

RESEARCH ON OBTAINING SILVER NANOPARTICLES USING THE EXTRACT OF *CHIAZOSPERMUM ERECTUM* (L.) BERNH.

Emujin Shijirbaatar¹, Byambasuren Gerelt-Od¹, Choijamts Gotov², Altansukh Tsend-Ayush, Tserendolgor Batsukh^{1*}

¹ Department of Pharmaceutical Management and Organization, Mongolian University of Pharmaceutical Sciences, Ulaanbaatar, Mongolia

² Mongolian National University of Medical Sciences, Ulaanbaatar, Mongolia

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ABSTRACT

Background: Scientists have found that *Chiazospermum erectum* (L.) Bernh. has anti-inflammatory, anti-bacterial, and anti-tumor properties. In recent years, the development of bio-compatible, bio-safe, and ecologically friendly nanoparticles using medicinal plants with high therapeutic activity has become an urgent need for research in the field of nanotechnology. In this study, we have aimed to prepare an extract of *Chiazospermum erectum* (L.) Bernh. and use it for the synthesis of silver nanoparticles.

Methods: In the research, the raw material of *Chiazospermum erectum* (L.) Bernh. was used. The upper part of the plant was firstly extracted by circulation, remaceration, and repercolation in 70% ethanol and distilled water (1:10). The quality analysis of total alkaloids and flavonoids, which are the biologically active substances of the extract, was determined by thin layer

chromatography, and the concentration of the substances was determined spectrophotometrically.

After preparing the ethanol extract from the raw material of *Chiazospermum erectum* (L.) Bernh., silver nanoparticles were synthesized using silver nitrate solution. Results: The raw material of *Chiazospermum erectum* (L.) Bernh. was extracted by remaceration with 70% ethanol.

A change in color from light to deep brown was observed when silver nanoparticles were synthesized from the extract of *Chiazospermum erectum* (L.) Bernh.

Results: As assessed by spectral analysis, the light absorbance value increases with increasing reaction time, indicating the formation of silver nanoparticles. The size of silver nanoparticles obtained from the plant extract was 39.84 nm. Based on these results, we successfully prepared silver nanoparticles from the plant extract.

*Corresponding author: Department of Pharmaceutical Management and Organization, Mongolian University of Pharmaceutical Sciences, Ulaanbaatar, Mongolia, Songolon's road 4/A, Songinokhairkhan District 20th khoroo, Ulaanbaatar, Mongolia
E-mail address: tserendolgor@monos.mn (Tserendolgor Batsukh)

Conclusion: Extraction of raw material by remaceration with 70% ethanol was suitable. Silver nanoparticles with a

size of 39.84-112 nm were determined using a nano-sizing instrument for silver nanoparticles synthesized from the extract of the plant.

1. INTRODUCTION

In Mongolian and Tibetan traditional medicine, *Chiazospermum erectum* (L.) Bernh. has been used under the name “Barbad” in the treatment of jaundice, typhoid, and influenza. Among the biologically active substances contained in the composition of the plant, total alkaloids of the “protopine” group have been found to be active in protecting liver cells from necrosis and disintegration through antioxidant and membrane strengthening mechanisms in acute and chronic liver inflammation modeled in experimental animals. Studies have shown that it improves liver protein synthesis and bile secretion, improves normal immune cell function, and has immunomodulatory effects (Sarantsetseg, 1994).¹⁻⁴ Nanotechnology is one of the fastest growing fields of technology⁵⁻⁶. Therefore, research on extraction techniques, and investigation of qualitative and quantitative content of some biologically active substances of *Chiazospermum erectum* (L.) Bernh. have attracted more attention in the field of pharmacy. In the current study, we have aimed to obtain a suitable extract from the raw material of *Chiazospermum erectum* (L.) Bernh., identify some biologically active substances, and synthesize silver nanoparticles.

2. MATERIALS AND METHODS

The raw material of *Chiazospermum erectum* (L.) Bernh. was used in the research. The aerial part of the medicinal plant was extracted by circulation, remaceration, and repercolation techniques with 70% ethanol and distilled water (1:10).⁷⁻⁸ The qualitative analysis of total flavonoids, which are biologically active substances of the extract, was determined by thin layer chromatography, and the quantitative content was determined by spectrophotometry.⁹⁻¹¹ After preparation of alcoholic extract from raw materials of *Chiazospermum erectum* (L.) Bernh., nanoparticles were synthesized using silver nitrate solution.¹²

3. RESULTS

3.1. Qualitative analysis of alkaloids and flavonoids extracted from *Chiazospermum erectum* (L.) Bernh.

Qualitative analysis of flavonoids in distilled water and 70% ethanol extract of *Chiazospermum erectum* (L.) Bernh. was carried out by thin layer chromatography using a solvent system in ethyl acetate-formic acid-acetic acid-water (100:11:11:26) (Figure 1A).

Qualitative analysis of alkaloids in the medicinal plant was carried out by thin layer chromatography using a solvent system of toluene-acetone-methanol-ammonia (8.3:9.9:1.6:1) (Figure 1B).

