Isolation and Physicochemical Characterization of Mucilage from *Portulaca oleracea* L.

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Abstract

The mucilage (natural polymer) has been used in different pharmaceutical formulations. They are easily available non-toxic, biodegradable and cost effective to be used as pharmaceutical excipient. The purpose of present study is to investigate the physicochemical properties and chemical characterization of the mucilage extracted from *Portulaca oleracea* L. The water based extraction method was used; the yield of mucilage was 18.09% (w/w). The isolated mucilage was highly soluble in polar solvents and least soluble in chloroform whereas the swelling index of isolated mucilage in distilled water was 4 and its pH was 6.0. In EDXRF spectroscopy analysis, Potassium (6.59%), chlorine (0.59%), Sulphur (0.135%) and iron (0.059%) were present in isolated mucilage. According to the results of FTIR spectroscopic analysis, the isolated mucilage was assigned as polysaccharide. The findings of this research could be used as a standardizing parameters for drug developments.

Keywords: mucilage, *Portulaca oleracea* L., swelling index, extraction, EDXRF

Introduction

Natural polymers are materials of large molecular weight from natural origin such as plants, microorganisms and animals. In comparison to synthesis, natural polymers are preferable due to low toxicity, renewability, flexibility, to modification, biodegradability and low cost (Ngwuluka,2012). Natural polymers such as polysaccharides are hydrophilic, enzymatically degradable and are able to retain the stability of protein drugs incorporated in them as well as increase their (proteins) therapeutic effects (Sonia,2012). Most natural polymers are generally regarded as safe for oral consumption and so fine applications in the food and pharmaceutical industries. Moreover, the use of natural polymers has increased in recent times; also due to the advocacy of "green" materials from "green" chemistry and technologies.

Natural polymers are biogenic and their biological properties such as cell recognition and interactions, enzymatic degradability, semblance to extracellular matrix and their chemical flexibility make them materials of choice for drug delivery (Hoppel,2014).

Portulaca oleracea L. is a useful plant belongs to the family Portulacaceae. In Myanmar, *P. oleracea* L. is commonly known as "Mya Byit" (Kress, *et al*., 2003). In China, it is used in Traditional Chinese Medicine (TCM), commonly known as Ma-Chi-Xian, purslane in Australia and rigla in Egypt (Elkhayat, *et al*., 2008).According to Kress, *et al*., 2003, four species of this genus were found in Myanmar Namely, *P. grandiflora* Hook., *P. oleracea* L., *P. pilosa* L., and *P. quadrifida* L.In Traditional Chinese Medicine (TCM), *Portulaca oleracea* L. is cold in nature, sour in taste and is used to cool the blood, clear heat and resolve toxins (Li. *et al*., 2013). The whole plant is used to cure hypertension, coronary artery disease, cancer and other inflammatory

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and anti-immune disorders (Zhou, *et al*., 2015). The plant possesses flavonoids, fatty acids, proteins, sterols and vitamins (Zhou, *et al*., 2015 and Eldeighyde, 2016). Furthermore, the plant has been reported to be a storehouse of omega-3 fatty acids such as alpha-linolenic acid (Liu,2000). Since detailed analysis of mucilage (polysaccharides) from *Portulaca oleracea* L. was not found to be reported earlier, this study could be further used by researchers to assess the beneficial properties of this species for new drug developments.

Materials and Methods

Collection site and identification of *Portulaca oleracea* L.

The plant sample used in this research was collected from Taungup Township, Rakhine State, N - 18^0 50′ 31.8′′ and E - 94^0 12′ 31.8′′ during January 2019. Fresh specimens were photographed and recorded their measurements in detail for classification and identification with the help of available literatures such as Hooker (1875), Backer (1963), Dassanayake (1996), and Kress, (2003).

