Inline TDS mittausteknologia ja todennetut hyödyt

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Taking every measure

Maailman johtava ilmastotoimia mahdollistava mittausteknologiayritys.

Vaisala general
https://materialhub.vaisala.com/galleries/f714e495-92e4-44c6-b647-07e67f3f971a_ff7fd6a1-85c6-4b46-afaf-2d66dd4b00a5-ExternalUser

Key figures

Customers in over

150

countries

570 MEUR

in net sales

2,400+

experts

300+

product families

1,400+

shipments weekly

4.1/5

Employee engagement index

59

nationalities

28%

of our people work in R&D

We operate around the world and measure on 2 planets

24 offices

17 countries

400+ partners worldwide

Inline TDS mittausteknologia ja todennut hyödyt

Kuitulinja, kemikaalien talteenotto ja jäteveden käsittely

VAISALA

Vaisala Polaris process refractometer

Refined 5th generation reliability

Vaisala quality

Robust design

Engineer to order service

Drift-free measurement

Global and local customer service and support

Widest offering and industry expertise

Fast delivery (standard shipped in 2 weeks)

Polaris https://materialhub.vaisala.com/galleries/f714e495-92e4-44c6-b647-07e67f3f971a_17d7ebc4-b54e-4922-97c5-dacef4870be4-ExternalUser

Vaisala Polaris inline TDS mittausteknologia

Vaisala Polaris PR53SD -prosessirefraktometri mahdollistaa yksittäisten prosessivaiheiden jatkuvan seurannan ja koko pesulinjan ohjauksen. Inline TDS mittaus asennetaan suoraan sellu- tai suodoslinjaan.

TDS muutokset havaitaan välittömästi syöttö- ja poistolinjoissa sekä sisään- ja ulos tulevissa suodoslinjoissa.

Refraktometri mahdollistaa BSW:n optimoinnin : massasuspension tarkat, luotettavat ja jatkuvat TDS-mittaukset nestefaasissa yksittäisten pesuvaiheiden paremman hallinnan ja jatkuvan valvonnan mahdollistamiseksi. Sekä pesun että koko selluntuotantoprosessin taloudellinen ja ympäristöystävällinen suorituskyky paranee.

Kun tehtaalla on asennettuna riittävä määrä linjassa olevia TDS-mittauslaitteita, se voi laskea ja optimoida BSW-muuttujia, kuten optimaalisen laimennuskertoimen (DF) ja siirtymäsuhteen (DR), suhteellisen pesuhäviön (1-Y) ja laitoksen kokonaishyötysuhdekertoimen (E).

Yksinkertaisimmassa muodossaan pesujärjestelmän tehokkuus voidaan laskea TDS-mittausten perusteella. Järjestelmään massan mukana tulevan ja järjestelmästä suodoksen mukana poistuvan liuenneen kiintoaineen suhde edustaa poistettujen kiintoaineiden määrää.

$$\%\ \text{Efficiency} = \frac{\text{Dissolved Solids to evaporation} \left(\dfrac{\text{weight}}{\text{ton of pulp}}\right)}{\text{Dissolved Solids to the washing system} \left(\dfrac{\text{weight}}{\text{ton of pulp}}\right)}$$

