



STUDY ON OBTAINING SILVER NANOPARTICLES FROM *CARTHAMUS TINCTORIUS* L. EXTRACT

Batbyamba Munkhbat¹, Byambasuren Gerelt-Od¹, Altansukh Tsend-Ayush², Bayanmunkh Altangerel³, Tserendolgor Batsukh^{1*}

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

² School of Bio-Medicine, Mongolian National University of Medical Sciences, Ulaanbaatar, Mongolia

KEYWORDS

Extract, Herbal plant, Green synthesis, Silver, Nanoparticle

Revised: 2023/10/02

Accepted: 2023/11/28

Revised: 2023/10/19

Published: 2024/01/10

Copyright: © Author(s), 2024

CC BY-NC 4.0 - <https://creativecommons.org/licenses/by-nc/4.0/>

ABSTRACT

Background: Cancer, especially liver cancer, is the second leading cause of mortality and morbidity among the Mongolian population. In traditional medicine, Safflower (*Carthamus tinctorius* L.) has been used as a disinfectant, pain reliever, fever reducer, and anti-toxic drug. Nanotechnology is one of the fastest-growing fields of science and technology. In the current study, we aimed to obtain a suitable extract of the Safflower (*Carthamus tinctorius* L.) plant and then synthesize the plant extract-based silver nanoparticles.

Methods: The raw material of the *Carthamus tinctorius* L. plant was used in the research. The upper part of *Carthamus tinctorius* L. was extracted by circulation, remaceration, and repercolation with 70% ethanol and distilled water (1:10). 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. After the preparation of ethanol extract from the raw material of *Carthamus tinctorius* L., nanoparticles were synthesized using silver nitrate solution.

Results: The raw material of *Carthamus tinctorius* L. was extracted by circulation method with 70% ethanol. A color change from light to deep brown color was observed when observing the synthesis of silver nanoparticles using the extract of *Carthamus tinctorius* L. As assessed by spectral analysis, the absorbance value increases with increasing reaction time, indicating the formation of silver nanoparticles. The size of the silver nanoparticles obtained from *Carthamus tinctorius* L. extract was 24.62 nm.

Conclusion: Based on these results, we successfully prepared silver nanoparticles based on plant extracts.

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

1. INTRODUCTION

According to Mongolia's annual report on health indicators, cancer-related deaths continue to increase. As for the second leading cause of death, the majority of cancers are liver and bile duct cancer.¹ According to the report by Bolormaa Z (2010) research team, *Carthamus tinctorius* L. plant can reduce the lysis of liver cells by reducing protein production. It has been determined by molecular biology research that it can restore synthesis and reduce bile stasis.² In traditional medicine, *Carthamus tinctorius* L. has been used as a disinfectant, pain reliever, fever reducer, and anti-toxic drug.³ Nanotechnology is the most advanced science and technology. Also, it is one of the fastest growing industries.⁴⁻⁶ It is widely used and studied in many fields such as agriculture, food production, beauty, and medicine. In this study, identifying some biologically active substances and synthesizing silver nanoparticles were the basis for this research.

2. MATERIALS AND METHODS

2.1. The raw material of *Carthamus tinctorius* L 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 *Carthamus tinctorius* L., nanoparticles were synthesized using silver nitrate solution.

3. RESULTS

3.1. Qualitative analysis of flavonoids in *Carthamus tinctorius* L.

The qualitative analysis of flavonoids in 70% ethanol extract of *Carthamus tinctorius* L. was carried out by thin layer chromatography using a solvent system of ethyl acetate-formic acid-glacial acetic acid-water (100:11:11:26). (Figure 1)