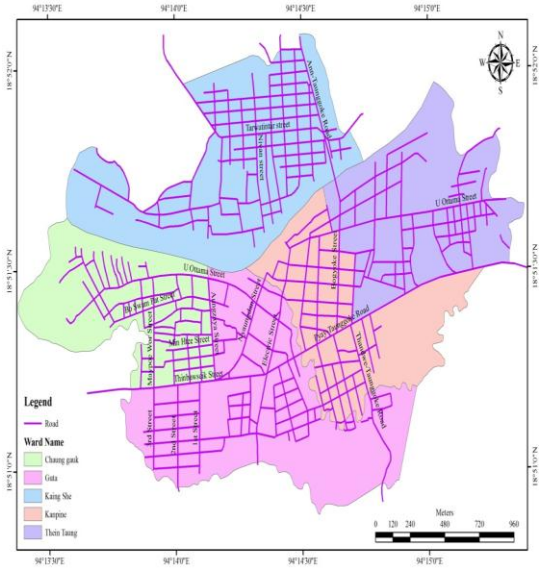

Fig. 1 GPS Data for collection area of Taungup Township

Preparation of powdered of *Portulaca oleracea* L.

The fresh specimens were cleaned and air dried for four weeks. The dried materials were pulverized by grinding machine. Then, the powdered plant was tightly packed in container and stored at room temperature to prevent moisture changes and contamination.

Extraction of mucilage by using Soxhlet apparatus

The dry powdered 25g with distilled water 300ml were extracted at 60 ˚C and stirred for two hours by using Soxhlet extractor. Then, the filtrate was kept aside for four hours to release mucilage into water. The same procedure was repeated for three times. The materials were squeezed in a muslin bag to remove the marc from filtrate. Then, the equal volume of ethanol was added to filtrate to precipitate mucilage. Then, the isolated mucilage was collected and dried in oven at 45 ± 5 ˚C. Finally isolated mucilage was obtained.

Fig.2 Extraction of mucilage by soxhlet extractor

Fig.3 Separated with ethanol

Fig.4 Reduce the filtrate on water- bath

Fig.5 Isolated mucilage from *Portulaca oleracea* L.

Physicochemical Characterization of Isolated Mucilage

The extracted mucilage was characterized for properties such as odour, color, texture ,pH, solubility and swelling index were carried by WHO guidelines.

Elemental analysis of powdered of mucilage from *Portulaca oleracea* L. by using Energy Dispersive X-ray Fluorescence Spectrometer (EDXRF)

The relative concentration of elements in. were analysed powdered of mucilage from *Portulaca oleracea* L. by using Energy Dispersive X-Ray Fluorescence (EDXRF) spectrometer at Universities' Research Centre (URC). The Parameter of each part of the spectrometer were given below.

Dectector type : Si (Li) detector

LN_2 supply : Only during measurement

Dewar capacity : 3 liters

LN_2 consumption : less than 1 liter per day

Detection area : $10mm^2$

Resolution : less than 155 ev Min K, 1500 H_2

The EDX-700 Shimadzu spectrometer can detect a wide range of the elements from Calcium (Ca) to Copper (Cu). The powdered sample (2g) was pressed into pellet by a hydraulic pressure and the relative abundance of elements in plant samples was analyzed by EDXRF X-ray fluorescence spectrometer, Shimadzu EDX-720, emit simultaneous analysis from light to heavy elements.

FTIR Spectroscopic study of isolated mucilage from *Portulaca oleracea* L.

The FTIR spectrum of isolated mucilage was recorded by using Perkin Elmer Spectrum at Department of Chemistry and recorded by using Shimazu FTIR- 8400 spectrophotometer at Universities' Research Centre, University of Yangon.

Results

Morphological characters of *Portulaca oleracea* L.

