

ABSTRACT

Slaughterhouses (RPH) play a critical role in the national meat supply chain but still face challenges in water efficiency and wastewater management, particularly in the cleaning process of cattle intestines. This study aims to design an integrated water filtration system for a cattle intestine cleaning machine to reduce clean water consumption and ensure that the resulting wastewater complies with environmental quality standards and halal requirements. The system was developed using the *Engineering Design Process* (EDP), which includes requirement, constraint analysis, conceptualization, concept evaluation, and design validation.

The filtration system applies a dual-media configuration consisting of silica sand and activated carbon derived from candlenut shells. Innovation was further enhanced through the utilization of *Artificial Intelligence* (AI) to assist in the ideation phase of the design. Simulation and validation results indicate that the system successfully reduced *Chemical Oxygen Demand* (COD) from 1,127 mg/L to 225.4 mg/L (80% efficiency), and *Total Suspended Solids* (TSS) from 592 mg/L to 88.8 mg/L (85% efficiency), while reducing daily clean water usage by over 50%. The design also complies with halal standards as set by BPJPH in terms of materials and operational procedures. The study concludes that the proposed integrated filtration system is technically effective, field-adaptive, and supports sustainable operations in slaughterhouse facilities. Future research is recommended to include physical prototyping and economic feasibility analysis.

Keywords: water filtration, cattle intestine, slaughterhouse, EDP, candlenut shell carbon, AI, halal, COD, TSS.