

Ultra High Dispersing: increased dispersion efficiency and considerable steam savings

Author:

Andreas Gorton-Hülgerth
General Manager Pilot Plant, Pulping and Fiber Division
Andritz AG, Graz/Austria

Abstract

The dispersion process has already been used for a long time to improve the quality of the final stock in a recycled fiber line. Over the years, this process stage has been continuously improved to make it more efficient and it is used today as a combination of dispersing and mixing with chemicals.

To achieve today's dispersing stage feed consistency of approx. 30%, thickeners like twin wire presses or screw presses are installed upstream of the disperser. Different disperser types are now in operation: These are low-speed machines, also known as "kneaders", as well as high-speed machines with disperser fillings like a refiner.

Steam is used to heat the stock, which is necessary for effective dispersing. The steam can be applied in different ways: directly ahead of the dispersing zone, although there is a risk here that the steam cannot condense and thus passes right through, or with a heating screw flanged directly onto the disperser or installed separately.

To obtain high dispersion efficiency, several parameters, such as energy input, temperature, and especially the consistency of the dispersed stock, are crucial. The first two parameters – energy input and temperature – have the most influence on the operating costs. Thus, it is important to reach these targeted parameters in an optimized way.

This can be achieved by increasing the inlet consistency. In order to do so, the stock is further dewatered to almost 40%. To reach this consistency level, a plug screw feeder providing a large dewatering surface is used as additional dewatering equipment after the pulp screw press. With this measure, the steam consumption is reduced significantly by more than 25%. In addition, the dispersion efficiency is also increased and, therefore, the specific energy input can be reduced. If chemicals are applied in DIP plants, the increase in consistency results in reduced chemical costs.

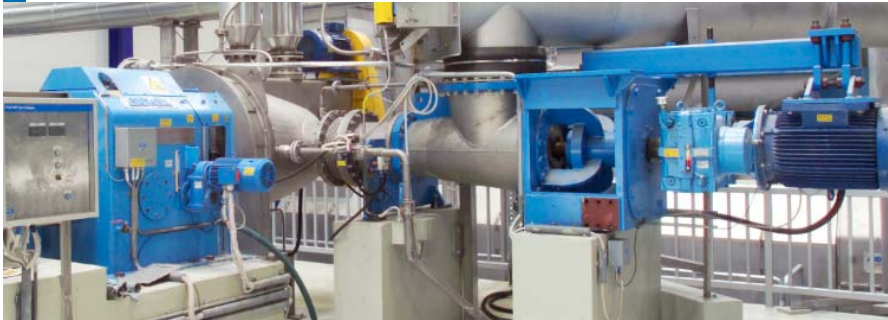
This system for "Ultra High Dispersing" patented by ANDRITZ is a further milestone in the development of dispersing systems. By using this new system, a significant reduction in operating costs can be achieved.



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Ultra High Dispersing

Andreas Gorton-Hülgerth, ANDRITZ AG, Graz/Austria



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Ultra High Dispersing

Content

- Features of dispersing systems
- Basics of stock heating
- Advantages of high consistency for bleaching
- Advantages of high consistency for dispersing
- High-consistency dispersing set-up
- Disperser fillings
- Conclusions

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Features of dispersing systems

Status quo

- Dispersion is necessary to reach high final pulp quality
- Feed consistency to disperser today between 25% and 30%
- Different heating procedures and heating times available on the market
- Most important parameters are temperature, SEC and plate design

Ultra High Dispersing

- For "Ultra High Dispersing" a consistency of up to 40% is utilized
- Significantly lower steam demand
- Leads to lower chemical costs for bleaching at high consistency
- Higher efficiency for contaminants (sticky, dirt) removal
- Patented "Ultra High Dispersing" lowers the operation costs significantly

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Basics of stock heating

Basic equation

$$\Delta Q = c m \Delta T$$

ΔQ ... change in heat
 c ... specific heat capacity
 m ... mass
 ΔT ... temperature difference

► At higher consistency, both **specific heat capacity** and **total mass** are lower

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Basics of stock heating

Specific heat capacity

$$cp(\text{water}) = 4.18 \frac{\text{kJ}}{\text{kg}}$$

$$cp(\text{pulp}) = 1.26 \frac{\text{kJ}}{\text{kg}}$$

$$\frac{cp(\text{water})}{cp(\text{pulp})} = 332\%$$

- At higher consistency, the **relative pulp amount** increases and **specific heat capacity** of the mixture is lower

