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**SYNTHESIS OF ZINC OXIDE FROM POLYPHENOL OF *Punica granatum*
(POMEGRANATE) PEEL FOR NATURAL SUNSCREEN**

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Punica granatum (POMEGRANATE) PEEL FOR NATURAL
SUNSCREEN**

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ABSTRACT

This study investigates the synthesized of Zinc Oxide (ZnO) derived from the polyphenols of *Punica granatum* (pomegranate) peel as a natural sunscreen agent. Plant-based antioxidant-mineral UV filters are increasingly favoured for their safety and skin-friendly properties. The maceration method was employed to extract polyphenols from pomegranate peels using an 80:20 v/v ethanol-water solvent. The resulting polyphenol solution was then reacted with zinc nitrate hexahydrate ($\text{Zn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$) through chemical reduction to synthesize ZnO. The FTIR spectrum displayed major absorption bands at 3273.97 cm^{-1} (O–H stretch of carbonyl groups) and 1638.91 cm^{-1} (C=C stretch of aromatic rings), confirming the presence of polyphenolic compounds. A strong absorption band at 553.1 cm^{-1} indicated a typical ZnO vibrational mode. The colour changes from red to pure green upon titration with 0.01 M EDTA further confirmed the formation of ZnO. Three sunscreen formulations A, B and C were successfully developed using different amounts (6–9 g) of ZnO powder. The antioxidant activity (radical scavenging percentage) for formulations A, B and C was 71.67, 68.67, and 67.38 respectively. Corresponding Sun Protection Factor (SPF) values were recorded as 10.30, 13.90, and 17.40. Formulation stability was assessed over three weeks by monitoring changes in colour, odour, phase separation, and pH. All formulations remained stable under ambient conditions; however, a slight oil layer separation was observed in samples exposed to $40\text{ }^\circ\text{C}$. The use of green ZnO synthesized from *Punica granatum* peel polyphenols as a substitute for synthetic ZnO represents a promising advancement in the development of natural and sustainable cosmetic products.

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