Figure 3: Washing system efficiency calculation

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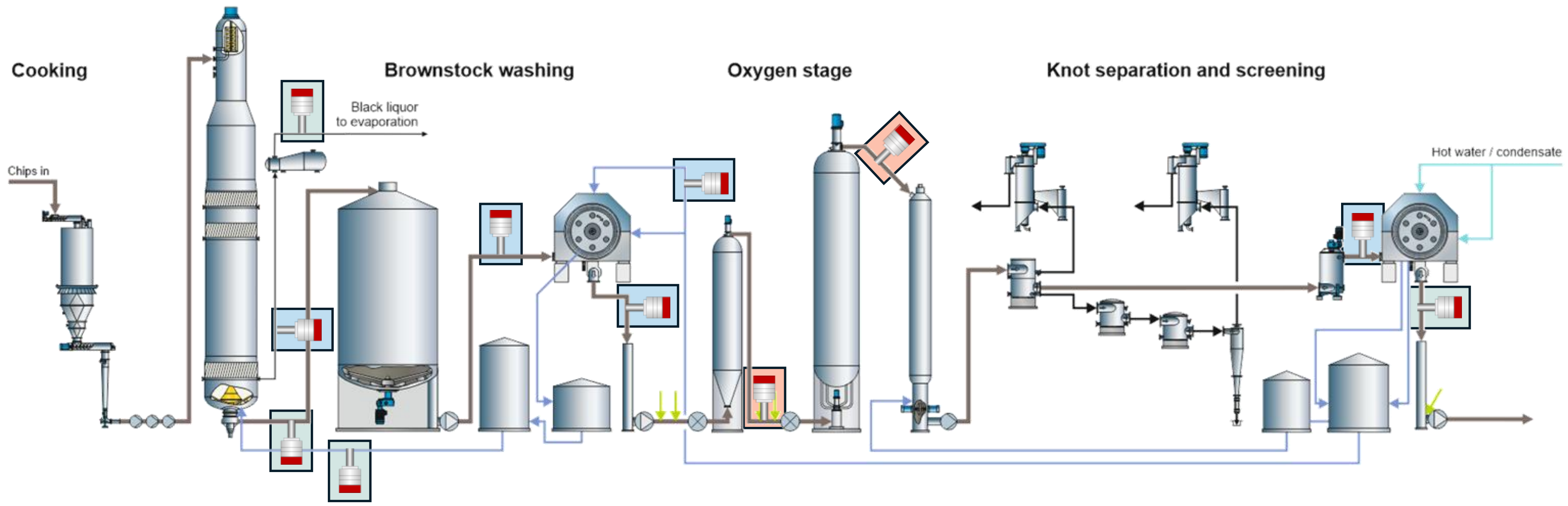
Inline TDS mittaus ruskean massan pesun ja happivaiheen toiminnan tehostaminen