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Basics of stock heating

Heating from 45°C to 90°C

Consistency	[%]	28%	38%
Total mass/kg pulp	[kg/kg]	3.6	2.6
Specific heat capacity	[kJ/kg K]	3.36	3.07
Specific heat	[kJ/kg]	540	364

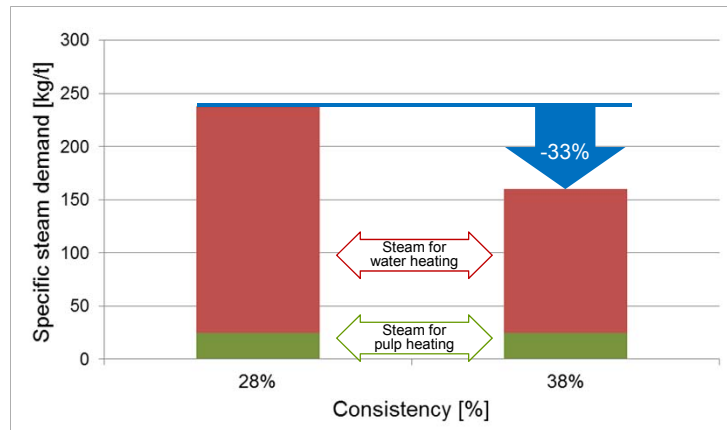
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Basics of stock heating

Steam demand



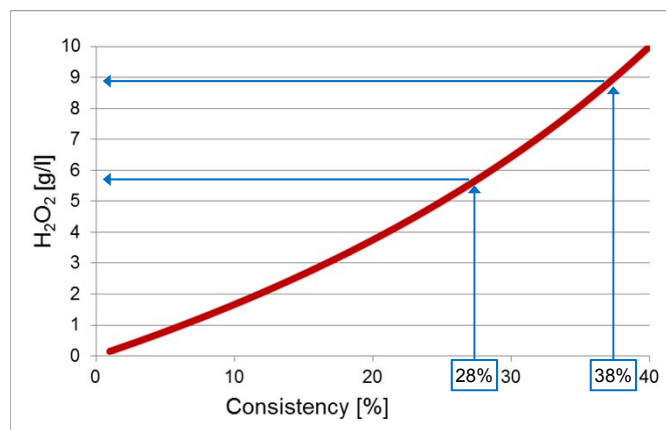
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Advantages of high consistency for bleaching

Peroxide concentration (at 1.5% H₂O₂ dosage)



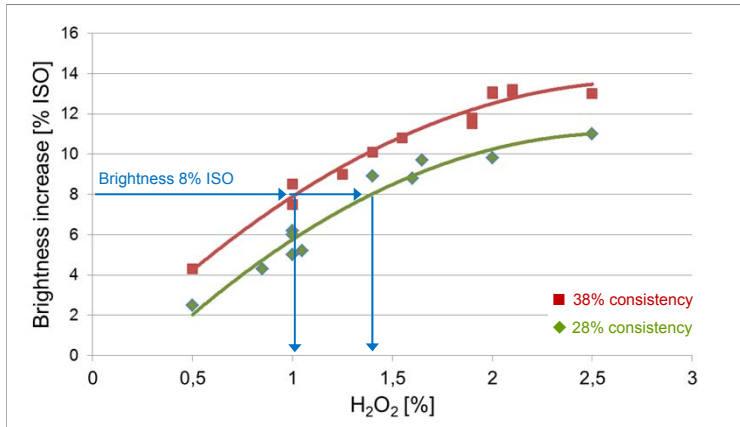
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Advantages of high consistency for bleaching

Brightness increase (for MOW)



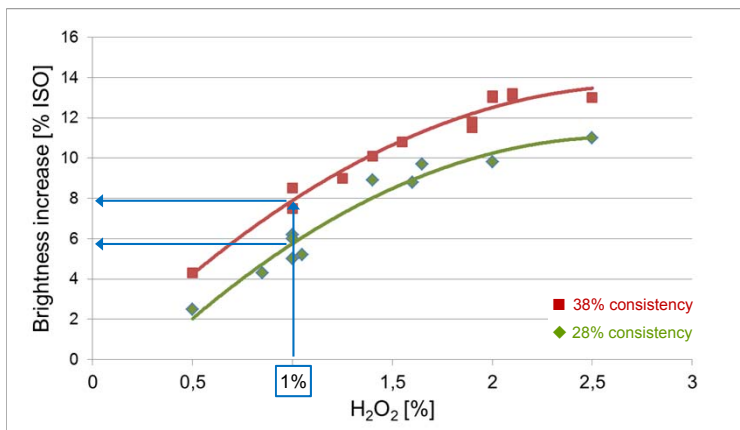
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Advantages of high consistency for bleaching

