

***Design and Construction of a Solar-Based Pyrolysis Device Equipped with a  
Smoke Filtration System for Liquid Smoke Production***

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**ABSTRACT**

*This study aims to design and analyze the performance of a solar-powered pyrolysis system for the production of liquid smoke from corn cob biomass, equipped with a natural cooling system and smoke filtration. The system utilizes an off-grid Solar Power Plant (PLTS) with a 100 Wp panel capacity to meet an energy demand of 398.76 Wh/day for operating a blower (34.2 W) and a water pump (22 W). The results show that the pyrolysis system was successfully realized according to the design, using a stainless steel reactor with a thickness of 0.006 m. The PLTS system operated with a relatively stable efficiency of 2–3% under a maximum solar irradiance of 967.2 W/m<sup>2</sup>, thereby meeting the required power demand. The reactor reached a maximum temperature of 576°C with an average operating temperature ranging from 435–509°C, indicating that the pyrolysis process occurred optimally, with the highest liquid smoke production obtained under condition A2 at 351.94 g (0.35 L). The natural cooling system, with a capacity of 365 liters, was effective in condensing pyrolysis vapors, while the filtration system successfully reduced pollutant gas concentrations, where TVOC levels decreased from approximately ±2 ppm to ±0.002 ppm, along with reductions in CO<sub>2</sub> and HCHO. In conclusion, the designed solar-powered pyrolysis system is capable of operating optimally, independently meeting energy requirements, and effectively producing liquid smoke while reducing pollutant gas emissions, thus showing strong potential as an environmentally friendly and sustainable biomass processing technology.*

**Keywords:** *Pyrolysis, Off-grid Solar Power Plant, Liquid Smoke, Solar Energy.*