Black Liquor Evaporators: Water Removed and Steam

Water to evaporate when weak black liquor is concentrated to heavy liquor, and the live steam from the evaporator train's steam economy (kg water per kg steam).

Method: Smook; Handbook for Pulp & Paper Technologists; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Weak black liquor	10,000	t/d
Weak liquor solids	15.000	%
Heavy liquor solids	72.000	%
Steam economy	5.0000	

Calculated results

Parameter	Value	Unit
Heavy liquor	2,083.3	t/d
Water evaporated	329.86	t/h
Live steam	65.972	t/h

Notes for this case

- The last step to 75–80 % solids is often done in a concentrator; washing more (higher dilution factor) adds directly to this water.

Formula and method

$$\dot{m}_h = \dot{m}_w \frac{x_1}{x_2}, \quad \dot{m}_{ev} = \dot{m}_w - \dot{m}_h, \quad \dot{m}_s = \frac{\dot{m}_{ev}}{E}$$

Variables

$\dot{m}_w$	Weak black liquor	kg/s
x_1	Weak liquor solids	-
x_2	Heavy liquor solids	-
E	Steam economy	-
$\dot{m}_h$	Heavy liquor	kg/s
$\dot{m}_{ev}$	Water evaporated	kg/s
$\dot{m}_s$	Live steam	kg/s

Method and standards

Solids balance with steam economy.

Assumptions and limits

- No solids removed.

References

- Smook
- Handbook for Pulp & Paper Technologists
- 3rd ed. (Angus Wilde, 2002)
- ch. 10 (black liquor evaporation from about 15 % to 70–75 % solids)

Report details

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Release checks	2 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/chemical/pulp-paper/black-liquor-evaporation

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.