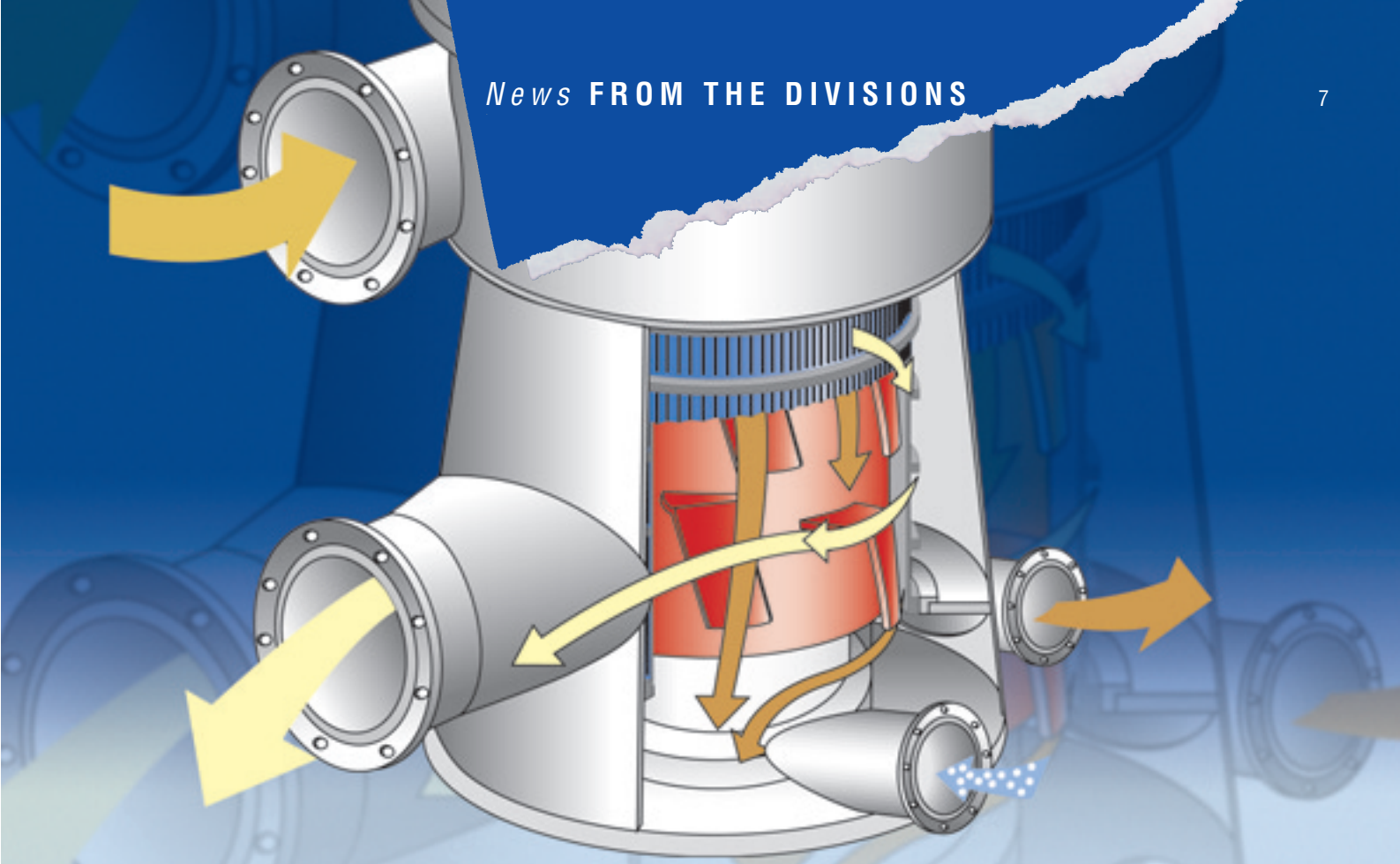

# Stock preparation – the key to ensure the productivity of newsprint and SC paper machines

*The author:*
*Harald Selder,*
*Fiber Systems*

**The Federal Republic of Germany holds a top position in Europe with regard to the use of secondary fibers for the manufacture of paper and board products. The rate of utilisation of recovered paper is presently 62%. For Germany, this ratio is expected to be increased further, which will lead to a further reduction in fresh fiber usage.**

It is known that the largest quantities of recovered paper are used in the field of packaging papers. In this product sector, signs of maximization have already become apparent, so that in this sector no increase in the use of recovered paper is to be expected. A higher percentage can therefore only be achieved by raising the secondary fiber usage for graphical papers.

