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Characterization and antimicrobial properties of Matcha green tea

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ABSTRACT

Matcha, made from the finely ground powder of green tea leaves, is used as a nutritious food ingredient because of its unique properties. In this study, Matcha was characterized using Fourier transform infrared (FT-IR) spectroscopy, X-ray diffraction analysis (XRD), energy-dispersive X-ray spectroscopy (EDX). Also, the antimicrobial properties of Matcha against 8 types of bacteria, 1 type of fungus, and 1 type of yeast were investigated. The results showed that Matcha has a completely amorphous structure and has a high content of carbon and oxygen. The results of antibacterial tests showed that Matcha has the ability to inhibit gram-positive and gram-negative bacteria as well as yeast, but has no effect on the fungus. Also, Matcha has a greater effect on gram-positive bacteria, which is due to the simple and reasonably porous cell wall of these bacteria. According to the results, the maximum and minimum inhibition zones created by Matcha belonged to *Pseudomonas aeruginosa* and *Escherichia coli*, respectively.

1. Introduction

Over the time drug resistance of many gram-positive, gram-negative bacteria and fungi has increased and has become one of the global public health challenges [1-6]. Every year, more than one billion people worldwide get fungal infections one of the most common of which is *Aspergillus* [7-9]. Gram-negative bacteria are much more resistant to drugs than gram-positive bacteria, and research has shown that two-thirds of bacterial deaths in Europe are due to gram-negative infections [10-15]. Environments with high population densities such as hospitals, subway and bus stations are major candidates for the cyclical transmission of bacteria and fungi [16-22]. Over the years there have been extensive efforts to obtain antimicrobial materials that among these which plants have a special place because due to their non-toxicity, they can be used in various fields such as medical equipment and food packaging [23-35]. Tea is one of the most popular and widely-consumed beverages, which in many societies second to water, mostly because distinctive flavour and aroma [36]. Matcha (*Camellia sinensis*) is a type of tea that originates from Japan and has amazing properties [37]. Matcha has potentially antioxidant, anti-viral and anti-inflammatory function properties due to its high content of polyphenols, amino acids and caffeine [38,39]. Matcha can reduce of blood glucose and total cholesterol levels and also play a role in reducing stress [40]. In addition to using Matcha as a beverage, it has other uses as well. Research has shown that the use of Matcha in cooking rice noodles reduces cooking loss, thereby inncreasing chewability and stretchability. It also gives rice noodles a unique color and flavor and higher antioxidant capacity [41]. Moreover, Matcha phenolic compounds can stabilize the quality of rice cakes during long-term storage [42]. In this research, Matcha were investigated using FTIR, XRD, and EDX techniques. Also, the antimicrobial properties of Matcha against 4 types of gram-positive bacteria, 4 types of gram-negative bacteria, one type of yeast, and one type of fungus were investigated.

2. Results and Discussion

Figure 1 showed the FT-IR spectra of Matcha. Peaks at around 486, 1020, 1270, 1631, 2905-2954, and 3311 cm^{-1} are corresponding to the COOH, C-O-C vibrations, -C-OH bending, -OH bending and stretching vibrations, C-H stretching vibration, and -OH stretching vibration,

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