Brightness increase (for MOW)



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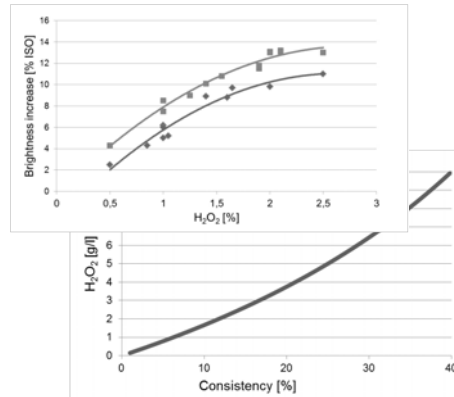
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Advantages of high consistency for bleaching

Bleaching at higher consistencies

- Savings of chemicals
- Less side reactions that consume peroxide unintentionally
- Lower COD creation
- Improved water loop separation
- Reduced anionic trash towards paper machine



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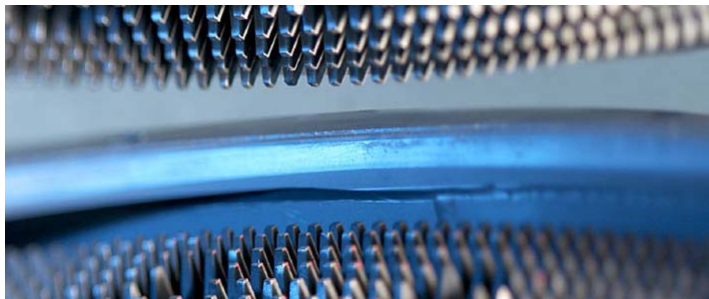
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Advantages of high consistency for dispersing

High consistency increases apparent viscosity of pulp

- Higher **shear forces** are generated inside disperser gap
- Higher **efficiency** in contaminant dispersing



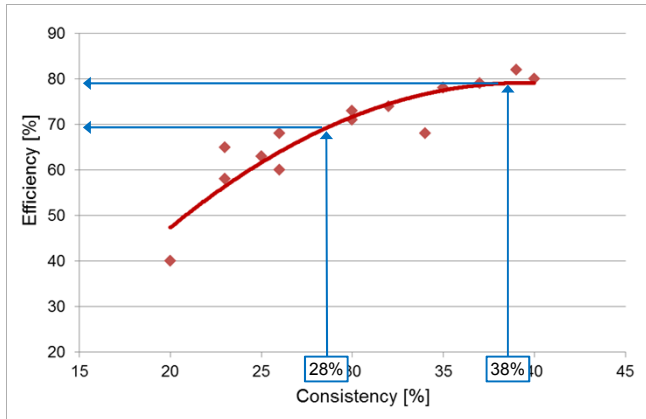
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Advantage high consistency dispersing

Dirt



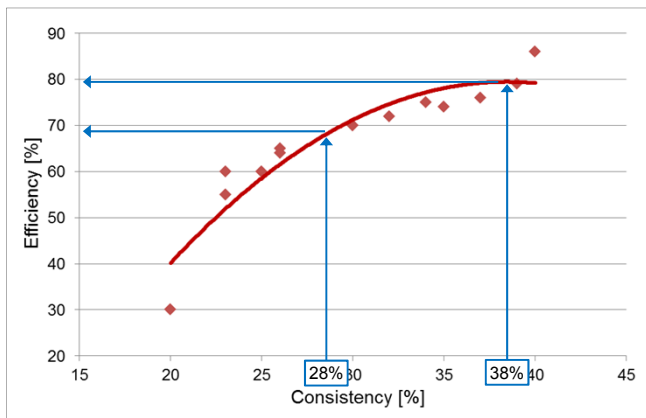
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Advantage high consistency dispersing

Stickies



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Ultra High Dispersing Dispersing Systems

Dewatering machines applied

- Twin-wire press:
 - Up to 40% consistency
 - Large footprint
 - Higher investment costs
- Screw press
 - Up to 30% consistency
 - State-of-the-art dewatering equipment

