



PHYTOCHEMICAL ANALYSIS AND SILVER NANOPARTICLE SYNTHESIS FROM THE TRADITIONAL DECOCTION “MQINTANG”

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KEYWORDS

Mqintang; flavonoids; tannins; nanoparticles; phenolic compounds

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ABSTRACT

The action of traditional prescription needs to be proven and verified by modern scientific methods. Purpose: To study on phytochemical analysis of the traditional decoction “Mqintang” and to obtain silver nanoparticles from water extract of the traditional decoction “Mqintang”. Materials and methods: The quantitative and qualitative analyses of plant bioactive compounds of “Mqintang” were evaluated by the method according to Mongolian National Pharmacopeia. Silver nitrate nanoparticles based on the water extract of “Mqintang” were synthesized by the green synthesis method. Result: Quality analysis of “Mqintang” raw materials were evaluated and determined, thus the following statements have been identified: 11.82% of extractable matter,

7.5% moisture and 13.81% of total ash. The amount of total phenolic compounds was 1.527% at 760 nm of spectrophotometry, and 0.730% of total flavonoids at 401 nm. The color change in the synthesis of silver nanoparticles using the extract of “Mqintang” plant material and silver nitrate indicated the synthesis of silver nanoparticles (the complete reduction of silver ions). Also, during the reaction, the spectra detection at 433 nm of the sample at 0 minutes, 30 minutes, 60 minutes, 90 minutes, 120 minutes and 24 hours increases with the reaction time, which confirms the synthesis of silver nanoparticles. Five nanoparticles were detected in the determination of silver nanoparticles extracted from “Mqintang” extract using an Atomic Force Microscope.

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Conclusion: Mongolian National Pharmacopoeia standard was provided through quality analysis of the traditional decoction “Mqintang” and raw materials of the decoction.

Condensable and water-degradable substances were found in the 1:10 water extract of “Mqintang”. A total of 5 nanoparticles with an average height of 19.57 nm and a width of 84.81 nm were obtained from the water extract of “Mqintang”.

According to Mongolian health statistics, digestive system disorders are increased from 355.9 per 10,000 population in 2002 to 1027.8 in 2012, the second leading cause of population disease. In addition, the spread of liver disease is always the first among digestive system diseases. The prevalence of liver disease increased from 24.5% in 2002 to 26.6% in 2012. It can be seen that the prevalence of liver disease is very high in our country, and due to this, the problem of diagnosis and treatment of liver disease is important¹. Therefore, in line with the high demand for drugs and prescriptions for liver disease, it is necessary to systematically conduct research on them and provide people with drugs of guaranteed quality and safety, which are proven and verified by modern scientific methods. In recent years, the tendency to use traditional medical treatments that natural medicines as safe and effective has been increased worldwide². Among all liver diseases, 39% of liver cirrhosis, 27% of fatty liver, 23% chronic hepatitis cirrhosis, and 11% of chronic hepatitis due to alcohol liver disease. The prevalence of liver disease in our country is very high. So, diagnosis and treatment of liver disease are important. Therefore, it is necessary to carry out systematic research in accordance with the high demand for drugs and traditional prescriptions for liver diseases. There is a legitimate need to provide the people with traditional drugs whose quality and safety are guaranteed³. So our research team were aimed to study on phytochemical analysis of raw plant materials of “Mqintang” and traditional decoction “Mqintang”; to syntheses of silver nanoparticles based water extracts of the traditional decoction “Mqintang”.

INTRODUCTION

According to Mongolian health statistics, digestive system disorders are increased from 355.9 per 10,000 population in 2002 to 1027.8 in 2012, the second leading cause of population disease. In addition, the spread of liver disease is always the first among digestive system diseases. The prevalence of liver disease increased from 24.5% in 2002 to 26.6% in 2012. It can be seen that the prevalence of liver disease is very high in our country, and due to this, the problem of diagnosis and treatment of liver disease is important¹. Therefore, in line with the high demand for drugs and prescriptions for liver disease, it is necessary to systematically conduct research on them and provide people with drugs of guaranteed quality and safety, which are proven and verified by modern scientific methods. In recent years, the tendency to use traditional medical treatments that natural medicines as safe and effective has been increased worldwide². Among all liver diseases, 39% of liver cirrhosis, 27% of fatty liver, 23% chronic hepatitis cirrhosis, and 11% of chronic hepatitis due to alcohol liver disease. The prevalence of liver disease in our country is very high. So, diagnosis and treatment of liver disease are important. Therefore, it is necessary to carry out systematic research in accordance with the high demand for drugs and traditional prescriptions for liver diseases. There is a legitimate need to provide the people with traditional drugs whose quality and safety are guaranteed³. So our research team were aimed to study on phytochemical analysis of raw plant materials of “Mqintang” and traditional decoction “Mqintang”; to syntheses of silver nanoparticles based water extracts of the traditional decoction “Mqintang”.