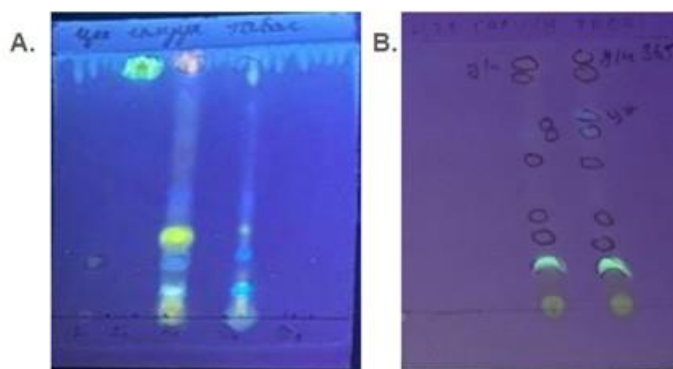


Figure 1. Thin layer chromatogram for an extract of *Chiazospermum erectum* (L.) Bernh: A. Flavonoid detection, and B. Alkaloid detection In the thin layer chromatogram of *Chiazospermum erectum* (L.) Bernh., a brown spot was detected at the same level as the standard quercetin (Rf=0.94) and rutin (Rf=0.18), indicating the flavonoid of the extract. In the chromatogram of *Chiazospermum erectum* (L.) Bernh., a standard protopine (Rf=0.23) green spot was detected, which is an alkaloid.

3.2. Detection of suitable extracting solvent for *Chiazospermum erectum* (L.) Bernh.

The raw materials of *Chiazospermum erectum* (L.) Bernh. were extracted using remaceration, repercolation, and circulation methods with distilled water and 70% ethanol, and the total alkaloid and flavonoid content was determined by spectrophotometry (Table 1).

Table 1. Results of the study on extracts from *Chiazospermum erectum* (L.) Bernh.

Extraction liquid	Method of extraction	Total flavonoids
Distilled water	Circulation	0.91±0.01*
	Remaceration	0.11±0.13*
	Repercolation	0.23±0.09*
70% alcohol	Circulation	1.1±0.01*
	PRemaceration	1.56±0.09*
	Repercolation	0.47±0.14*

The total alkaloid and flavonoid content of the upper part of *Chiazospermum erectum* (L.) Bernh. was extracted in 70% ethanol by remaceration, and the concentration of total alkaloids and flavonoids was 1.56±0.09*, and remaceration was more suitable.

3.3. Synthesis of silver nanoparticles from *Chiazospermum erectum* (L.) Bernh.

The color change of the reaction was observed from pale yellow to deep brownish brown during the synthesis of silver nanoparticles using the extract of *Chiazospermum erectum* (L.) Bernh. In the current study, the UV-vis spectral analysis was performed for silver nanoparticles using the extract of *Chiazospermum erectum* (L.) Bernh., and spectral characteristics were checked at 433 nm. According to the results obtained, the spectral values were 0.999 at 0 minutes, 1.199 at 30 minutes, 1449 at 60 minutes, 1637 at 90 minutes, 1.963 at 120 minutes, and 2.246 at 24 hours, respectively.

3.4. Size determination of silver nanoparticles from *Chiazospermum erectum* (L.) Bernh.

The nano size of silver nanoparticles synthesized using *Chiazospermum erectum* (L.) Bernh. extract was determined using an Atomic Force Microscope (AFM) microscope (Figure 2).



Figure 2. Size determination of silver nanoparticles obtained from *Chiazospermum erectum* (L.) Bernh: A total of ten nanoparticles with sizes of 39.84 nm, 51 nm, 52 nm, 53 nm, 58 nm, 63 nm, 67 nm, 76 nm, 91 nm, and 112 nm were determined in the determination of the size of nanoparticles of *Chiazospermum erectum* (L.) Bernh.

4. DISCUSSION

Our research team aimed to conduct qualitative research for raw materials in Hepaclin-4 prescription with preventive effects against liver diseases and complications, obtain suitable extracts, and determine the qualitative and quantitative content of some biologically active substances. Research conducted by Ikhbayar et al (2013) used the solvent system of toluene-acetone-methanol-ammonia (8.3:9.9:1.6:1) to detect the protopine alkaloid ($C_{20}H_{19}NO_5$) of quinoline species in *Chiazospermum erectum* (L.) Bernh. for qualitative analysis of the raw materials.¹³ Our research team also used that solvent system to conduct qualitative analysis for the raw material of *Chiazospermum erectum* (L.) Bernh. According to the result, a green spot was found on thin layer chromatography, indicating that the result was consistent with the aforementioned result from the research team.

In conclusion, the raw material of *Chiazospermum erectum* (L.) Bernh. was extracted by remaceration with 70% ethanol. We have successfully synthesized silver nanoparticles using *Chiazospermum erectum* (L.) Bernh., with an average size of 39.84 nm.

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

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