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Solar box Cooker thermal performance analyze

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Abstract

Internal heat transfer of a solar box cooker's double glass cover has been studied using MoS_2-Fe_2O_3-Cr_2O_3 nanomaterials. By using the performance of nanomaterials with and without covering materials, the design was able to achieve the bar plate temperature of roughly 163.74 °C and 113.34 °C below solar radiation of 1037 W/m^2.Fuzzy intelligent logic and Cramer's rules are used to run the simulation model. It was 91% in line with the trial's findings.

Introduction

MoS_2-Fe_2O_3-Cr_2O_3 nanoparticles were used to coat a solar cooker, which Bhavani et al. [1] experimentally investigated. The nano composite material's high surface-to-volume ratio allows it to achieve a bar plate temperature of up to 163.74 °C. The energy control study of a solar cooker with a fuzzy set was investigated by Bhavani et al.[2] Al_2O_3 nanoparticle blended with black paint was calculated to transport heat with a thermal proceed of 15.14% and a nanoparticle expertise of 7.10%, according to authors. The performance of the heat transmission in cooker with fuzzy logic controller was examined by Bhavani et al [3]. Here, we will discuss the fuzzy mode of the solar cooker utilizing the fuzzy set of mathematical representations. Thamizharasu et al. [4] verified the effectiveness of the solar cooker using SiO_2/TiO_2 materials in ratios ranging from 5% to 25%. SiO_2/TiO_2 materials improve the moist air temperature in comparison to the single nanolayer coating in standard type cookers, achieving a thermal performance of up to 49.21% (15%).

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Fig. 1 experimental analysis

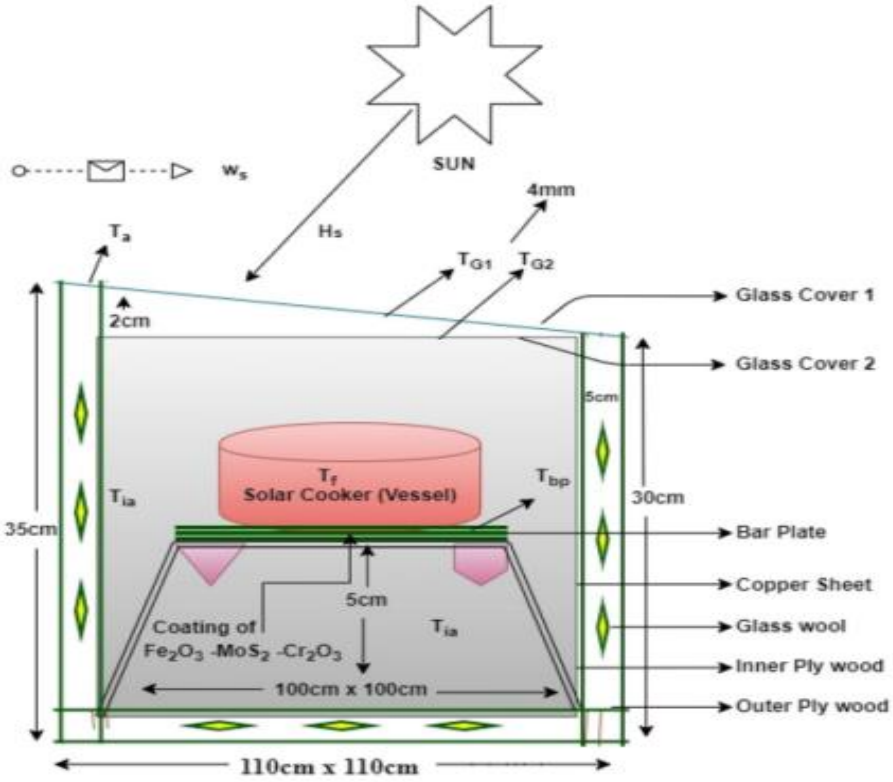

Fig 2 Schematic diagram

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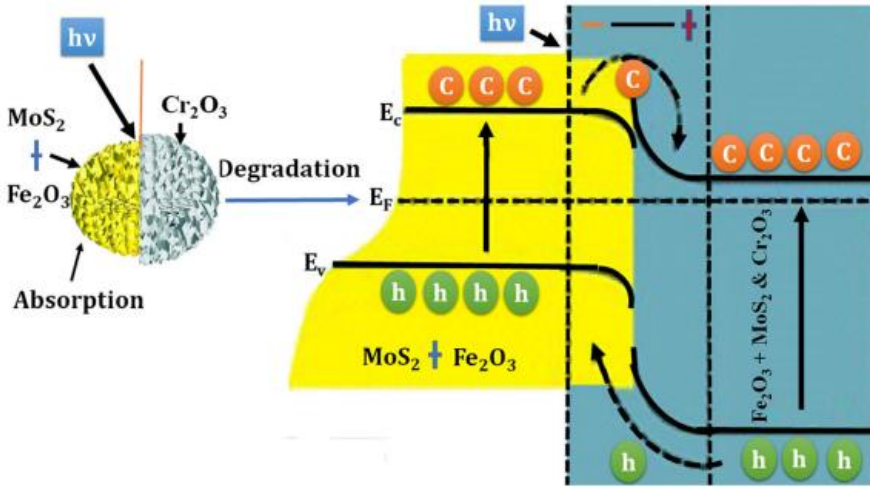