MATERIALS AND METHODS

The research was carried out with the support of the drug analysis laboratory and post-graduate research laboratory of the Mongolian University of Pharmaceutical Sciences, and the Central Laboratory of Nanoscience and Nanotechnology under the School of Engineering and Technology of the National University of Mongolia. Research materials: stone

givan, woody stems of *Clematidis armandi* L, flora *Carthamus tinctorius* L, fruits of *Terminalia chebula* Retz, *Gardenia Jasminoides* Ellis), *MeLia toosendan* Sieb.et Zucc, herb of *Odontites rubra* Baumg Pers were bought from “Ariun Mongolia” LLC pharmaceutical factory. The moisture content and ash content of the traditional decoction “Mqintang” were determined according to the general pharmacopoeial methodology. The biologically active compounds of “Mqintang” were synthesized by spectroscopic method and silver nitrate nanoparticles were synthesized from aqueous extract by green synthesis method.

RESULTS

3.1 Result of the amount of extractable substances of traditional decoction “Mqintang”

The 11.82% water soluble substances were in the traditional decoction “Mqintang”.

3.2 Result of the total ash determination of the traditional decoction “Mqintang”

The 13.81% ash content was in the traditional decoction “Mqintang”.

3.3 Result of the moisture content in the traditional decoction “Mqintang”

Table 1. Result of the moisture content in the whole decoction and some raw plant materials in the traditional decoction “Mqintang”

№	Raw plant materials	Moisture, %
1	<i>Gardenia jasminoides</i> L (Sguyarura)	4.4
2	<i>Melia toosendan</i> Sieb.et Zucc (barura)	5.2
3	<i>Terminalia chebula</i> Ret (Arura)	5.1
4	<i>Carthamus tinctorius</i> L (Gurgum)	5.5
5	<i>Clematidis armandi</i> L (Balega)	5.4
6	Whole decoction “Mqintang”	7.5

According to the table, the moisture content of composite jam is 2.38% higher than the moisture content of raw materials.

3.4 Results of total flavonoid content of the traditional decoction “Mqintang”

Total phenolic compounds were determined according to the method in aqueous and alcoholic extracts of traditional decoction “Mqintang”. The results are shown in the table 2.

Table 2. Total flavonoid content of the traditional decoction “Mqintang”

№	Decoction “Mqintang”	Total flavonoid content, %	
1	Aqueous	1,566	1,527±0,92
	extract	1,489	
2	Ethanol	2,539	2,528±1,12
	extract	2,518	

The content of total flavonoids in the ethanol extract of “Mqintang” decoction was 1.6 times higher than water extract of “Mqintang” decoction. Determination of total flavonoid compounds in aqueous extracts revealed the form of glycosides flavonoids in the traditional “mqintang” decoction.

3.5 Results of quantative analysis of total flavonoid in the traditional decoction “Mqintang”

The total phenolic compounds in the aqueous and ethanol extracts of “Mqintang” were determined according to the method, and the results are shown in the table below.

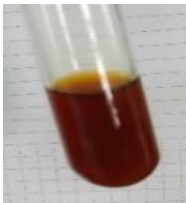
Table 3. Result of total flavonoid in the traditional “Mqintang” decoction

Decoction “Mqintang”		Total flavonoid content, %
1	aqueous extract	0,787
		0,726
		0,743
		0,663
2	ethanol extract	1,031
		0,964
		0,909
		1,025

See the table, the amount of total flavonoids contained in the ethanol extract of “Mqintang” decoction was 1.34 times higher than water extract of “Mqintang” decoction.

3.6 Quality analysis of tannin ingredients of the traditional “Mqintang” decoction

Table 4. The results of the qualitative analysis of the tannin content of traditional “Mqintang” decoction

Reagent	Water extract	Ethanol extract
1 5% potassium dichromate		
2 Iron ammonium slag		
3 40% formaldehyde hydrochloric acid solution with concentration Iron ammonium slag Crystalline sodium acetate		
4 Crystalline sodium nitrite 0.1ml hydrochloric acid		

Condensable and water-degradable reagents were detected during reagent identification reactions (5% potassium dichromate, iron ammonium slag, formaldehyde, hydrochloric acid reagent) of the tannin content of traditional “Mqintang” decoction.