What is the present situation in the use of recovered papers in the field of graphical papers?

*Fig. 1* shows the relative recovered paper contents for the most important graphical, wood-containing paper grades. The abscissa in this diagram represents the quality whereas the ordinate stands for the price achieved with these products. The red field describes the average, relative recovered paper content used in these products.

Today, the standard newsprint paper is usually made from 100% deinked pulp (DIP). The same applies for upgraded newsprint. In the SC paper sector, 40% of secondary fibers are used on average, and for LWC papers, approximately 25%. A similar percentage is also used for the high-grade coated papers.

*Fig. 1: Content of deinked pulp in wood-containing printing papers.*

*Fig. 2: Number and relative weight of advertising inserts in newspapers.*

$$*\text{Relative weight} = \frac{\text{Weight of inserts}}{\text{Overall weight (newspaper + inserts)}} \times 100$$

*Fig. 3: Trend in paper grades used for magazines and change in inorganic content of DIP. German deinking furnish: 50% ONP, 50% OMG.*

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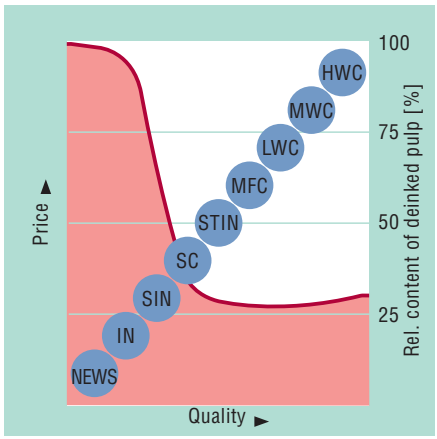


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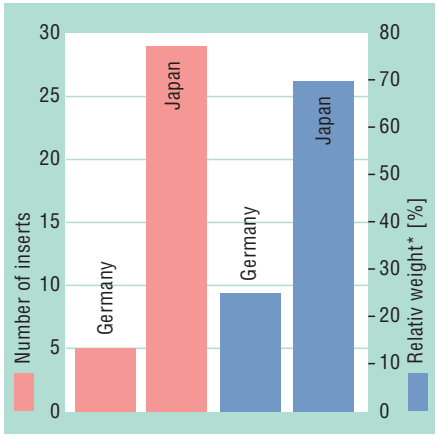


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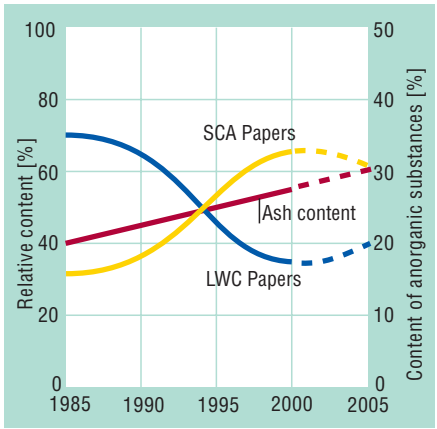


## Recovered paper: quality and availability

The recovered paper grade, which is available in sufficient quantities in Germany and of satisfactory quality uniformity, suitable for the higher-quality, graphical papers, is the deinking furnish.

This deinking furnish is collected in the form of a household collection grade by the recovered paper trade, and it's then separated into brown and white paper fractions in sorting plants.

The resulting white paper fraction consists of approximately 50% old newspapers and 50% magazines and is supplied to the paper mills as deinking furnish. The paper composition of this deinking furnish is subject to continuous change, which the stock preparation engineers have to take into consideration. In this article, we will point out the most essential changes in the deinking furnish composition, which have an influence on the deinkability and the DIP quality.

Today, the daily newspapers include approximately 2-5 advertising inserts per paper. These inserts are in most cases printed on SC and LWC papers. The printing process is mostly sheet-fed offset with integrated heat-set drying. Due to this heat-set treatment, many problems have to be reckoned with when it comes to deinking. The quantitative share of these inserts is approximately 10-20% of each newspaper, as shown in *Fig. 2*.

In Japanese daily newspapers up to 30 inserts per distributed paper can be found. In this case, the inserts have a share of 70%. In Japan, statutory regulations limit the advertising space in daily newspapers, which explains this high percentage of inserts.

