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BIOMATERIALS FOR SKINCARE APPLICATIONS: SUGARCANE BAGASSE-BASED ACTIVATED CARBON AS A SUSTAINABLE ALTERNATIVE

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INTRODUCTION & AIM

The demand for eco-friendly skincare products is rising as consumers prioritize sustainability. Conventional activated carbon production is resource-intensive, creating a need for greener alternatives. Sugarcane bagasse, an abundant agro-industrial byproduct, provides a renewable and low-cost precursor for activated carbon with tunable pore structure and surface chemistry.

AIM: To develop and characterize sugarcane bagasse-based activated carbon (SBAC) for skincare applications, focusing on its deep-cleansing performance and adsorption of sebum and skin-relevant toxins. This study explores SBAC as a sustainable and high-performance biomaterial, linking agricultural waste valorization to the growing demand for eco-friendly cosmetic ingredients

METHOD

SYNTHESIS PROCESS

Sugarcane bagasse was converted into activated carbon using a two-step process involving pyrolysis and KOH chemical activation.

Sugarcane Bagasse

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Pyrolysis (500 °C, 2 h)

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Chemical Activation (KOH, 800 °C, 1 h)

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Activated Carbon

CHARACTERIZATION AND TESTING

BET Analysis: Measured surface area & pore volume.

SEM: Observed porous structure.

FTIR: Identified O–H, C=O, C–O groups confirming surface functionalization.

Adsorption Testing: Evaluated removal of sebum analogs (lipids) and model toxins (methylene blue) using the silicone skin model.

Comparison with Commercial AC: Benchmarked against commercial activated carbon (Performance evaluation).

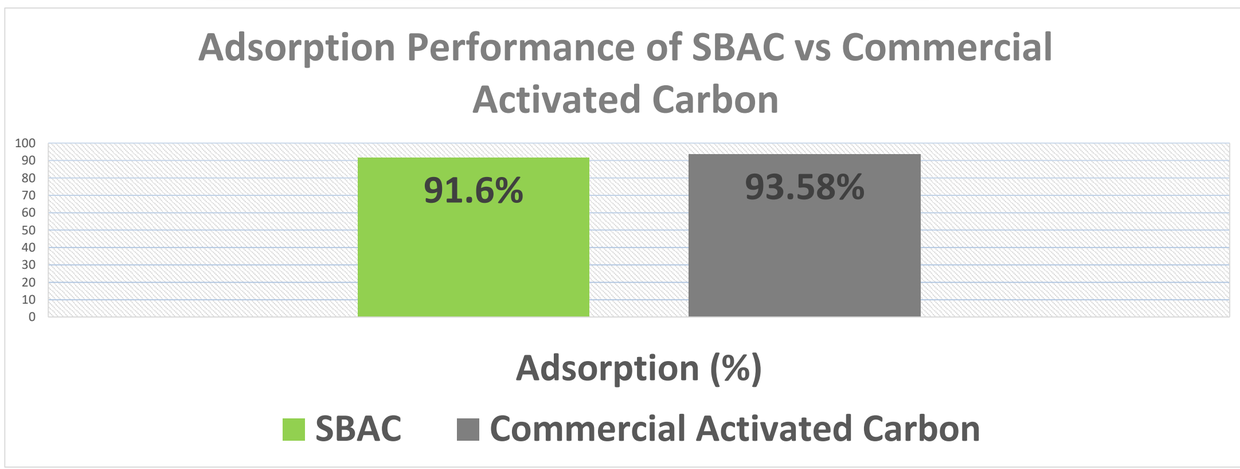
RESULTS & DISCUSSION

STRUCTURAL CHARACTERIZATION

Sample	BET Surface Area (m^2/g)	Total Pore Volume (cm^3/g)	Avg. Pore Diameter (nm)	MB Adsorption (mg/g)	Iodine Number (mg/g)
SBAC	3543	1.05	6.7	341.5	1095
Commercial AC	2140	1.27	3.1	301.7	1135

SBAC shows higher surface area and mesoporous character, supporting efficient adsorption comparable to commercial AC, even without extensive surface imaging data.

ADSORPTION PERFORMANCE



SBAC demonstrated comparable adsorption capacity to commercial activated carbon, validating its suitability for eco-friendly skincare formulations.

DISCUSSION & IMPLICATIONS

Efficient waste-to-value conversion: Transforms sugarcane bagasse into high-performance activated carbon, supporting circular economy goals.

Sustainable material source: Provides an eco-friendly and consistent alternative for skincare manufacturers.

Economic potential: Creates a new revenue stream for sugar mills through bagasse valorization.

CONCLUSION

SBAC demonstrated high surface area, tunable porosity, and favorable surface chemistry, resulting in efficient adsorption of skin-relevant substances. These properties make it a promising eco-friendly ingredient for cosmetic formulations, supporting sustainability and circular economy goals.

FUTURE WORK / REFERENCES

Future studies will focus on integrating the material into cosmetic formulations and assessing long-term biocompatibility. Optimization of activation conditions for large-scale production is also planned.