Annual erect or decumbent herb, succulent, up to 7-10 cm in height. Stems usually purplish-red to green, about 0.5 cm in diameter. Leaves alternate or subopposite, subsessile, fleshy, glabrous; leaf blade obovate-cuneate , leaf margin entire, leaf apex truncate-emarginate and leaf base acute. Flowers terminal clusters of 3-5 flowers, yellow, sessile, bracteate, , complete, bisexual, irregular, zygomorphic, pentamerous, cyclic, epigynous. Sepals (2), synsepalous, valvate, connate at the base into sepaloid, carinate (boat-shaped), carina 3. Petals (5), synpatalous, imbricate, petaloid (yellow), superior. Stamens 10 - 15 (-17), apostamonous; filament about 1.0 – 2.0 mm long, introrse; anther dithecous, dorsifixed, longitudinal dehiscence, superior. Carpel (5), pentacarpellary, syncorpous, unilocular, free central placentation, numerous ovules in the locule; style up to 2 mm long; stigma 5 arms; ovary inferior. Fruits capsule ovoid or subglobose, operculum to 2/3 of the length of capsule, opening transversely, numerous seeds.

Fig 6 Habit

Fig 7 L.S of flower

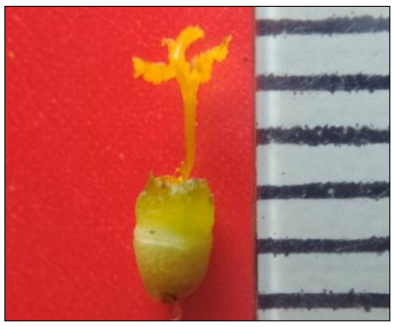

Fig 8 T.S of ovary

Fig 9 T.S of ovary

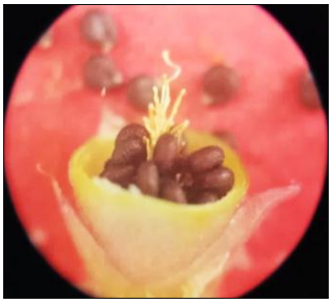

Fig 10 Fruits as seen

Fig 11 seeds as

Isolation of mucilage and Physicochemical characterization of mucilage from *Portulaca oleracea* L.

After extraction of mucilage from *Portulaca oleracea* L. by water-base extraction method. The percentage yield of mucilage was found as 18.09%(w/w). Physicochemical properties are shown in table (1). From evaluation of mucilage isolated from *Portulaca oleracea* L., it was observed that the mucilage is brownish, aromatic, sticky with pH 5.75±2. Moreover, it is found to be soluble in water, ethanol, methanol but insoluble in ethylacetate, hexane and petroleum ether whereas swelling index of isolated mucilage in distilled water is 4.

Figure (8) shows the results for elemental analysis on mucilage sample. It can be seen that Potassium (6.59%), Chlorine (0.59%), Sulphur (0.13%), Iron (0.06%) as principal elements in isolated mucilage.

Fig (9) peaks of FTIR spectroscopy for *Portulaca oleracea* L. which is useful too in identification as well as purity of a compound**.** The principal absorption peaks of polysaccharide were found at 1045cm^{-1} (C-O stretching),1365cm^{-1} (symmetric CH_3 bending), 2927cm-1(asymmetric CH_2 stretching, $CH_3$and CH_3 group), 3268cm^{-1} (primary OH) which indicate that isolated mucilage was polysaccharide.

Table (1) Evaluation of mucilage obtained from *Portulaca oleracea* L.

Parameter	***Portulaca oleracea* L.**
Yield	18.09%(w/w)
Color	Brown
Odor	Aromatic

Texture	Smooth
PH	5.7
Swelling Index	4
Solubility	Form viscous solution in warm water, swell in cold water, soluble in ethanol, methanol, insoluble in ethylacetate, , hexane, petroleum ether