Such a high share of inserts is not to be expected in Europe. However, a further increase in the number of advertising inserts in daily papers is to be reckoned with. Local and regional advertising is not of interest as yet for the electronic media, and it will remain a domain of print advertising for now and the near future.

Another change can be noted for the magazine paper grade. Approximately 15 years ago, the principal paper grade for magazine production was LWC paper. Today, the predominant paper grades used for magazines in Germany are the SC paper grades suitable for roto-gravure printing, as can be seen from *Fig. 3*. About 70% of the magazines published in Germany are presently printed on SC papers.

This situation must be expected to change again. The reason is the new generation LWC papers. These papers are coated and calendered in an online process. In this way, production costs can considerably be reduced. In addition, the quality of these papers is equivalent or even superior to that of the corresponding SC papers. Consequently, there will be more LWC papers in the deinking furnish in the future.

From *Fig. 3*, it is also obvious that a constant rise in ash content can be noted in the deinking furnish. This rise is the result of continuously increasing ash contents in LWC and SC papers, and on

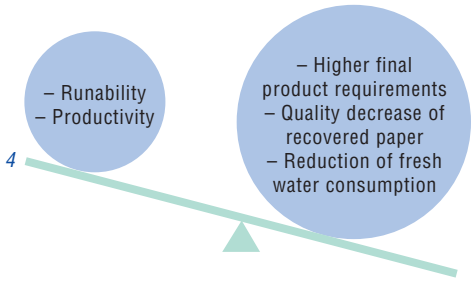


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*Fig. 4: Runnability- and productivity-related variables.*

*Fig. 5: Simplified block diagramm of analyzed system.*

the other hand of rising ash contents in standard newsprint papers.

Along with the higher percentage of magazines in the deinking furnish, more adhesive glue and more hotmelts are automatically fed into the stock preparation systems. These substances are the sources of the macro stickies, which will cause many upsets on the paper machine if not sufficiently removed. In addition, large quantities of coating binders and coating additives are included in the coated papers. It is from these substances that the micro stickies originate resulting in serious runnability and availability problems on the paper machines if their removal is not satisfactory. This situation will require systematic countermeasures in the future *(Fig. 4)*.

In addition to the usual targets of optical brightness and cleanliness, which are aimed at in the stock preparation process, the separation of detrimental substances in the recovered paper must also be increasingly considered in the future. As fresh water usage in paper production is reduced, this subject becomes even more important. The remainder of this article describes solutions for the control of detrimental substances in the stock preparation system. The control strategies are integrated with plans for optimizing paper machine operation.

## Process modules for controlling detrimental substances

In order to be able to fight detrimental substances effectively, it is necessary to define those modules integrated in stock preparation systems with regard to the separation of detrimental substances. For this reason, the results of a detrimental substances analysis will first of all be presented.

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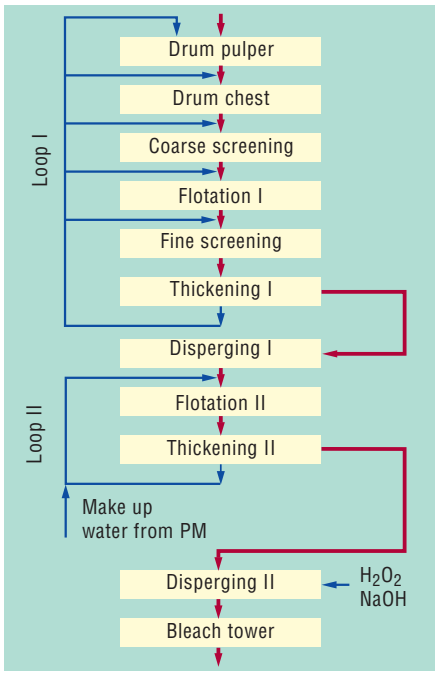


The system chosen for the analysis *(Fig. 5)* consists of a 2-loop process for the production of DIP for SCB papers. The first process loop includes the drum pulper, coarse screening, flotation I, fine screening, thickening and disperging I. The second process loop contains flotation II, thickening and disperging II. Disperging II is combined with peroxide bleaching. No process water cleaning is connected, neither in the first nor in the second process loop. Only the make-up water from the paper machine, which is carried over to the stock preparation, is run through a microflotation. The system analysis focused on establishing the change in the macro and micro stickies area. For reasons of completeness, the development of the chemical oxygen demand and the anion-charged substances was also established.