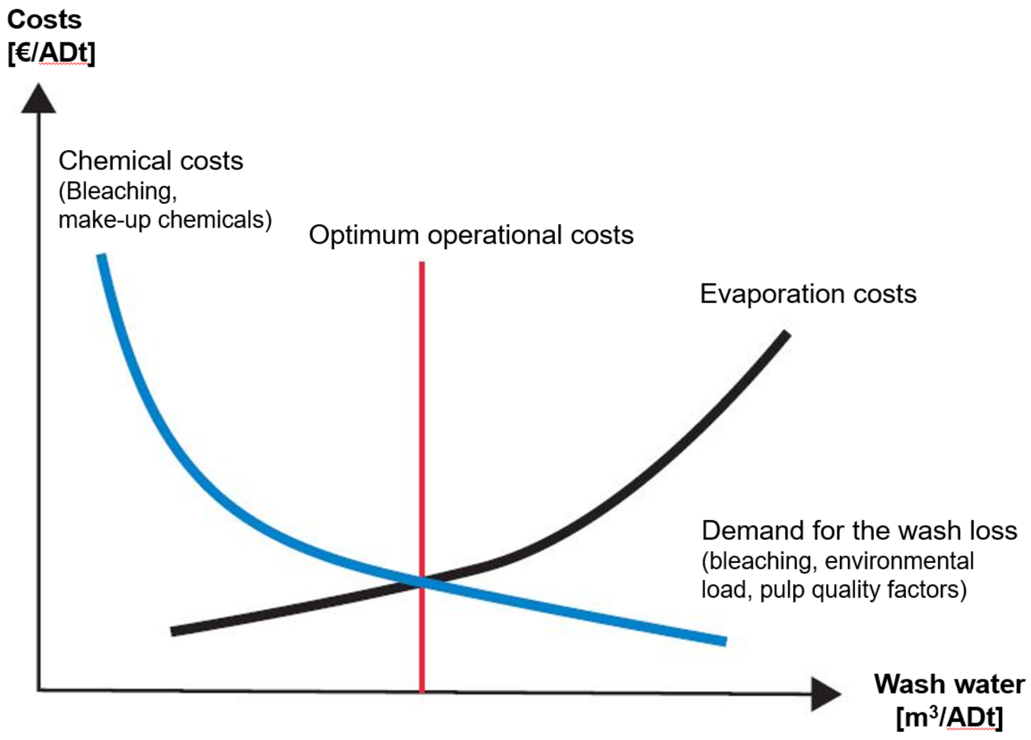


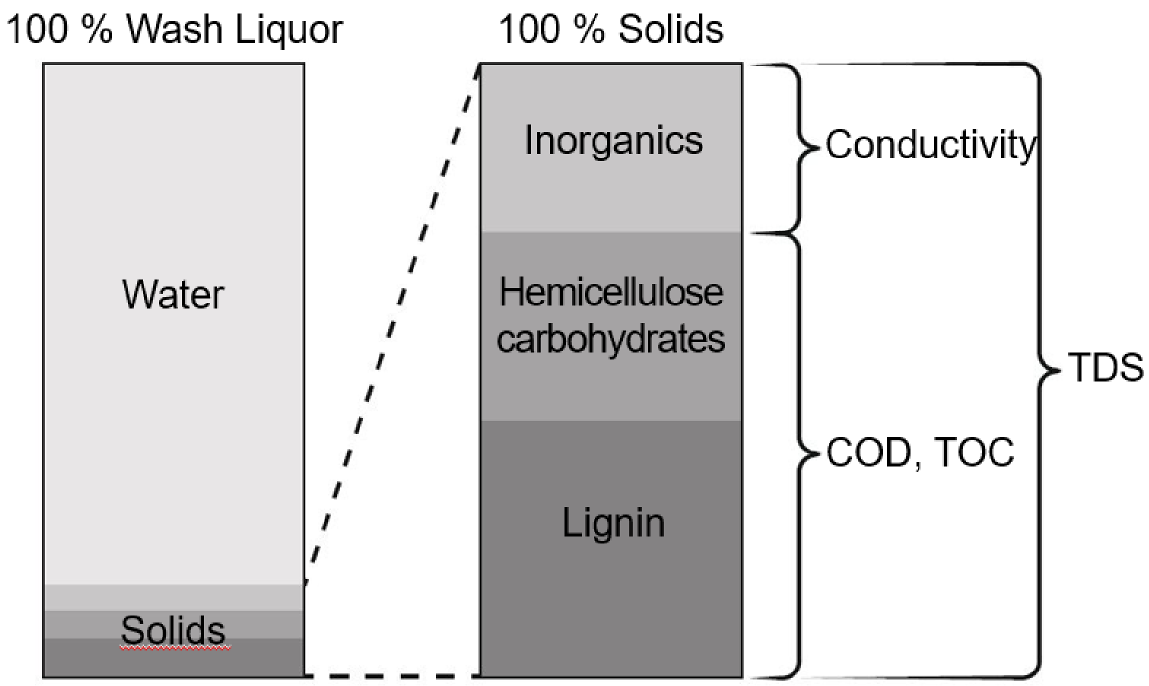
Basic installation

Advanced installation

Complete installation

Ruskean massan pesun inline TDS optimointi

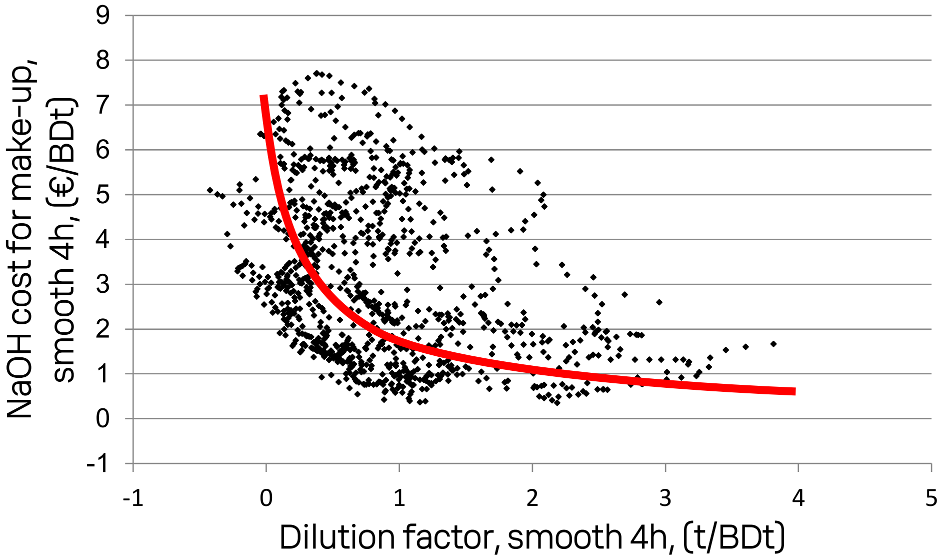


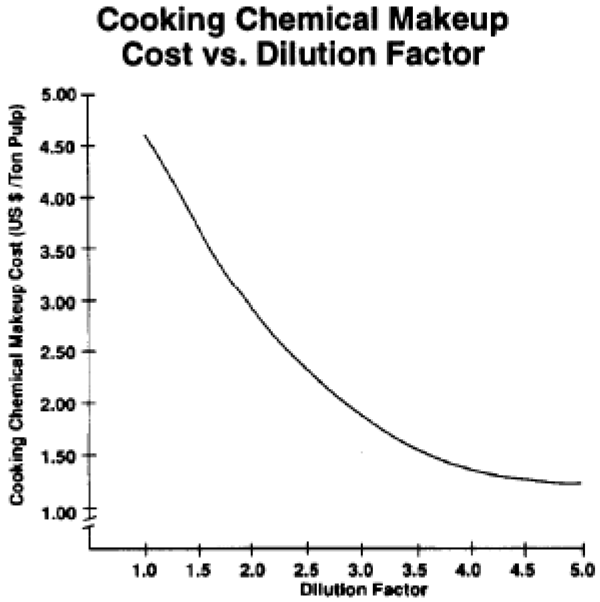


Kemikaalien talteenotto I:

