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REVIEWER'S REPORT

Manuscript No.: IJAR- 57643

Title: Influence of copper oxide nanoparticles on UV aging resistance and thermal degradation of sulfonated poly (1,4-phenylene ether ether sulfone) (SPEES) membrane

Recommendation:
Accept

Rating	Excel.	Good	Fair	Poor
Originality	Yes			
Techn. Quality	Yes			
Clarity	Yes			
Significance		Yes		

Reviewer Name: Dr. Ashish Yadav

Detailed Reviewer's Report

Reviewer's Comment for Publication.
Acceptance Comment are mentioned below suitable for the paper titled " Influence of copper oxide nanoparticles on UV aging resistance and thermal degradation of sulfonated poly (1,4-phenylene ether ether sulfone) (SPEES) membrane"

Reviewer Comments: Accept

Reviewer Comments –

Introduction:

The manuscript presents a relevant and scientifically valuable study on the development of multifunctional SPEES membranes reinforced with copper oxide nanoparticles. The introduction clearly explains the importance of polymer nanocomposite membranes in enhancing thermal stability, UV resistance, and optical performance. The motivation for sulfonating PEES to improve hydrophilicity and nanoparticle dispersion is well justified. The topic is highly significant for advanced membrane materials and functional polymer applications. Overall, the introduction establishes a strong foundation for the research objectives and highlights the novelty of the work effectively.

Literature Review:

The literature review adequately discusses previous studies related to PEES-based membranes, nanoparticle reinforcement, and thermal degradation behavior of polymer composites. The manuscript successfully explains the role of copper oxide nanoparticles in improving UV shielding, thermal resistance, and antimicrobial properties. The review also identifies the limitations of neat PEES membranes, particularly their hydrophobic nature and poor nanoparticle interaction. The authors effectively position their work within the context of recent advancements in nanocomposite membrane technology. The cited concepts support the research gap and justify the need for SPEES/CuO membrane development.

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Solution Approach:

The solution methodology adopted in the study is systematic and scientifically sound. The sulfonation of PEES using H_2SO_4 to enhance hydrophilicity and nanoparticle compatibility is appropriately designed. The preparation of SPEES membranes with varying concentrations of copper oxide nanoparticles demonstrates a clear experimental strategy to evaluate performance variations. The approach successfully integrates material modification with nanofiller reinforcement to improve membrane functionality. The methodology appears reproducible and suitable for investigating the influence of CuO nanoparticles on UV aging resistance and thermal degradation properties.

Results and Discussion:

The results and discussion section provides meaningful insights into the relationship between copper oxide concentration and membrane performance. The study clearly demonstrates that the incorporation of CuO nanoparticles enhances thermal stability, UV shielding capability, and optical properties of the SPEES membrane. The correlation between nanoparticle loading and degradation behavior is well interpreted and scientifically explained. The discussion effectively highlights the improved dispersion achieved through sulfonation and its positive impact on membrane properties. The findings are relevant, technically sound, and contribute valuable knowledge to the field of polymer nanocomposites.

Conclusion:

The conclusion successfully summarizes the major outcomes of the study and emphasizes the significance of copper oxide nanoparticle reinforcement in SPEES membranes. The manuscript demonstrates that sulfonation and nanoparticle incorporation significantly improve thermal degradation resistance and UV aging performance. The work provides a promising pathway for the development of advanced multifunctional membranes with enhanced optical and antimicrobial properties. The conclusions are consistent with the presented results and reinforce the practical importance of the research. Overall, the manuscript represents a meaningful contribution to membrane science and nanocomposite materials research.