3.7 Results of silver nanoparticles based on aqueous extracts of the traditional decoction “Mqintang”

Synthesis of silver nanoparticles using extract from “Mqintang” raw material and silver nitrate (complete removal of silver ions) was confirmed by color change from yellow to black. Figure 12 shows the color changes during the reaction (0 min, 30 min, 60 min, 90 min, 120 min, 24 h).



Figure 1. Color change of traditional “Mqintang” decoction nanoparticles reaction

Silver nanoparticles extracted from “Mqintang” aqueous extract changed from yellow to dark brown after the reaction.

When a 1:10 aqueous extract of “Mqintang” was reacted with 1mM silver nitrate to conduct a silver nanoparticle synthesis reaction, a color change indicated the synthesis of silver nanoparticles (the complete liberation of silver ions).

3.8 The results of determination of the spectral characteristics of nanoparticles

During the reaction (0 minutes, 30 minutes, 60 minutes, 90 minutes, 120 minutes, 24 hours) samples were taken from the synthesized silver nanoparticles, and the spectra light detection in the range of 433 nm of the spectrophotometer increased, which indicates the formation of silver nanoparticles, shown in Figure 2.

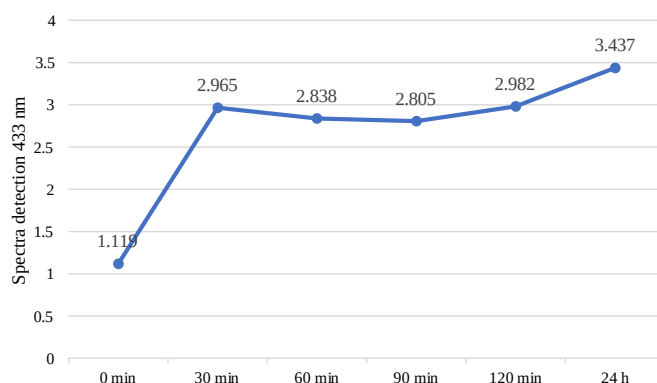


Figure 2. Spectral properties of silver nanoparticles in “Mqintang” aqueous extract

The absorption of silver nanoparticles in “Mqintang” aqueous extract in the spectrophotometer at 433 nm showed spectra detections of 1.119 at 0 minutes, 2.965 at 30 minutes, 2.838 at 60 minutes, 2.805 at 90 minutes, 2.982 at 120 minutes, and 3.437 at 24 hours.

3.9 Result of determination of size of the silver nanoparticles extracted from traditional decoction “Mqintang”

The nanosize of the silver nanoparticles based on the aqueous extract of “Mqintang” was determined using an Atomic Force Microscope (AFM) microscope (Figure 2).