Make up

- Recovery of inorganic chemicals is a primary reason for using pulp washing. Inorganic chemical recovery directly affects the cost associated with make-up chemical purchasing. In modern kraft mills, usually 96%-99% of the inorganic cooking chemicals are recovered back into the system.
- At this mill experiment increasing the dilution factor by 1 unit, the make-up chemical cost as NaOH decreases on an average by 1.0 €/BDt.



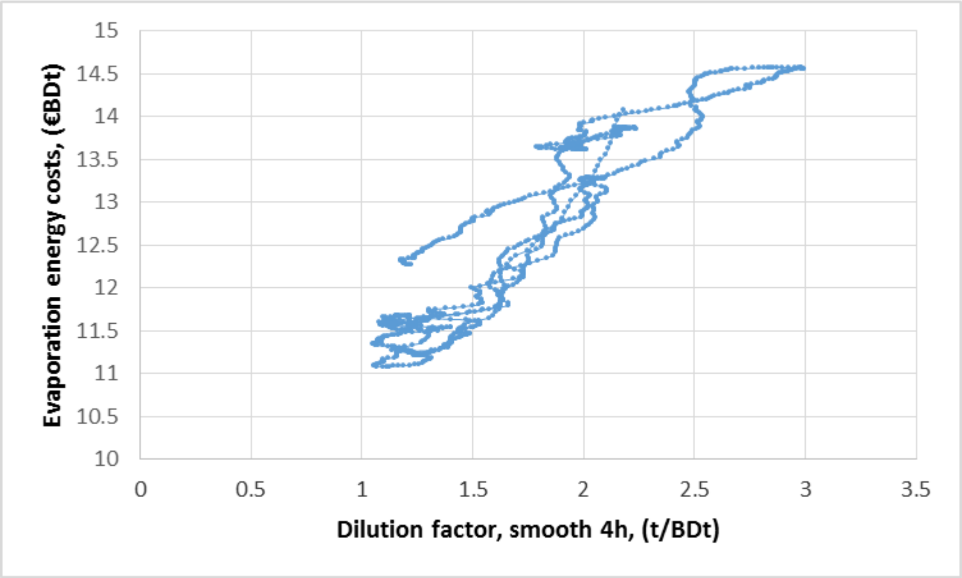


Source: Kopra et al. 2010

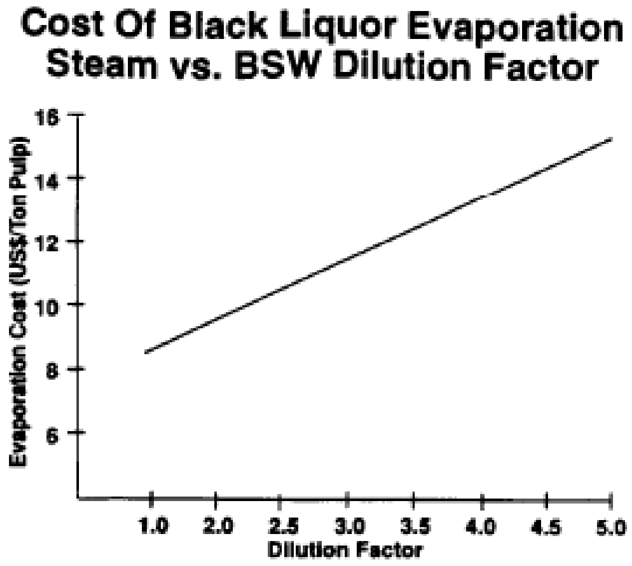
Source: Compton 1997

Kemikaalien talteenotto II:
Evaporation

- At this mill experiment increasing the dilution factor by 1 unit, evaporation costs increase on an average by 1.5 €/BDt.