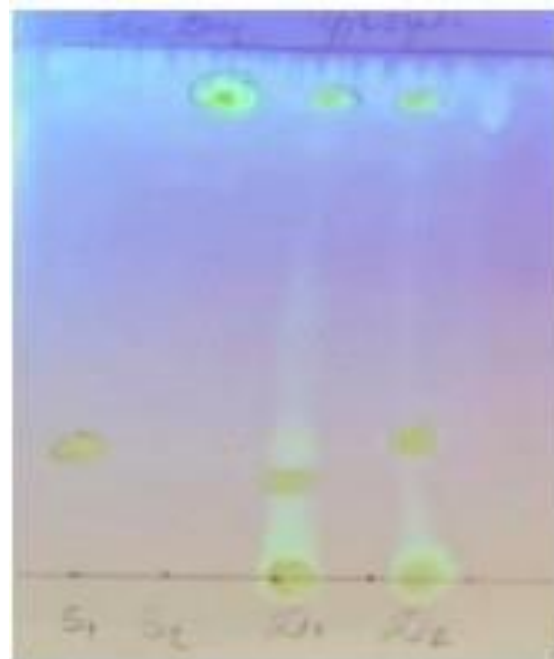


Figure1. Thin-layer chromatogram of Safflower (*Carthamus tinctorius* L.) extract In the thin-layer chromatogram of *Carthamus tinctorius* L., a brown-colored spot was detected at the same level as the standard substance quercetin ($R_f=0.94$) and rutin ($R_f=0.19$), which indicated a flavonoid content.

3.2. Quantitative analysis of the extract obtained from *Carthamus tinctorius* L. The raw materials of *Carthamus tinctorius* L. were extracted using remaceration, repercolation, and circulation methods using water and 70% ethanol, and the total flavonoid content was determined by spectrophotometry (Table 1).

Table 1. Total flavonoid contents of the extracts isolated from *Carthamus tinctorius* L.

Raw material	Extractor liquid	Extract method	Total flavonoids
<i>Carthamus tinctorius</i> L.	Water extract	Circulation	0.95±0.004**
		Remaceration	0.24±0.01**
		Repercolation	0.16±0.001*
	70% ethanol extract	Circulation	1.35±0.009**
		Remaceration	0.39±0.12**
		Repercolation	0.27±0.01*

As shown in Table 1, it is suitable to extract the raw material of *Carthamus tinctorius* L. in 70% ethanol by the Circulation method. Synthesis of silver nanoparticles using *Carthamus tinctorius* L. The silver nanoparticles synthesized using the extract of *Carthamus tinctorius* L. showed a change in color from orange to brown.

3.3. Spectral characteristics of the silver nanoparticles synthesized using *Carthamus tinctorius* L.

The absorbance of synthesized silver nanoparticles using *Carthamus tinctorius* L. was checked in the range of 433 nm in a spectrophotometer. The absorbance values were 3.452 at 0 minutes, 3.526 at 30 minutes, 3.475 at 60 minutes, 3.416 at 90 minutes, 3.482 at 120 minutes, and 3.611 at 24 hours, respectively.

Nanoparticle size determination: The nano size of silver nanoparticles obtained from *Carthamus tinctorius* L. extract was determined using an Atomic Force Microscope (AFM) microscope (Figure 2).

