

INSTITUTE OF TECHNICAL SCIENCES OF SASA
MATERIALS RESEARCH SOCIETY OF SERBIA



Programme and the Book of Abstracts

**TWENTY-THIRD YOUNG RESEARCHERS' CONFERENCE
MATERIALS SCIENCE AND ENGINEERING**

Belgrade, December 3 – 5, 2025

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**Materials Research Society of Serbia
&
Institute of Technical Sciences of SASA**

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Program and the Book of Abstracts

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Aim of the Conference

Main aim of the conference is to enable young researchers (post-graduate, master or doctoral student, or a PhD holder younger than 35) working in the field of materials science and engineering, to meet their colleagues and exchange experiences about their research.

Topics

Biomaterials
Environmental science
Materials for high-technology applications
Materials for new generation solar cells
Nanostructured materials
New synthesis and processing methods
Theoretical modelling of materials

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Results of the Conference

Beside printed «Program and the Book of Abstracts», which is disseminated to all conference participants, selected and awarded peer-reviewed papers will be published in journal “Tehnika – Novi Materijali”. The best presented papers, suggested by Session Chairpersons and selected by Awards Committee, will be proclaimed at the Closing Ceremony. Part of the award is free-of-charge conference fee at YUCOMAT 2026.

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Chemical characterization and cytotoxic profile of cocoa bean shell (*Theobroma cacao* L.) extract as a potential cosmetic ingredient

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The cocoa bean shell (*Theobroma cacao* L.) represents a significant by-product of the confectionery industry, generated during the removal of the outer seed coat after the roasting process and accounting for approximately 12–20% of the total bean mass. Traditionally treated as waste, this biomass is increasingly recognized as a secondary raw material suitable for valorization across various industrial sectors, including food, cosmetic, and biotechnological applications. Such an approach aligns with the principles of the circular economy, which emphasize closing material loops through waste reduction, reuse, and resource recycling, thereby improving both environmental performance and the economic efficiency of production systems. In the present study, extraction of the cocoa bean shell was carried out using aqueous Soxhlet extraction. The obtained extract was chemically characterized through the determination of total polyphenol content (TPC), total flavonoid content (TFC), antioxidant capacity (DPPH and ABTS methods), and sun protection factor (SPF). TPC, determined using the Folin-Ciocalteu method, amounted to 8.13 ± 0.59 mg gallic acid equivalent/100 mg of dried extract, while TFC was 2.37 ± 0.05 mg catechin equivalent/100 mg of dried extract. The IC₅₀ value (the concentration of the extract required to neutralize 50% of free DPPH radicals) was 4.05 ± 0.02 mg/mL, and the anti-ABTS potential was 28.89 ± 3.11 mmol Trolox equivalent/g of dried extract. SPF, determined using the *in vitro* spectrophotometric method and the Mansur equation, varied in the range of 0.94–21.40, depending on the tested concentration of the extract (175–3000 µg/mL). Cytotoxicity of the extract was assessed using the MTT (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) assay on human fibroblasts (MRC-5). The starting extract concentration of 21.1 mg/mL was diluted in medium to 2×, 4×, 8×, 16×, 32×, and 64×. Significant cytotoxicity was observed at 2× and 4× dilutions ($p < 0.001$), partial recovery of cell viability at 8× ($p < 0.001$), a mild but significant effect at 16× ($p < 0.05$), while 32× and 64× dilutions showed no statistically significant effect compared to the control ($p > 0.05$), indicating the absence of cytotoxicity at these concentrations. One-way ANOVA ($F = 449.6$; $p < 0.0001$) confirmed significant differences between treated groups. Dunnett's *post hoc* test was used to compare each treatment with the control. These findings highlight the notable potential of cocoa bean shell extract as a natural antioxidant and auxiliary UV filter for incorporation into cosmetic formulations.