For the macro stickies determination, the pick-up method, developed by Voith Sulzer was used. And, the micro stickies were determined with the laser optical particle counting method developed by BASF.

In the following section, a thorough description is given of the results obtained regarding the macro and micro sticky behaviour.

## Results

*Macro stickies*

The first reduction in macro stickies worth mentioning occurs in coarse screening, as shown in figure 6. In flotation I, no macro stickies are removed. With 85% removal efficiency, fine screening is by far the most effective process module. A further reduction in macro stickies can be noted in both disperging systems.

The total sticky loading was reduced from 11510 $mm^2/kg$ b.d. to 192 $mm^2/kg$ b.d. which corresponds to a total reduction of 98.3%.

*Micro stickies*

The change in micro stickies area in each process step presents a completely different picture from that of the macro stickies. The screens do practically noth-

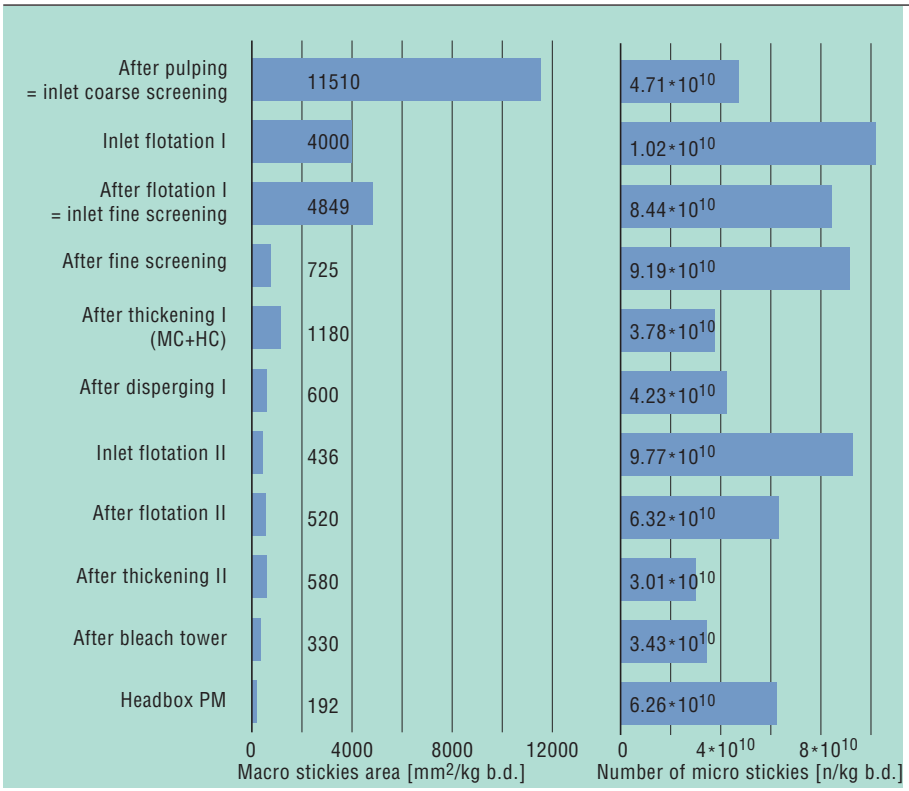


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*Fig. 6: Change in macro stickies area in the analyzed deinking system.*

*Fig. 7: Change in number of micro stickies in the analyzed deinking system.*

*Fig. 8: Effectiveness of stock prep process units in removing substances detrimental to runnability and productivity.*

*Fig. 9: MultiScreen fine screen optimized for macro stickies removal.*
*Rotor*
*– Multiple blades*
*– Adequate pressure pulses*
*Screen basket*
*– C-bar™ technology*
*– High precision of slot width*
*Housing*
*– Conical design*
*– Fishmouth accept discharge*

8

| Process blocks | Macro stickies | Micro stickies | COD | Cationic demand |
|---|---|---|---|---|
| Coarse screening | ● ● | — | — | — |
| Flotation I | — | ● ● | — | — |
| Fine screening | ● ● ● | — | — | — |
| Thickening I | — | ● ● ● | ● ● ● | ● ● ● |
| Disperging I | ● ● | — | — | — |
| Flotation II | ● | ● ● | — | — |
| Thickening II | — | ● ● ● | ● ● ● | ● ● ● |
| Disperging II | ● ● | — | — | — |

— No influence ● Low improvement ● ● Medium improvem. ● ● ● High improvem.