Source: Kopra et al. 2016



Source: Compton 1997

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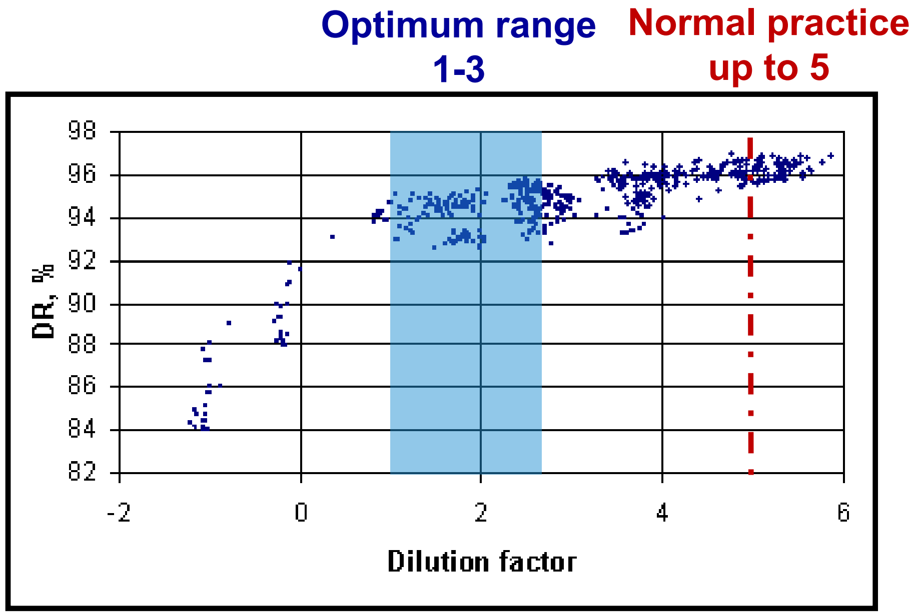
Kemikaalien talteenotto III:

DF vs DR

- Using real time measurements, it is possible to monitor effectiveness of the washer and find optimal values.
- In this case, the dilution factor should be above 1 to guarantee unobstructed washer performance
- If have to reduce the amount of wash water, should remember for example: pulp cleanness, performance of oxygen delignification, chemical consumption in bleaching and wastewater load.



Source: Kopra et al. 2011

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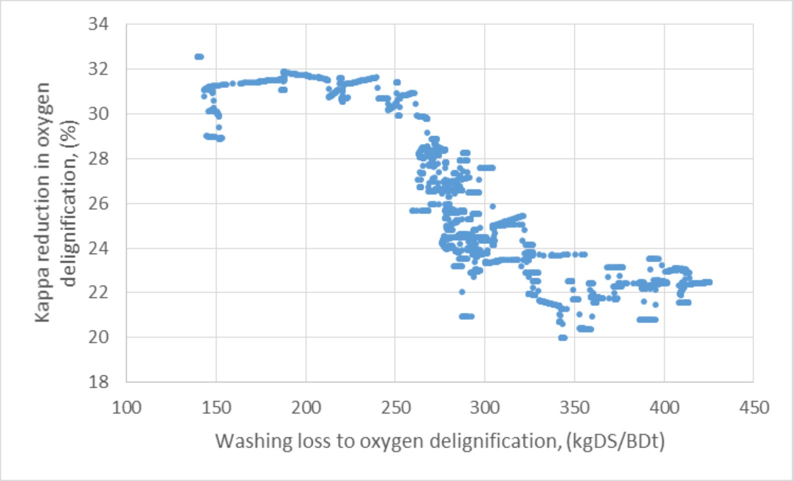
Happivaihe ja valkaisu I:
Pesuhäviön vaikutus kappareduktioon

- The oxygen delignification response was highly affected by the amount of washing loss. This is due to the fact that oxygen is consumed in the oxidation reactions of the washing loss
- The temperature in the oxygen reactor correlates with the amount of washing loss.