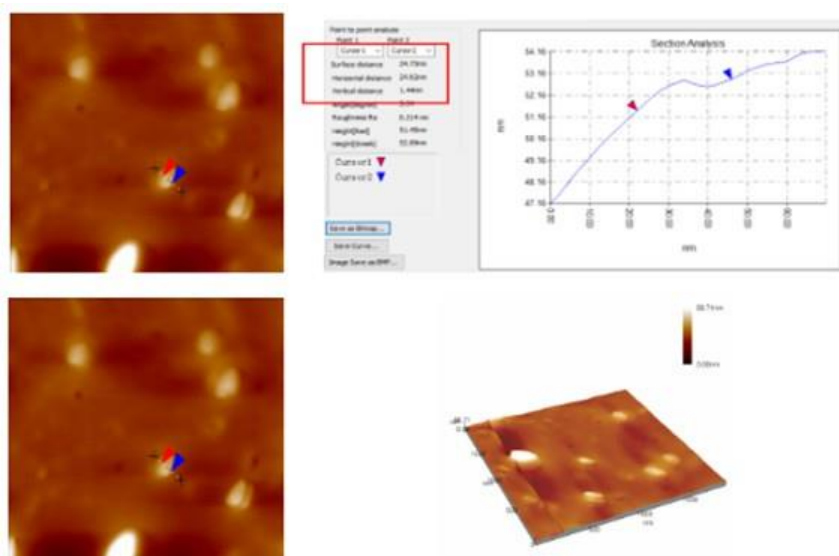


Figure 2. Size measurements of newly synthesized silver nanoparticles using *Carthamus tinctorius* L. extract: 2D and 3D topography of the surface morphology of silver nanoparticles synthesized using the extract of *Carthamus tinctorius* L. were measured using a microscope (Atomic Force Microscope (AFM)). According to the result, the average size of silver nanoparticles was detected around 24.62 nm to 154 nm.

4. DISCUSSION

Our research was aimed at conducting qualitative research for raw materials in Hepaclin-4 prescription with preventive effects against liver diseases and complications, obtaining suitable extracts, and determining the qualitative and quantitative content of some biologically active substances.

Francisco et al used the extract of *Carthamus tinctorius* L. to synthesize the silver nanoparticles by using green synthesis technology. The size of the silver nanoparticles obtained was detected around 8.67 ± 4.7 nm and round in shape.¹²

In our study, the extract of *Carthamus tinctorius* L. was also used to synthesize the silver nanoparticles. The size of the silver nanoparticles we obtained was around 24.62 to 154 nm and round shaped. The result also suggests that our result was consistent with the aforementioned result. The raw material of *Carthamus tinctorius* L. was extracted by circulation method with 70% ethanol. Moreover, total flavonoids were detected in the medicinal plant extract. Finally, we have successfully synthesized the silver nanoparticles using the extract of *Carthamus tinctorius* L.

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

REFERENCES

1. Mongolia Health Indicators, Center for Health Development. Ulaanbaatar: 2022. p. 129
2. Global burden of primary liver cancer in 2020 and predictions to 2040. Journal of hepatology. p. 2-3.
3. Bolorma Z. Effects of *Carthamus tinctorius* L. on hepatotoxicity induced in experimental animals. Thesis for the degree of Master of Medicine. Ulaanbaatar: University of Health Sciences, 2010
4. Dhandapani K, Anbumani D, Dhanesh Gandhi A, et al. Green route for the synthesis of zinc oxide nanoparticles from *Melia azedarach* leaf extract and evaluation of their antioxidant and antibacterial activities. Biocatalysis and Agricultural Biotechnology. 2020;24:101517.
5. Bayda S, Adeel M, Tuccinardi T, Cordani M, Rizzolio F. The History of Nanoscience and Nanotechnology: From Chemical-Physical Applications to Nanomedicine. Molecules. 2019;25(1):112.
6. Contera S, Bernardino de la Serna J, Tetley TD. Biotechnology, nanotechnology and medicine. Emerg Top Life Sci. 2020;4(6):551-554.
7. Erdenetsetseg G, Khansuren S, Enkhzaya Sh. Pharmaceutical Technology-Vol.2. Ulaanbaatar city, 2005. pp. 170-181.
8. Naranchimeg E. Methodology of Galen's technology lesson. Ulaanbaatar city, 2013. pp. 18-20
9. National Pharmacopoeia of Mongolia First Edition. Ulaanbaatar city, 2011. pp. 509-589.
10. Pharmacopoeia of raw materials used in Mongolian traditional medicine-Volume I 39. 2022. Ulaanbaatar. p. 93.
11. Wagner H, Bladt S. Plant drug analysis a thin layer chromatography atlas. Springer. Germany. 2001. pp. 125-130, 195-210. S. Pogodin, E. A. Lushka, K.
12. Francisco Rodríguez-Félix, Astrid Guadalupe Lipez-Cota, María Jesús Moreno-Vásquez. Sustainable-green synthesis of silver nanoparticles using safflower (*Carthamus tinctorius* L.) waste extract and its antibacterial activity. 2021