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Evaluation of Turmeric-Based UV-Sensitive Cards as a Low-Cost Tool for Monitoring Sunlight Exposure and PET Transparency in SODIS Applications

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Introduction - Drinking safe water remains a challenge in many low-resource settings where Solar Water Disinfection (SODIS) is widely practiced. However, exposure times required for effective disinfection vary from 6 to 48 hours depending on sunlight and weather, and communities lack affordable tools to verify adequate UV exposure. This study developed a turmeric-based UV-sensitive indicator card designed to provide a simple, biodegradable, and low-cost means of monitoring sunlight exposure and assessing PET bottle suitability for SODIS.

Methodology - Turmeric indicators were prepared as filter paper strips with controlled concentrations (1 g/cm³, 0.4 g/cm³, 0.02 g/cm³) and Bristol board prototypes mixed with hand sanitizer for low-resource feasibility. Green, brown, and clear recycled PET bottles were tested as UV shields. Hourly colour change was quantified using the RYB Colorimeter app, and illuminance was measured using a mobile lux meter. Fading rates and rate constants (k) were calculated, and One-Way and Two-Way ANOVA were used to evaluate the effects of UV shielding, concentration, and material type.

Results - Initial tests showed that turmeric strips retained only 37 ± 4.7% of their colour after 3 hours of direct sunlight. PET shielding significantly reduced fading: green PET by 51% ($p = 0.003$) and brown PET by 66% ($p = 0.0002$). Lower turmeric concentrations faded fastest, while the highest concentration showed the slowest degradation. Bristol board provided clearer visual fading than filter paper. Turmeric brands differed in stability, with MARS performing slightly better than Keells, and strips exhibited acceptable stability after one month of storage.

Conclusion - Turmeric-based cards show strong potential as multi-zone UV indicators for SODIS, providing a practical visual method to gauge sunlight exposure and assess PET bottle transparency. Their low cost, biodegradability, and ease of fabrication make them suitable for community-level water safety monitoring and broader UV-exposure applications