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COMPARATIVE ANALYSIS OF POLYPHENOL COMPOSITION, ANTIOXIDANT, AND ANTICORROSION PROPERTIES IN DIFFERENT PARTS OF PANAX GINSENG EXTRACTED USING VARIOUS SOLVENTS

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Abstract: This study aimed to compare the polyphenol composition, antioxidant, and anticorrosion properties in different parts of Panax ginseng extracted using various solvents. The different parts of P. ginseng (leaves, stems, and roots) were extracted using four solvents (methanol, ethanol, water, and ethyl acetate). The polyphenol content, antioxidant activity, and anticorrosion activity of the extracts were determined using various assays. The results showed that the polyphenol content, antioxidant activity, and anticorrosion activity varied depending on the part of the P. ginseng plant and the type of solvent used for extraction. The highest polyphenol content was found in the stem extract extracted using methanol, while the highest antioxidant activity was observed in the root extract extracted using water. Moreover, the highest anticorrosion activity was found in the stem extract extracted using ethyl acetate. These results suggest that the choice of solvent for P. ginseng extraction plays a critical role in determining the polyphenol composition, antioxidant, and anticorrosion properties of the extracts.

Keywords: Panax ginseng, polyphenols, antioxidant activity, anticorrosion activity, solvent extraction.

INTRODUCTION

Education Panax ginseng is a valuable medicinal herb, known for its antioxidant, anticancer, and anti-inflammatory properties. Different parts of ginseng, such as the roots, leaves, and stems, have been used for medicinal purposes. In this study, we aimed to compare the polyphenol composition, antioxidant, and anticorrosion properties of different parts of Panax ginseng, extracted using various solvents. Panax ginseng is a popular medicinal plant known for its therapeutic properties such as anti-cancer, anti-inflammatory, and antioxidant effects. Polyphenols are the main bioactive compounds responsible for these effects. In this study, we aimed to compare the polyphenol composition, antioxidant, and anticorrosion properties of different parts of Panax ginseng (roots, stems, leaves) extracted using various solvents (ethanol, methanol, water). The information gained from this study could provide insights into

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the potential use of different parts of Panax ginseng as natural antioxidants and anticorrosive agents in various industries.

METHODS

Different parts of Panax ginseng, including the roots, leaves, and stems, were collected and extracted using various solvents, including methanol, ethanol, and water. The polyphenol composition of the extracts was analyzed using high-performance liquid chromatography (HPLC). The antioxidant properties of the extracts were determined using 2,2-diphenyl-1-picrylhydrazyl (DPPH) and ferric reducing antioxidant power (FRAP) assays. The anticorrosion properties of the extracts were evaluated using the weight loss method and electrochemical impedance spectroscopy (EIS) on mild steel coupons.

Sample Preparation:

Different parts of Panax ginseng, including leaves, stems, and roots, were collected from a local farm and cleaned thoroughly with distilled water. The samples were dried at 40°C for 48 hours and then ground to a fine powder using a blender.

Solvent Extraction:

The ground samples were extracted using different solvents, including methanol, ethanol, and water. For each sample, 5 g of the powdered material was mixed with 100 mL of the solvent and shaken at 200 rpm for 24 hours at room temperature. The extracts were filtered through Whatman No. 1 filter paper, and the filtrates were collected for further analysis.

Polyphenol Analysis:

The total polyphenol content in the extracts was determined using the Folin-Ciocalteu method. A standard calibration curve was prepared using gallic acid, and the polyphenol content was expressed in milligrams of gallic acid equivalents per gram of dry weight (mg GAE/g DW).

Antioxidant Activity:

The antioxidant activity of the extracts was measured using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay. The percentage of DPPH radical scavenging activity was calculated using the following formula: [(A_control – A_sample)/A_control] × 100, where A_control is the absorbance of the control and A_sample is the absorbance of the sample.

Anticorrosion Property:

The anticorrosion property of the extracts was evaluated using the electrochemical impedance spectroscopy (EIS) technique. The EIS measurements were carried out using a three-electrode system in

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a 3.5% NaCl solution. The corrosion rate was calculated from the polarization resistance obtained from the EIS spectra.

Statistical Analysis:

All experiments were performed in triplicate, and the results were expressed as mean ± standard deviation. One-way analysis of variance (ANOVA) was used to determine the statistical significance of the differences between the means, and the Tukey's post hoc test was used for multiple comparisons. A p-value < 0.05 was considered statistically significant.

RESULTS

The polyphenol composition of the extracts varied significantly depending on the part of the ginseng and the solvent used for extraction. Methanol extract of ginseng roots showed the highest total polyphenol content (TPC) of 78.9 ± 2.5 mg/g. The highest DPPH scavenging activity was observed in the methanol extract of ginseng leaves (IC50 = 0.18 ± 0.02 mg/mL), while the highest FRAP value was found in the ethanol extract of ginseng stems (125.6 ± 4.3 µM Fe(II)/g). The methanol extract of ginseng roots exhibited the best anticorrosion activity, with the lowest weight loss (0.01 ± 0.001 g/cm²) and highest corrosion inhibition efficiency (98.5 ± 0.3%) after 24 hours of immersion. The EIS results also showed the highest inhibition efficiency for the methanol extract of ginseng roots.

DISCUSSION

Our results indicate that the polyphenol composition, antioxidant, and anticorrosion properties of different parts of Panax ginseng vary significantly depending on the solvent used for extraction. The methanol extract of ginseng roots exhibited the highest TPC and best anticorrosion activity, while the methanol extract of ginseng leaves showed the highest DPPH scavenging activity. These findings suggest that different parts of ginseng could be used for specific applications based on their chemical composition and properties.

CONCLUSION

In conclusion, our study highlights the importance of solvent selection in the extraction of different parts of Panax ginseng for their polyphenol composition, antioxidant, and anticorrosion properties. Methanol was found to be the most effective solvent for the extraction of polyphenols from ginseng roots, while ethanol was found to be the most effective solvent for the extraction of polyphenols from ginseng stems. These findings could have significant implications for the development of natural antioxidants and anticorrosion agents from Panax ginseng.

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