System-scale simulation of continuous Digester

ADVANCED MODELLING & SIMULATION – AMS –

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DDIG-SIM

— A dynamic system-scale simulation tool to assist mill operations in improving digester runnability and reducing kappa variability

Physics-based modelling DDIG-Sim©

- System code dedicated to simulation of pulp cooking processes using first principles
- Consists of mass balances for the non-porous solid (wood chips) and free liquor components
- Accounts for energy transfer between the phases within the reactor

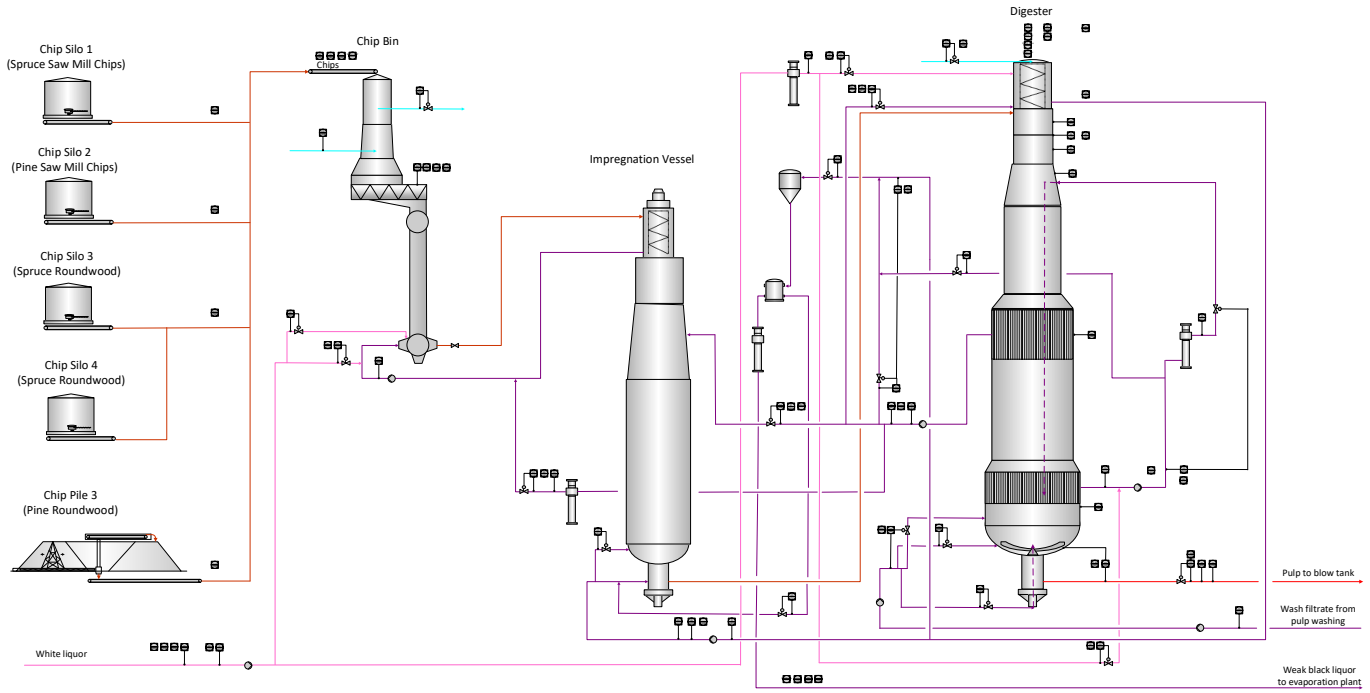
- Predicts at all digester locations:
  - Kappa number
  - Concentrations of main wood constituents
  - Concentrations of main liquor components
  - Temperature
  - Chip and liquor flow velocities

- DDIG-Sim© can be deployed under Windows, and runs under Matlab
- Tailored versions for other simulation tools, e.g. Python
- DDIG-Sim© can be adopted to various types of continuous digesters with different input, circulation and extraction configurations