Fig 3 Photo catalysis process

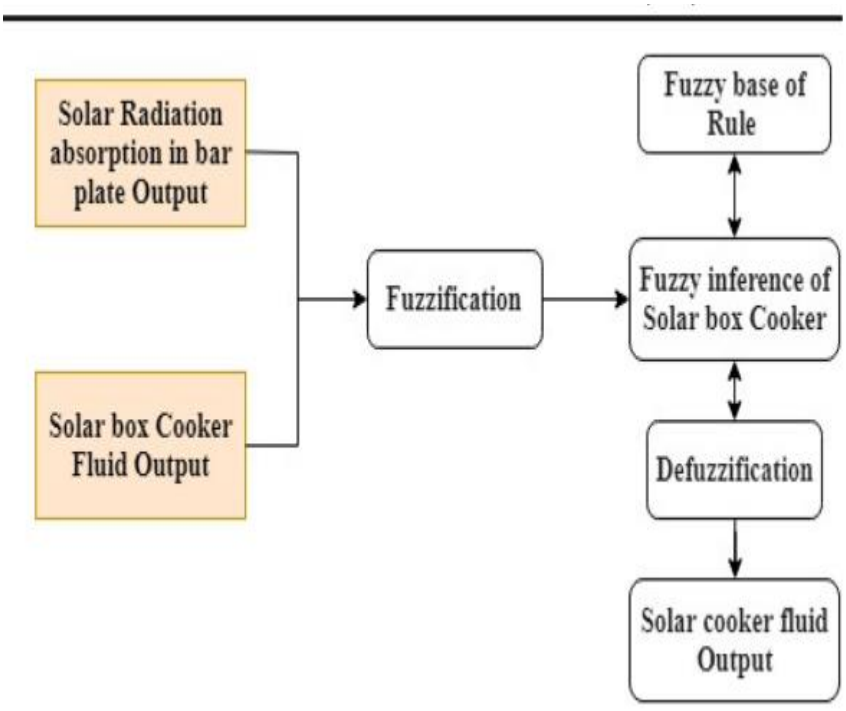

Fig 4 Fuzzy process

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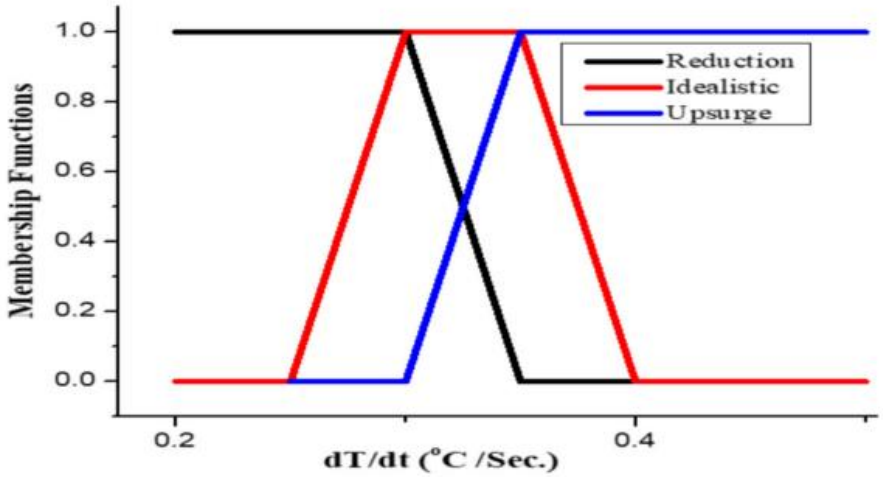