Optimum range Process difficulties

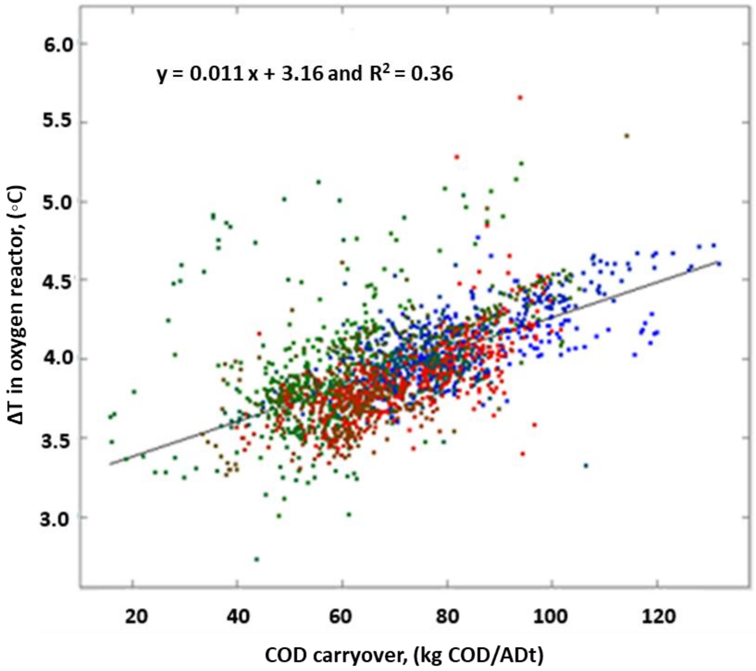


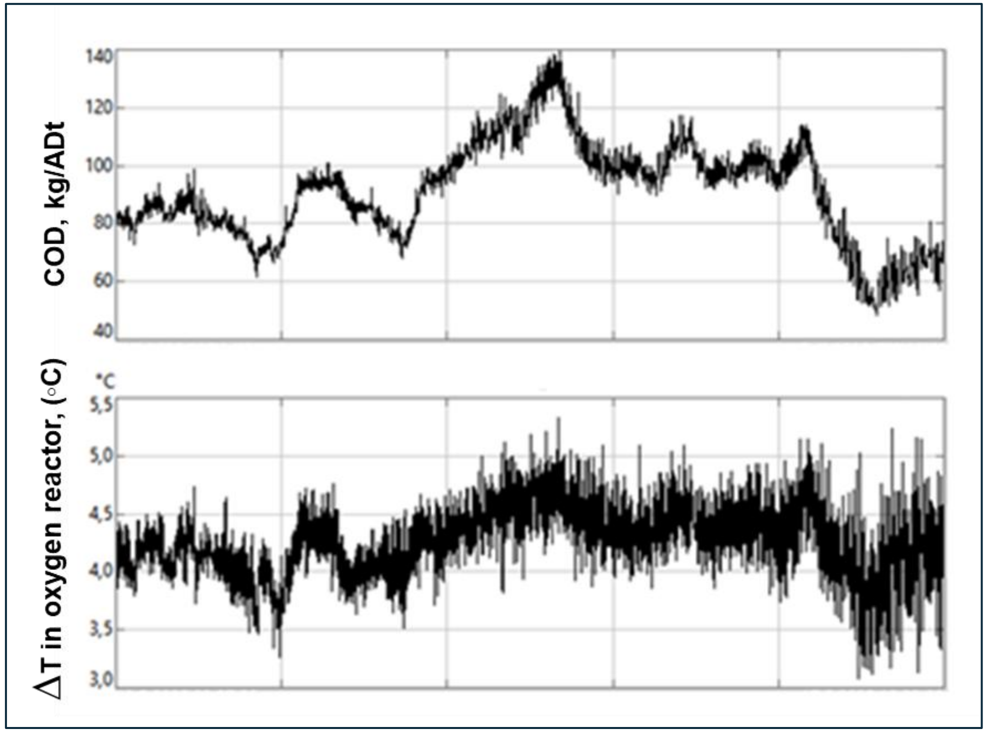
Source: modified from R Kopra et al.'s 2012 article

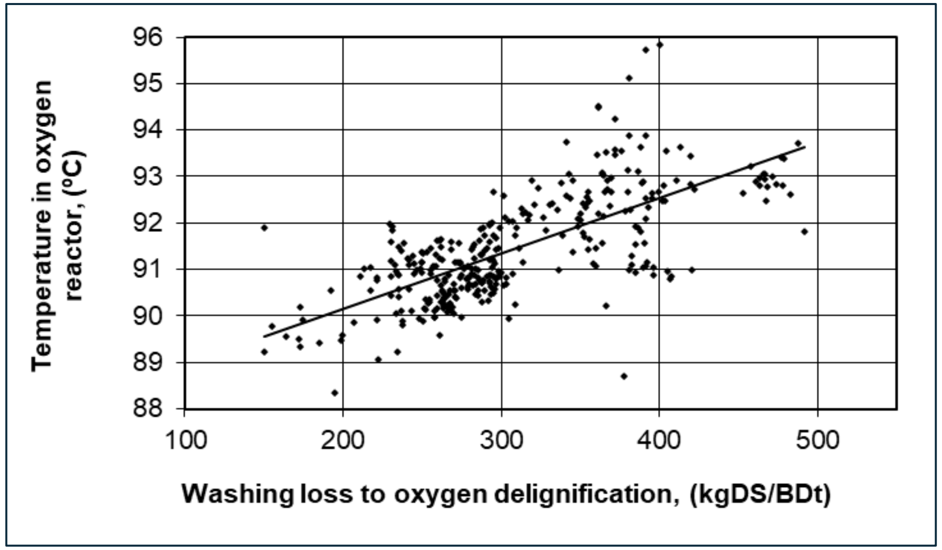
Happivaihe ja valkaisull:

Carryover Oxygen Consumption in the O_2 Delignification

- In the mill process, carryover oxygen consumption can be evaluated by measuring the variation in the COD, conductivity, or TDS before the O_2 process and the temperature increase in the reactor.
- It is possible to estimate how much oxygen would be consumed by washing loss/carryover.