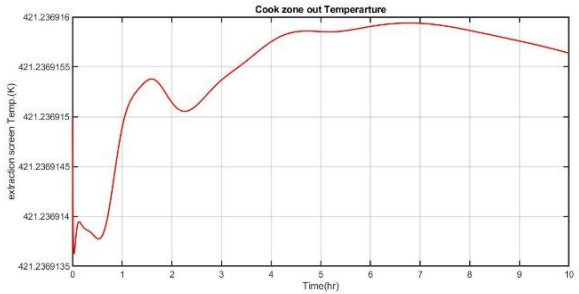
- Simulates impacts of changes in:
  - Production rate
  - Alkali charge
  - Chip mix
  - Cooking temperature
- Supports mill operations in reducing kappa and residual alkali variations
- Predicts hanging or plugging of digester

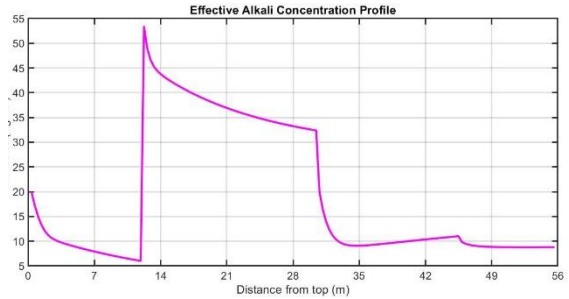
Use case: compact cooking g1 digester

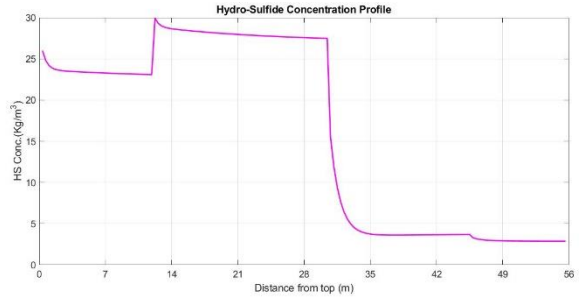
- Flows and cooking variables simulated for Compact Cooking G1 digester
- The plant is located in Finland
- Simulation can be executed for various parameters (e.g. changing cooking temperature, amount of wood, production changes, etc.)