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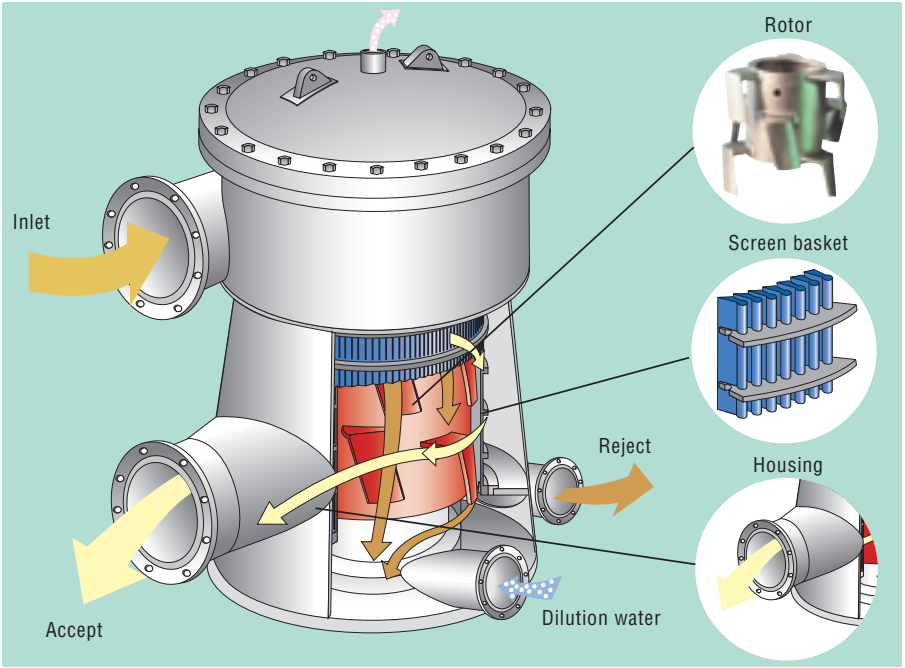


ing in terms of micro sticky removal. Whereas the flotation blocks possess a considerable separation ability. A high removal efficiency is produced in the thickening stages. But, the low micro sticky level after the thickening processes cannot be maintained due to the highly contaminated process water that is subsequently used for dilution. At this point it becomes noticeable that microflotation is needed for cleaning the process water *(Fig. 7)*.

*Fig. 8* summarizes the efficiency of the individual process modules used in the stock preparation system with regard to the separation of the investigated group of detrimental substances.

The most effective process module with regard to macro sticky separation is fine screening. Voith Paper Fiber Systems recognized the importance of fine screening for the macro sticky removal at an early stage and now offers a most effective machine – the MultiScreen. This screen *(Fig. 9)* is completely optimized from “head to foot”.

Micro sticky control is most effective in the flotation blocks and in microflotation used for water cleaning. However, there will always be some residual micro sticky load carried over to the paper machine.

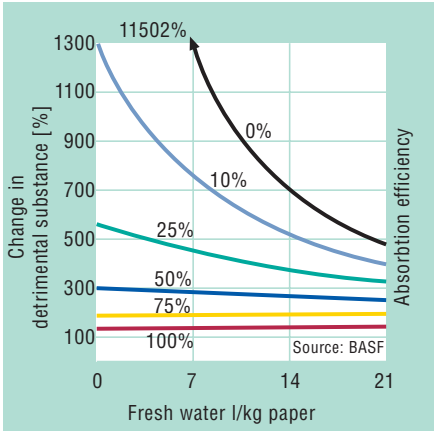


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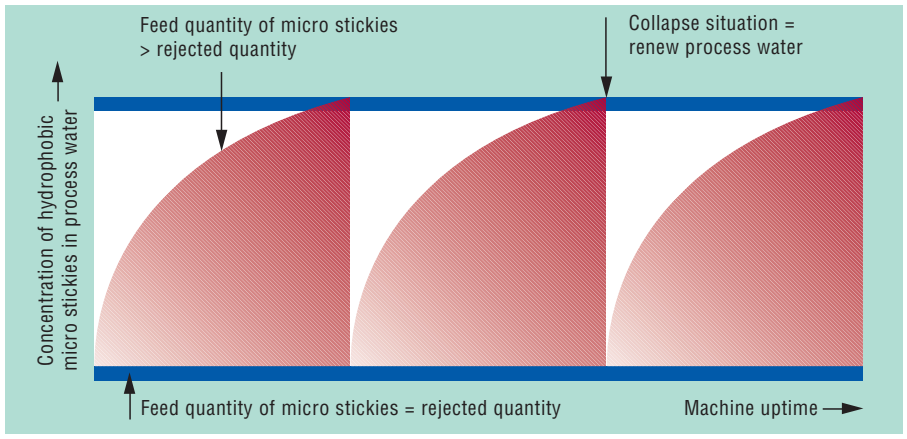
*Fig. 10: Correlation between build up of detrimental substances in the PM white water. absorption efficiency and fresh water usage.*