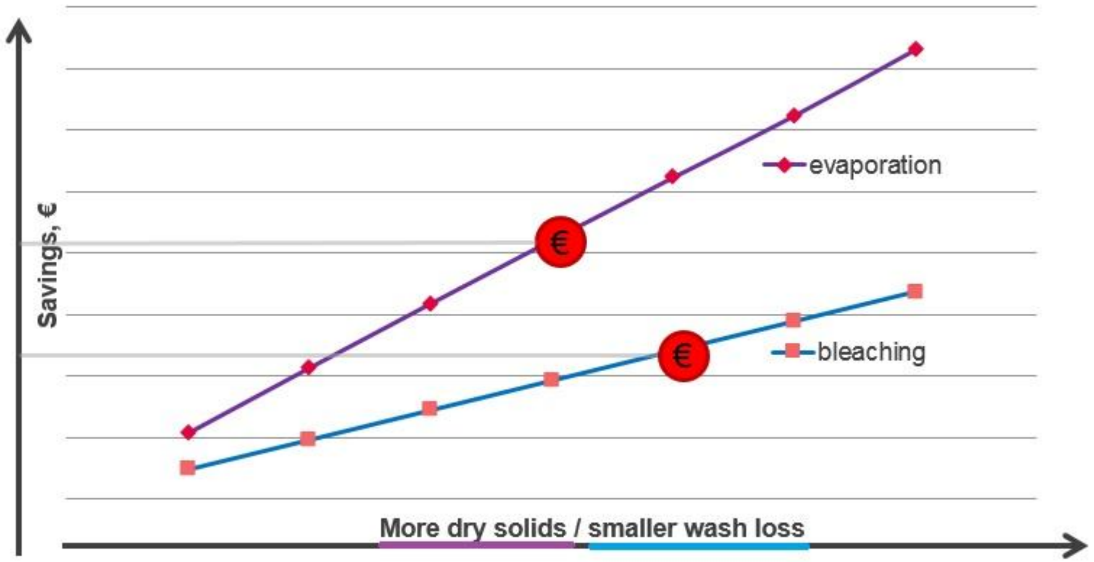




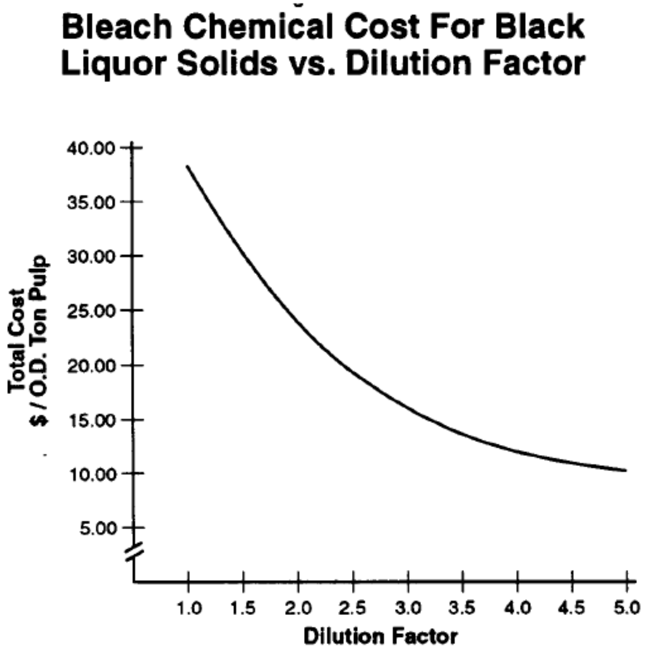


Happivaihe ja valkaisu III

- Efficient BSW reduces the consumption of reagents in the subsequent bleaching.
- With washing after oxygen delignification the economy and the environmental friendliness of the whole fiber line is improved.