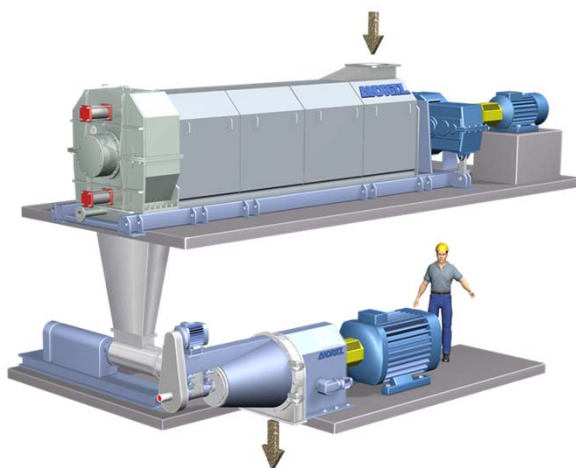


▶ To close the consistency gap, **additional dewatering capacity** is needed

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Ultra High Dispersing Compact dispersing systems



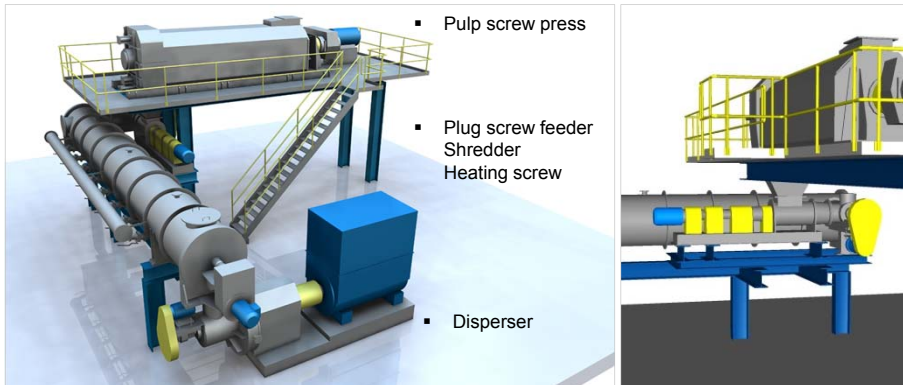
- Pulp screw press
- Plug screw feeder
- Disperser

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Pressurized dispersing systems



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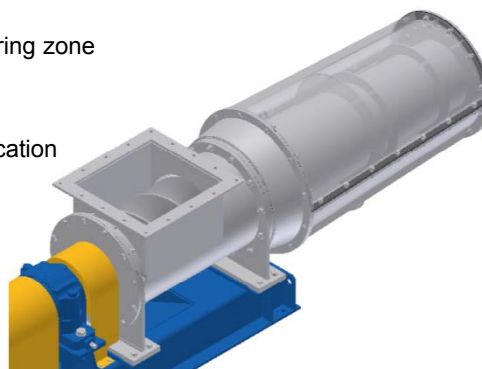
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Dewatering plug screw feeder

Features

The plug screw feeder is used as **additional dewatering equipment**

- Conical plug zone utilized as dewatering zone
- Large dewatering surface available
- No additional equipment needed
- ANDRITZ patent for dispersing application



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Great variation of plate designs for tailor-made optimization

Durapulse

with V-tooth design and feeder bars



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Ultra High Dispersing

Great variation of plate designs for tailor-made optimization

Multipulse

with V-tooth design



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Ultra High Dispersing

Great variation of plate designs for tailor-made optimization

Optipulse

Variation of tooth angle for pumping or holdback



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Savings

Example: 300 t/d MOW

Steam savings of 33% 150,000 €/year

Bleaching Chemicals 140,000 €/year
1% H₂O₂ instead of 1.4% H₂O₂

▶ **Total savings 290,000 €/year**

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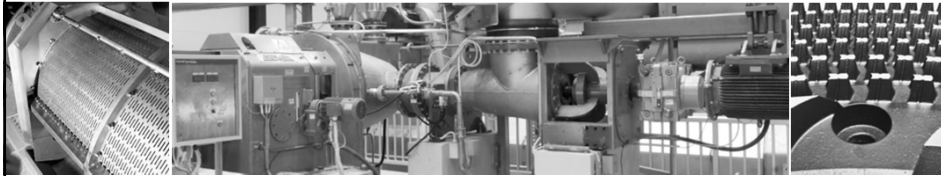
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Conclusions

Advantages

- Reduced **steam demand**
- Improved **bleaching response**
- Reduced **COD**
- Improved **dispersing efficiency**
- Minor additional **investment**
- Lower **operating costs**
- **Dewatering plug screw feeder** also for rebuilds and capacity increases



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