

CHEMICAL CHARACTERIZATION AND ANTIMICROBIAL ACTIVITY ASSESSMENT OF SPENT COFFEE GROUNDS USED IN BUILDING GYPSUM COMPOSITES

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The extensive global consumption of coffee results in significant quantities of spent coffee grounds (SCG) as a post-brewing residue. Such residue is usually disposed in landfills, raising environmental concerns and encouraging the need for sustainable reuse approaches [1]. The construction industry is a promising sector for the SCG valorisation, where they could be used as an additive in various building materials [2]. Although mechanical and physical properties of construction composites with organic additives are commonly evaluated, but information regarding antimicrobial behaviour of such additives, particularly for indoor construction applications, remains scarce. Additionally, treated SCG, despite containing potentially valuable bioactive compounds applied in other fields, remain mostly underutilised as well.

Therefore, this study aims to assess antimicrobial activity, bioactive compounds and mechanical properties of untreated and acetone or boiling water treated spent coffee grounds used as an additive in building gypsum composites.

The properties of two types of SCG were compared: collected from domestic manual brewing and from local coffee shop using machine brewing. The particle size used for further experiments of both types of SCG were lower than 0,5 mm. SCG treatment was performed with either 100 °C temperature boiling water, or with different concentrations of acetone solvent. Mechanical properties were determined by forming 2 × 2 × 2 cm specimens out of SCG and building gypsum, otherwise known as β -hemihydrate gypsum, and measuring their compressive strength. The chemical composition as well as antimicrobial activity of used organic additive was evaluated. Total phenolic content (TPC) of SCG, before and after treatment, was assessed using Folin-Ciocalteu assay, either directly from solid material by the QUENCHER method or from the methanolic SCG extracts.

[1] D. N. Dari, et al., "Spent coffee grounds: Insights and future prospects for bioenergy and circular economy applications", *Green Technologies and Sustainability*, 3, 4, 100213, 2025.

[2] J. J. Yee, et al., "Spent coffee grounds enhanced compressive strength of cement mortar: an optimization study", *Discovered Applied Sciences*, 6, 379, 2024.