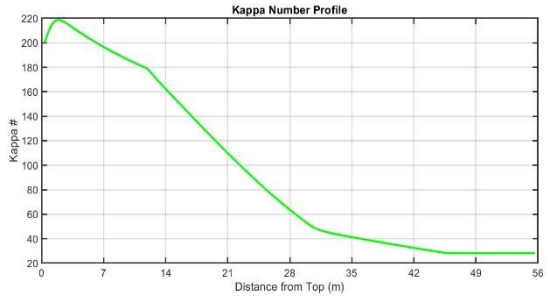


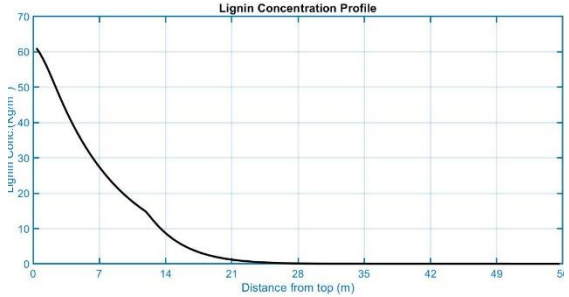
Use case: compact cooking g1 digester

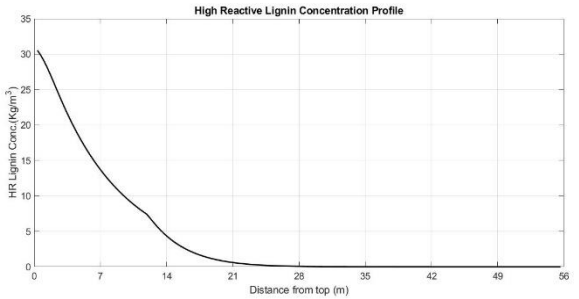


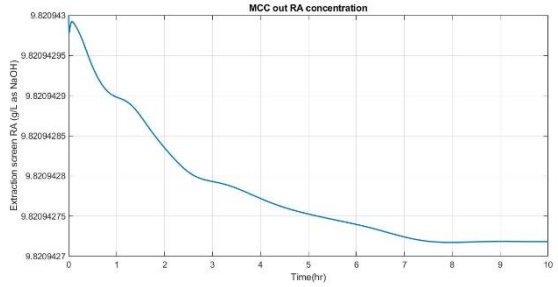


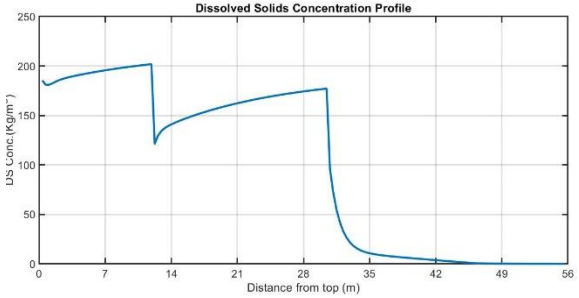


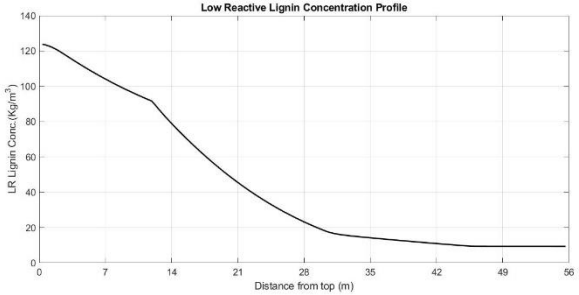












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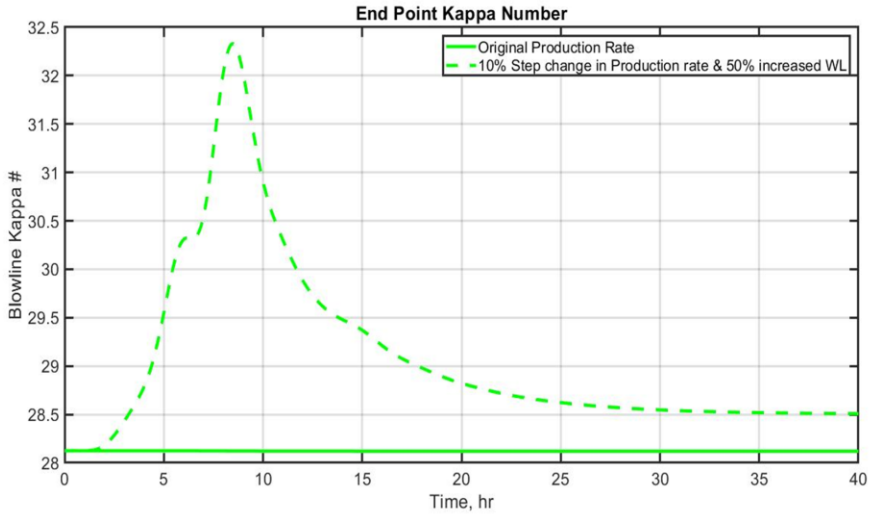
— Results: kappa after change (+10%) in production rate and WL charge; comparison of system simulation with field data



Parameter	***Plant Measurement***	***Model Output***	***Model Accuracy***
Blow-line Kappa number	28.97	28.12	97%
Cook Zone out Extraction screen RA	21.54	26.15	83%
MCC out Extraction screen RA	12.99	9.82	76%

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