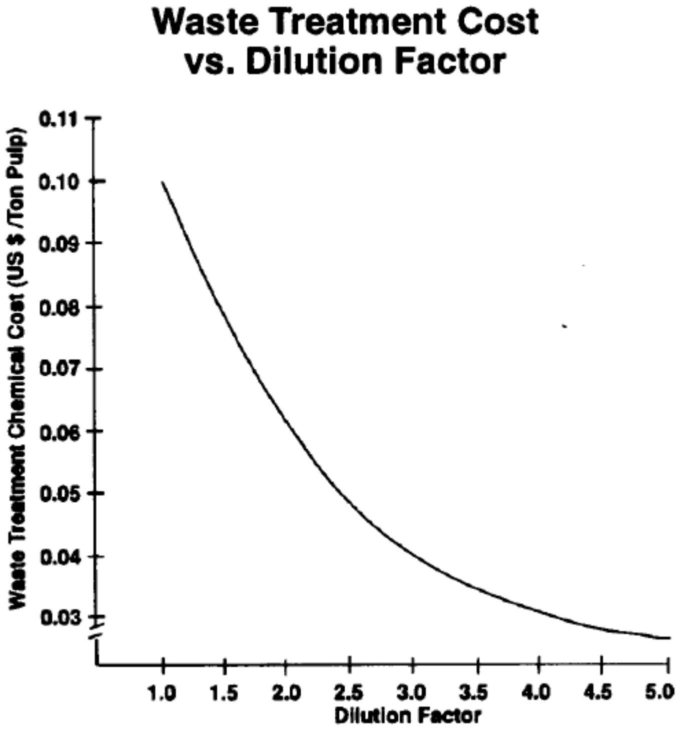
Source: Kopra et al 2015



Source: Compton 1997

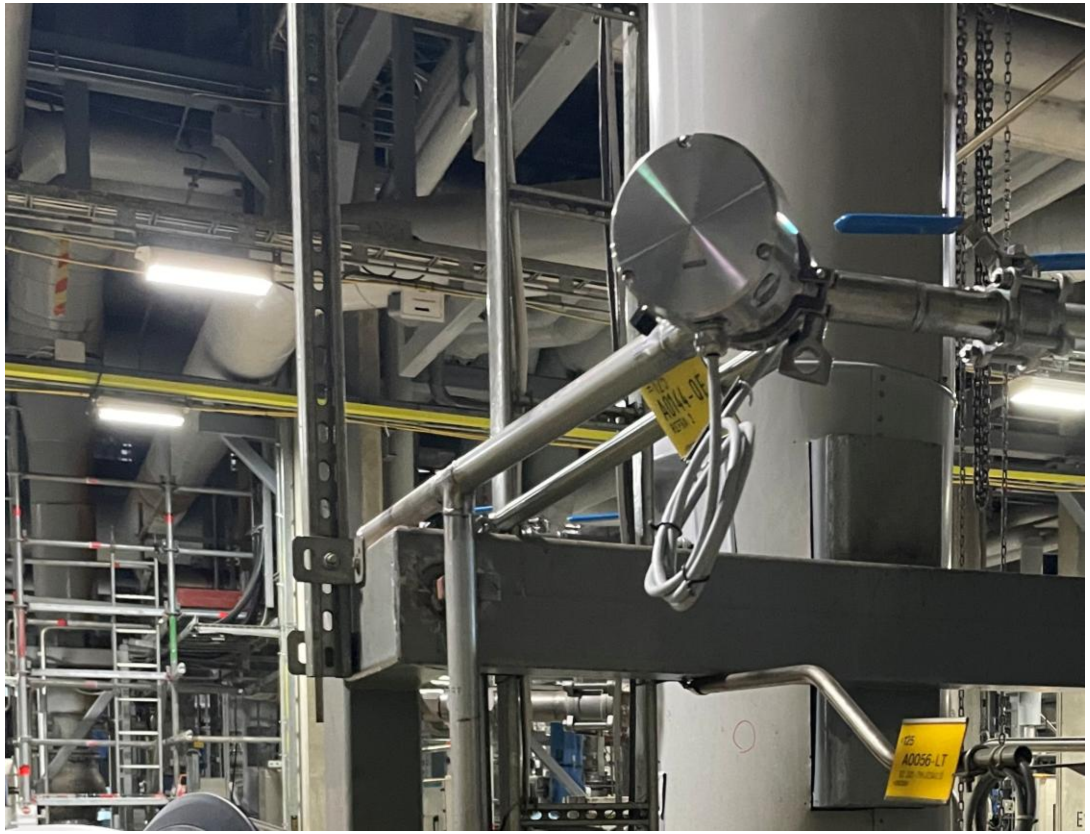
Jäteveden käsittely

- Main driving forces to reduce freshwater usage in chemical pulping and bleaching are economic and environmental reasons as well as the legislation.
- Inefficient washing results in higher effluent color, chemical oxygen demand (COD), and biochemical oxygen demand (BOD) in the receiving waters.



Source: Compton 1997

Vaisala Polaris inline TDS mittausteknologia



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