*Fig. 11: Effect of hydrophobic micro stickies concentration in the process water loop on paper machine availability.*

*Fig. 12: Strategy for control of detrimental substances.*
- *Process units relevant to macro stickies*
- *Process units relevant to micro stickies*
- *Process units relevant to COD*
- *Process units relevant to cat. demand.*

In this case, the carried over micro sticky load is to be bound to the fibers by means of fixing agents so that the left-over microstickies go out with the finished paper. The correlation between absorption efficiency and changes in concentration dependent upon fresh water usage is shown in *Fig. 10*. It can be noted that a 50% absorption efficiency is required for maintaining a stable micro sticky concentration in the white water circuit *(Fig. 10)*.

If more micro stickies are fed to the paper machine than can be absorbed by the fiber material, the concentration in the white water circuit will continuously rise. Eventually, a critical concentration is reached where slight changes in temperature and pH-value will induce the formation of macro stickies due to displacements in solubility. With a further increase in concentration, a collapse situation will be evoked. The paper machine must be shut down and the process water exchanged. This kind of situation will considerably impair paper machine availability *(Fig. 11)*.

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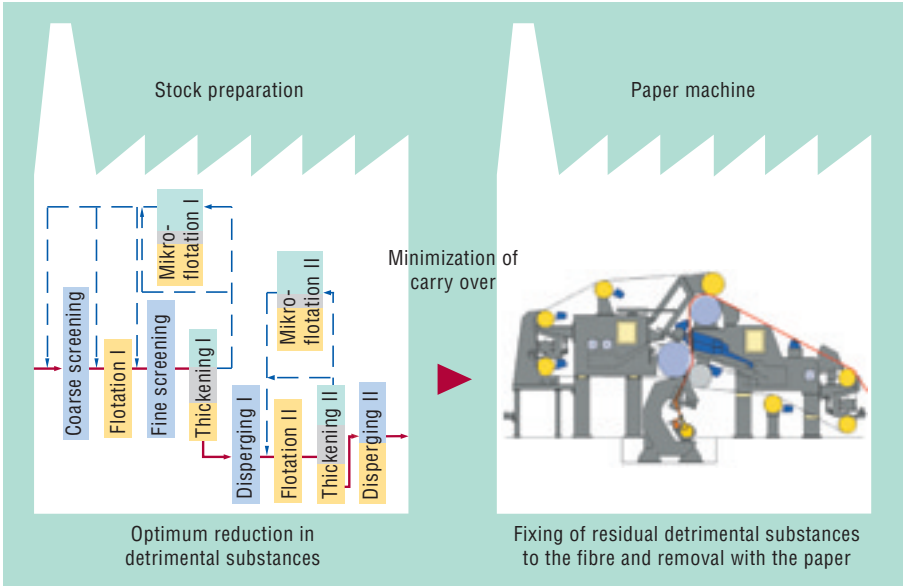


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## Summary and recommendations

In order to ensure the runnability and availability of high-speed newsprint and SC paper machines, it is absolutely necessary to control the level of detrimental substances. There is a continuously increasing load of detrimental substances, and countermeasures must be taken to fight this. Detrimental substances are combatted most efficiently in the stock preparation systems. The system supplier can decisively help to reduce the load of detrimental substances by a corresponding module arrangement and by optimized process water management and cleaning. The aim should always be to keep the carry over of detrimental substances to the paper machine as low as possible *(Fig. 12)*. This way, high concentrations of detrimental substances in paper machine circuits can be avoided. Consequently, deposits and contaminations of felts and screens can be eliminated. Another advantage of this control strategy is the much reduced usage of process chemicals during the manufacturing process. Fixing agents should only be used after the reduction in detrimental substances in the stock preparation system has been optimized.