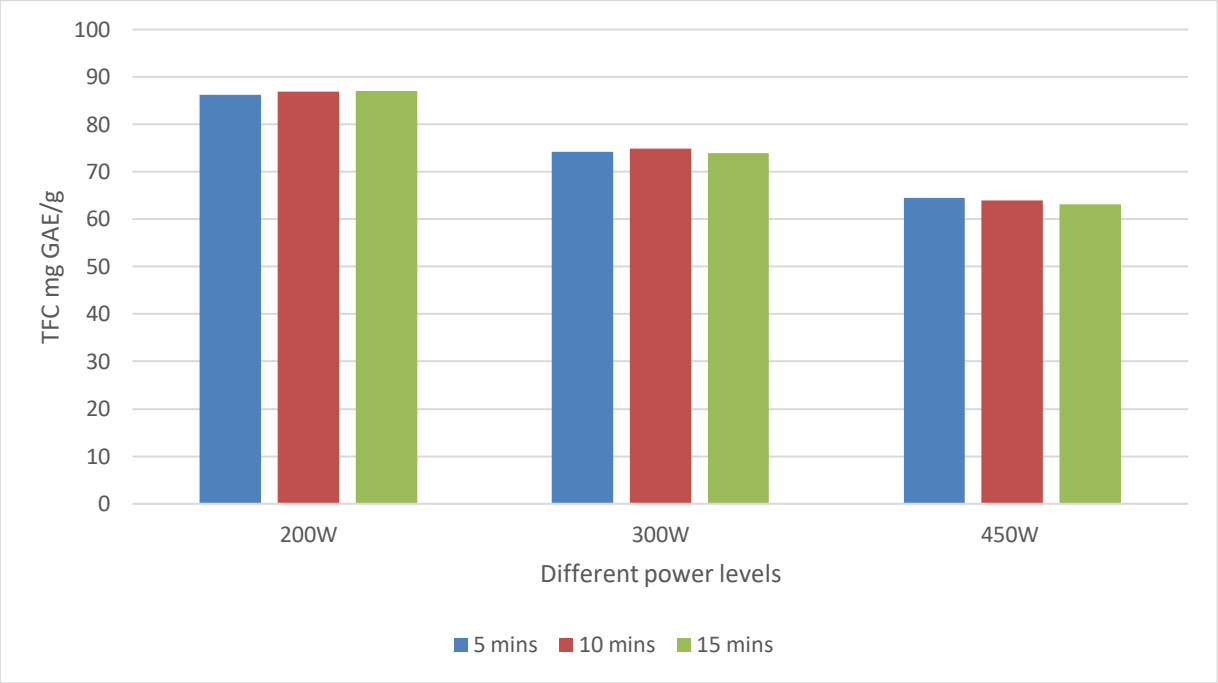
Table 4. Treatment table of Microwave assisted extraction

Treatment	T9	T10	T11	T12	T13	T14	T15	T16	T17	Total	Mean
R1	38.2	38.41	38.65	37.1	37.81	36.81	24.32	24.26	24.01	299.57	33.29
R2	38.21	38.42	38.64	37.12	37.81	36.82	24.31	24.25	24.05	299.63	33.29
R3	38.22	38.5	38.63	37.13	37.82	36.84	24.32	24.27	24.02	299.75	33.31
Total	114.63	115.33	115.92	111.35	113.44	110.47	72.95	72.78	72.08	898.95	179.79
Mean	38.21	38.44	38.64	37.12	37.81	36.82	24.32	24.26	24.03	179.79	
sd	0.01	0.05	0.01	0.02	0.01	0.02	0.01	0.01	0.02		
C.D	0.03										

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 12, Iss 2, 2023

Figure 2: Microwave assisted extraction of Total Flavonoid from onion peel



Determination of Yield

The yield was calculated by the formula given by Nan et al., 2019. As shown in Table 5 and Table 6, it is clear that MAE method have greater flavonoid yield compared to Conventional method (Soxhlet). MAE is more significant than Soxhlet extraction which enhances the yield of flavonoids depending on their time, temperatures and different power level. From comparable results, it was found that MAE results gave higher values as compared with Soxhlet extraction which is beneficial for extraction time **(Maran et al., 2014).**

Table 5 : TFC yield by Conventional Method

Treatments	C(mg/ml)	Yield (mg/g)
T0	19.32	23.18
T1	19.54	23.44
T2	19.75	23.7
T3	19.82	23.78
T4	20.01	24.01
T5	20.22	24.26
T6	18.56	22.27

Table 6 : TFC yield by MAE

Treatments	C(mg/ml)	Yield (mg/g)
T9	38.2	45.84
T10	38.41	46.09
T11	38.65	46.38
T12	37.81	45.37
T13	37.1	44.52
T14	36.81	44.1
T15	24.32	29.18
T16	24.26	29.11
T17	24.01	28.81

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T7	18.23	21.87
T8	17.95	21.54

4. Conclusion

The above research work showed that microwave assisted extraction results are outmatched with conventional method which total flavonoid content is acceptable at 200 W for 15 mins that is 38.65 mg GAE/ g in T11and for conventional method is acceptable at 60˚ for 4 hours that is 20.22 mg QE/g in T5. The flavonoids yield shows better results in microwave assisted extraction compared to soxhlet extraction and has higher extraction properties. In conclusion it can be said that onion peels should not be discarded as a waste, but instead it can be used for extraction purpose of flavonoid in the medical field and nutritional food which can improve well-being.

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