**Optimasi Pengisian Susu Pasteurisasi 950 mL melalui Pendekatan *SHERPA-HEART* dan Simulasi PID pada *Model First-Order***

*Optimization of 950 mL Pasteurized Milk Filling through SHERPA-HEART Approach and PID Simulation on First-Order Model*

Annisa'U Chairun S.T.P., M.T. as Chief Conselor

**Noval Andre Ramadani**
**Progam Studi Teknologi Rekayasa Pangan**
**Jurusan Teknologi Pertanian**
Study Program of *Food Engineering*
*Majoring of Agriculture Technology*

# ABSTRACT

*Koperasi Agro Niaga Jabung produces pasteurized milk using a manual filling system with a target volume of 950 mL per bottle. The process relies on operator judgement in regulating valve opening and closure, resulting in volume variability that causes overfill and underfill conditions. This study integrates the Systematic Human Error Reduction and Prediction Approach (SHERPA), Human Error Assessment and Reduction Technique (HEART), and First Order Plus Dead Time (FOPDT)-based PID simulation to identify critical human errors, quantify error probability, model process dynamics, and evaluate system performance under disturbance conditions. Observation of 30 filling cycles showed an average final volume of 956.97 mL with an average absolute deviation of 14.70 mL from the target volume. SHERPA identified fifteen potential human errors, while HEART analysis indicated that the highest Human Error Probability (HEP) occurred in the overfill activity with a value of 0.8726. The process was represented by an FOPDT model, $G(s)=0.393e^{-3s}/(11.83s+1)$, with an average relative RMSE of 4.09%. PID parameters obtained using the IMC method were Kp=5.0170, Ki=0.42409, and Kd=7.5254. The optimized variables in this study included overshoot, settling time, steady-state error, Integral Absolute Error (IAE), and Integral Squared Error (ISE). The IMC-PID method produced optimal controller parameters of Kp = 5.0170, Ki = 0.42409, and Kd = 7.5254, with the best performance achieved under the baseline condition, resulting in an overshoot of 1.3065%, a settling time of 17.67 seconds, and a steady-state error of 0.001815 mL/s. The proposed improvements include the implementation of visual volume indicators, process feedback systems, and operator training programs to reduce the probability of human error and improve filling consistency.*

***Keywords:*** *FOPDT, HEART, Human Error, PID Control, SHERPA.*