Fig 5. Membership function

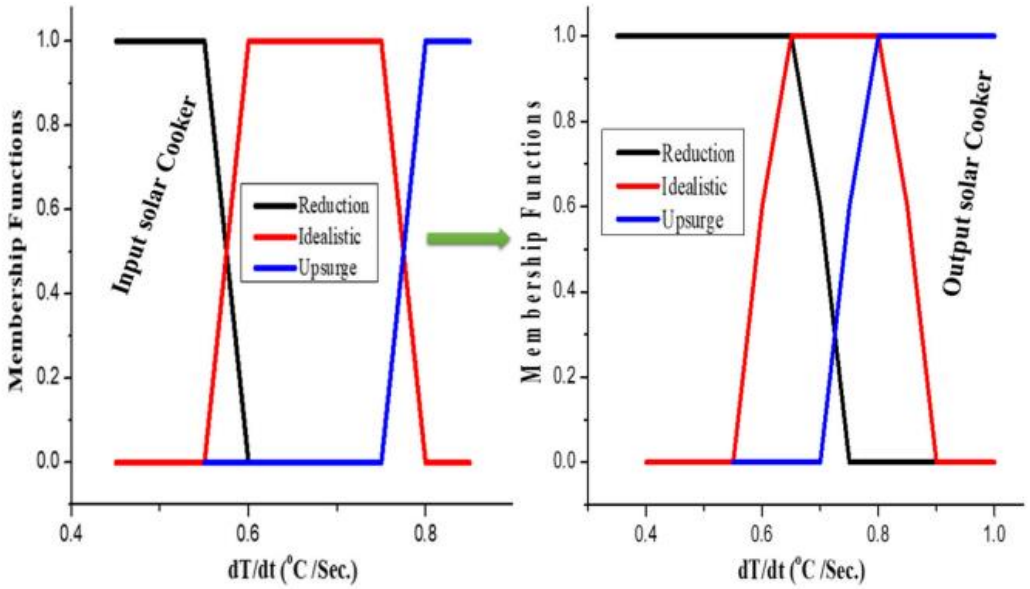

Fig 6. Input output cooker

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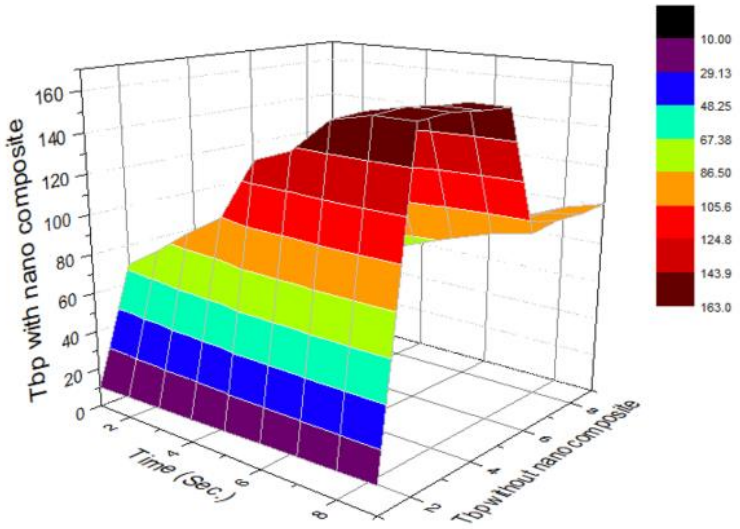

Fig 7. Parameter anlaysis

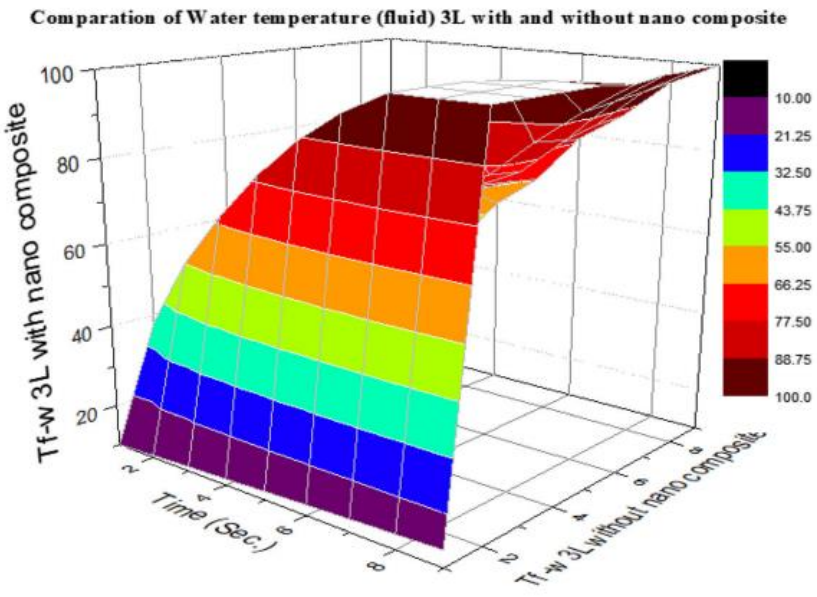

Fig 8. Water temperature

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Conclusion

The solar box cooker's thermal energy efficiency ranges from 56.21-31.77% to 33.90-24.90% with and without nanocomposites. It enabled domestic areas to access electricity for cooking. The performance of the cooker is enhanced by regulating the ambient temperature, solar radiation, fluid temperature, and wind speed. The findings indicated that the innovative and conventional cookers' maximum bar plate temperatures are 163.74 °C and 113.34 °C, respectively. Internal air temperature of the novel cooker is 164.12 °C, compared to 102.56 °C for the standard cooker. Additionally, the innovative cooker needed 30 to 58 minutes to cook the various food items in the different quantities, whereas the conventional cooker needed 51 to 110 minutes.

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