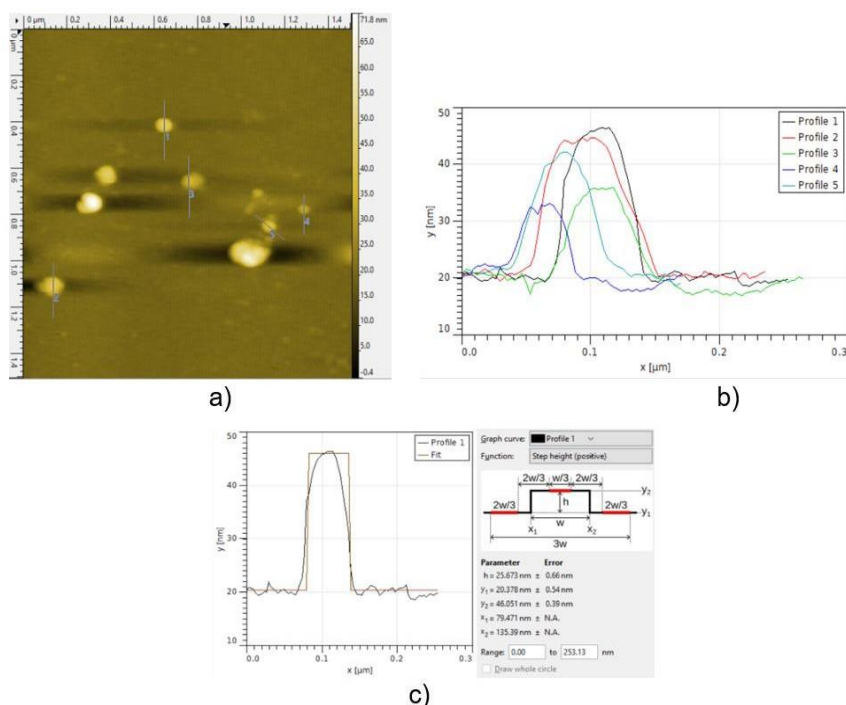


Figure 3. Height analysis of “Mqintang” silver nanoparticles a) position of the pieces b) height function corresponding to the slices c) an example of the analysis performed on the functions

Table 5 Height and width analysis of silver nanoparticles prepared by “Mqintang” extract

	Height, nm	Height error, nm	Width, nm
1	25.67	0.66	86.38
2	23.39	0.88	108.15
3	16.80	1.10	116.43
4	11.90	1.70	41.23
5	20.09	1.10	71.87
avg	19.57	1.09	84.81

2D, 3D topography of the surface morphology of silver nanoparticles extracted from “Mqintang” extract were determined using a microscope (Atomic Force Microscope 2D, 3D and topography of the surface morphology of silver nanoparticles extracted from “Mqintang” extract using a microscope (Atomic Force

Microscope) to determine the size of the nanoparticles in a 1.5x1.5 μm area, while the height was 25.67nm, 23.39nm, 16.80nm, 11.90nm, and 20.09nm. A total of five nanoparticles were detected with widths of 86.38 nm, 108.15 nm, 116.43 nm, 41.23 nm, and 71.87 nm.

CONCLUSION

Mongolian National Pharmacopoeia standard was provided through quality analysis of the traditional decoction “Mqintang” and raw materials of the decoction. Condensable and water-degradable substances were found in the 1:10 water extract of “Mqintang”. A total of 5 nanoparticles with an average height of 19.57 nm and a width of 84.81 nm were obtained from the water extract of “Mqintang”.

DISCUSSION

The population of Mongolia has 8.5 percent of liver disease by according to the statistics of 2022²⁵.

Compared to chemical preparations, herbal medicinal preparations have the advantages of low toxicity, gentle action, rapid absorption by the body, and few side effects²⁶. Prescriptions of innovative medicines and biopreparations, in Traditional Mongolian Medicine, are increasingly enriched with medicinal substances that have specific effects, different from the medicinal plants used in traditional medicine. In particular, the main ingredients of bioproducts regularly used in traditional medicine and animal husbandry are biologically active plant-derived compounds such as alkaloids, flavonoids, coumarins, saponins, and terpenoids, which contain heteroatoms such as nitrogen and oxygen in their molecular composition²⁷. Chimedragchaa Ch (2015) researchers studied on phytochemical studies of several traditional recipes which used to traditional medicine for liver disease. For example, traditional “Channadselshi” prescription, that used to treat alcohol acute toxicity, the water-soluble substance was 29.4%, the amount of substance soluble in 70% ethanol was 54.7%, the amount of total ash was 9.2%, and the total soluble substance was 7.8%. “Managhchenmo” traditional prescription that used to treat alcohol acute toxicity, the amount of substances soluble in water of was 31.6%, the amount of substances soluble in 40% ethanol was 35.4%, the amount of total ash was 8.9%, and the amount of total substances was 2.4%.

The amount of soluble substances in water extract of *Iris tenuifolia* P plants was 8.4%, the amount of ethanol 40% soluble substances of *Iris tenuifolia* P was 17%, and the amount of total ash was 7.2%. The ingredients of “Mqintang” decoction in our study had a high content of polyphenolic compounds, which may be the reason for their use in liver disease. For example, the content of polyphenolic compounds in Channadselshi and Managhchenmo compound recipes is 3-11%, while the content of *iris tenuifolia* P is 8-10%, which is equivalent to the compound traditional recipe for single plants, so it can be considered that it contains high polyphenolic compounds.

Also, it has been determined that polyphenolic compounds contained in the recipes used in alcohol-induced liver inflammation have high antioxidant activity^{28,29}.

Nano-sized inorganic compounds have a very low concentration, but depending on their unique physical and chemical properties, they have high biological activity such as antibacterial, antioxidant and anti-cancer.

Nanoparticles are more stable at high temperatures³⁰.

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Conflicts of Interest: The authors declare no conflict of interest.

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