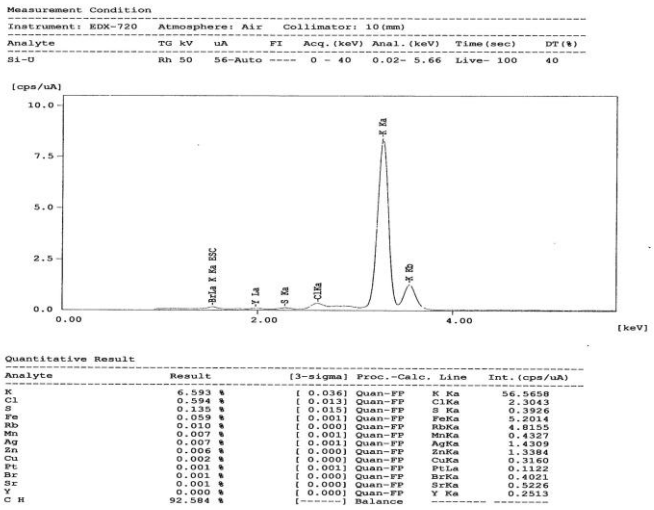

Fig 12 The EDXRF spectrum of isolated mucilage from ***Portulaca oleracea* L.**

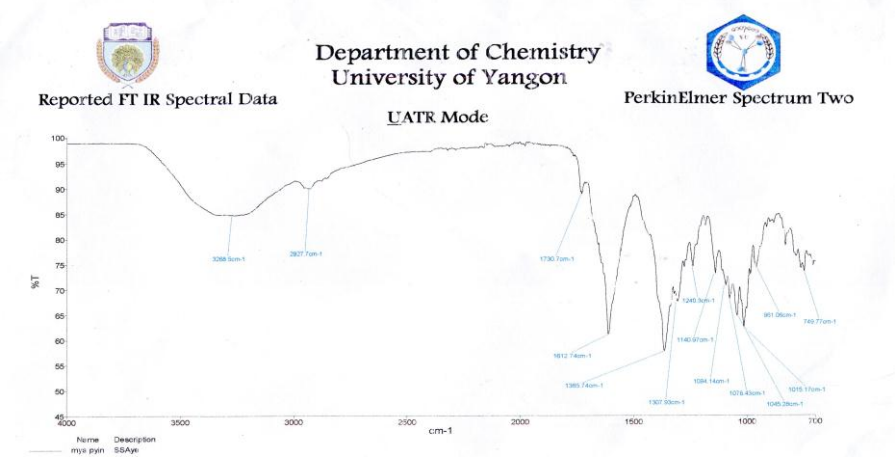

Fig 13 The FTIR spectrum spectrum of isolated mucilage from ***Portulaca oleracea* L.**

Discussion and Conclusion

In this research, *Portulaca oleracea* L. is annual, decumbent herb. Stems are publish-red to green. Leaves are subopposite and fleshy. Inflorescences are few-flowered terminal head. Flowers are bracteates, bisexual, irregular and zygomorphic. Sepals are (2), boat-shaped and petals are (5), yellow, slightly connate at the base. Stamens are numerous and longitudinal dehiscence. Ovaries are inferior and free central placentation. Fruits are capsule and ovoid with numerous seeds which are in agreement with those stated by Hooker (1875), Dassanayake and Clayton (1996), Wu, *et al*. (2003), Flora of Hong Kong (2007) and Uddin, *et al.* (2014).

In this study, the isolated mucilage from *Portulaca oleracea* L. was strongly soluble in water and its swelling index was 4.

Malviya (2011) reported that mucilage from plants can be used as disintegrants due to their swelling properties (3.5 – 6.0) as well as they can display good binding properties.

In EDXRF spectroscopic analysis, it was observed that the isolated mucilage contained the largest amount of Potassium (6.59%).

Yagi (2013) revealed that the high concentration of potassium in plants is needed for many essential processes including enzyme activation, protein synthesis, actively in the maintenance of the cardiac rhythm and in constipation.

In Conclusion, the present study has been extracted mucilage from *Portulaca oleracea* L.by using soxhlet extraction method, whereby the resulting polysaccharides with pH 6.0 and swelling index 4.

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