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Eco-friendly and efficient extraction of phenolic compounds from *Commiphora gileadensis* bark using microwave-assisted extraction

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ABSTRACT

Commiphora gileadensis (*C. gileadensis*) is a medicinal plant with a variety of biological activity; its bark has several therapeutic potentials, including the treatment of wounds, inflammatory diseases, and treating bacterial infections. This study utilized microwave-assisted extraction (MAE) to optimize the recovery and phenolic components of the ethanolic extracts of *C. gileadensis* bark. Different MAE process parameters (microwave power, irradiation time, sample/solvent ratio, extraction temperature, and solvent (ethanol) concentration) were studied for their impacts on the extraction process using One-Factor-At-a-Time (OFAT) method. The extracts were further characterized for the presence of different phytochemicals using Gas Chromatography-Mass Spectroscopy (FC-MS) and Fourier Transform Infrared Spectroscopy (FTIR) analyses. The experimental findings revealed that the maximum extraction yield, total phenolic content (TPC), and total flavonoid content (TFC) of the ethanolic extract of the of *C. gileadensis* bark using MAE process were 39.40 ± 0.47 w/w%, 166.41 ± 3.97 mg GAE/g d.w., and 52.83 ± 2.95 mg QE/g d.w., respectively. Furthermore, 30 phenolic constituents were discovered in the extract of *C. gileadensis* bark for the first time, and these compounds showed good in vitro antioxidant activity. Hence, MAE is a suitable technique for efficient and green extraction of different groups of phytochemicals of pharmaceutical importance from the bark of *C. gileadensis*.

Introduction

Medicinal plants have been used since prehistoric times to treat and prevent various ailments [1]. Today, herbal products continue to play a crucial role in healthcare, with the World Health Organization (WHO) reporting that they serve about 80 % of the global population [2,3]. Despite the extensive use of known medicinal plants, many potential species remain undiscovered, necessitating further research to ensure sustainability [4].

C. gileadensis is a 1–3 m long tree that belongs to the Burseraceae family [5–8]. It originated from the southern Kingdom of Sheba in the Arabian Peninsula [9–12], as well as found in Oman, Somalia, Ethiopia, and Sudan [13,14]. As per [14,15], *C. gileadensis*, also called balsam, is well recognized for the pricey perfume it produces as well as the amazing health benefits of its seeds, bark, sap, wood, and leaves. The aromatic *C. gileadensis* is used in herbal medicines as an alternative therapy for a wide range of ailments and it is still in use to date [5,10,16,17]. *C. gileadensis* could indeed treat a variety of ailments, and it has a powerful anti-impact on cancer cell lines [5]. It additionally has medicinal properties for controlling diseases such as stomach problems, liver problems, urinary retention, constipation, headache, and jaundice [15]. The phytochemical analysis of the plant's aerial parts showed the existence of phenolic, saponins, flavonoids, and triterpenes, and sterols [18,19,20] which has antibacterial, anti-infections, as well as cancer analgesic and diuretic [17,21].

The extraction of bioactive compounds from plant matrices involves the use of a variety of extraction techniques, both traditional and un-conventional. Depending entirely on their type and distribution within plant samples, phenolics can be recovered from plant materials utilizing a variety of methods and solvents. MAE is one of the non-conventional approaches that has lately caught the interest of researchers due to its short time of extraction, greater quality of yield, and decreased usage of

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